

**A MODEL TO ACHIEVE CONTINUOUS IMPROVEMENT AND INNOVATION IN THE
FRESHWATER PRODUCTION OF THE SHARPTOOTH CATFISH, *Clarias gariepinus*, IN
SOUTH AFRICA**

By

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DECLARATION

I Matebo Yvonne Moroasui hereby make a declaration that “A MODEL TO ACHIEVE CONTINUOUS IMPROVEMENT AND INNOVATION IN THE FRESHWATER AQUACULTURE (SHARPTOOTH CATFISH) SECTOR OF SOUTH AFRICA” is my work and is original. All the references applied in this thesis cited accordingly. I confirm that this thesis has not been submitted at any other university.

Signed:



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DEDICATION AND ACKNOWLEDGEMENTS

Dedication

I dedicate this work to God Almighty for giving me the strength, endurance, patience and persistence to drive this work to completion. The road was extremely hard and thorny and He kept me going in tough times. I also dedicate this work to my late mother Mosima Jane Manganeng who passed away when I was only three years old and my late grandmother Motlatjo Hellen Rapholo who raised me up since my mother's passing. Her drive and passion for education was grilled into me at a very young age and made me the person I am today. I also dedicate this work to my mother-in-law Madam Sefora Magdeline Moroasui and father in-law Mr. Matshela David Moroasui, who have been the pillar of support during this journey. I also thank my husband, Mr. Richie Sousalale Moroasui for his unwavering love and support even in vehicle breakdowns that I encountered as I was traveling through the lengths and breadth of the country. Finally, I want to dedicate this work to my children Molwedi Chishi Moroasui (8 years), Mogau Moroasui (6 years) and Molebogeng Ditheto Moroasui (14 months) as they have been my source of inspiration to keep moving and never lose hope. They had to learn to do things for themselves so early since mommy was so busy collecting data and writing. I also wanted to thank the Department of Agriculture in various Provinces for granting access to farmers and also the farmers themselves for their participation in this rigorous and lengthy data collection process.

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PAPERS PRESENTED AT CONFERENCES

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Moroasui, M. Y., Ampofo-Yeboah, A. and Antwi, M. A. 2018. A Model for Achieving Continuous Improvement and Innovation (CI & I) in the Freshwater Aquaculture Sector of the North West Province, South Africa. The Sixth International Pan African Fish and Fisheries Association (PAFFA) Conference. Poster presentation on 24-28 September 2018, Mangochi, Malawi.

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Moroasui, M. Y., Ampofo-Yeboah, A. and Antwi, M. A. 2019. The Impact of Continuous Improvement and Innovation (CI & I) Principle as a Business Management Model in the Freshwater Aquaculture Sector. Aquaculture Conference 2019. Oral presentation 8-14 September 2019, Stellenbosch, South Africa. Aquaculture Association of Southern Africa.

Abstract

Global population is ever - increasing and demand for animal nutrition is also on the rise. Fish is considered to be the healthiest food on the planet and less harmful to the environment. People rely on the oceans for their daily protein intake. Capture fisheries is near extinction and aquaculture is identified as a solution to address this gap. Aquaculture has played a critical role in global food security and has grown ever – since 1970 by 7.5% yearly. Aquaculture businesses in South Africa are producing less than 1% of global production. Aquaculture small businesses are not profitable and 'business as usual approach' is not enough to develop viable businesses. New innovative ways of producing more food and improving nutrition are essential. Continuous Improvement and Innovation (CI & I) is a business management strategy that concentrates thinking and action on the things that makes the real difference and was identified as a solution to disrupt businesses with the aim of achieving improvement and innovation and acquire profit. The study was conducted in five provinces of South Africa using mixed-method research methodology underpinned by paradigms, methodology, core methods and CI & I tools. Focus groups, in - depth - interviews, field notes, questionnaire and experiment were used as data collection instruments. The CI & I model is made of eight steps which are *focus, situation analysis, impact and influence, action design, action implementation, performance assessment, creation & synthesis and refocus*. The results showed that 30 projects were interested in the study and the opportunity of being involved in the study was high with mean score of 9 articulating that CI & I was a teaching and guiding process and it gave hope. Cycle 1 revealed that 87% partners focused on owning viable and sustainable businesses that generated income and created employment. In situational analysis, 93% of partners needed to secure market; 70% articulated lack of water; 13% reported lack of electricity. Impact and Influence revealed that 68% projects reported securing market access and improving water access as opportunities with high impact and influence. A total of 64% reported improving feed supply as critical; 54% increase number of ponds; 50% obtain equipments; 43% improve skills; 39% reported preventing predation and increasing number of fish; 36% obtain funding; 32% improving security; 21% establish accredited processing facility and improve electrical works. According to the profit driver tree the strongest drivers in the study were *marketing, genetics, nutrition and management*. In action design: the action was to secure local market via a questionnaire, to secure off- takes at a required price, branding, design business cards and posters and advertise on radio, shops and billboards. The action to have water access was to drill boreholes and obtain water licenses. The action for improving feed supply was to determine the effect of locally available food such as live earthworms and tilapia fish on the growth of catfish and demonstrate the applicability of the model in real life researches. The action for improving technical skills was attending practical training. The action for improving security was to install security fencing and also purchase equipments for

fish harvesting and processing. The action to obtain funding was to apply to government, banks and other private businesses (sponsors). Action implementation: Business stickers were designed and a date on local radio station was secured, social media page was created. The site where experiment was conducted was prepared and experimental materials were out-sourced and the experiment was conducted. Dates were secured for the training venue and the trainer. Quotations were obtained for the fencing and some partners were designing a trapping machine. Communication was not received on the progress of the construction of fish processing plant. In performance assessment: market access, signed orders for potential customers were secured. Signed orders for market liaison to fit product to market was also achieved. Small- scale partners had a secured market due to the newly completed processing plant. The results from earthworm experiment were analyzed. Creation & Synthesis revealed that 22% of the project were not registered and lacked funding; and they needed to obtain funding and develop a business plan. 27% of partners required funding to realize businesses growth. Refocus was to obtain funding and be involved in the development of a business plan. The study contributed to real life experiences of farmers in catfish farming who worked on a rigorous and spiraling CI & I model. Issues such as market, funding, nutrition, management and electricity were strongest drivers that required attention for small business to become profitable and sustainable. The outcomes would contribute significantly to aquaculture policy makers and managers in South Africa for improved development of the sector.

Key words: Continuous improvement, continuous innovation, model, management tools, profit, catfish small business.

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LIST OF ABBREVIATIONS

ADEP=Aquaculture Development and Enhancement Programme

AgriSETA=Agriculture sector Education Training Authority

ARC=*Agricultural Research Council*

AISA=Aquaculture Institute of South Africa

ANOVA=One Way Analysis of Variance

ARU=Aquaculture Research Unit

ATDC=Agricultural Technology Demonstration Centre

AW=Average Weight

BPPP=Beef Profit Partnership

CCTV=Closed-circuit Television

CI=Continuous Innovations

CIm=Continuous Improvements

CI & I= Continuous Improvement and Innovation

CPD=Continuous Performance Development

CPS=Creative Problem Solving

CRC=Cooperative Research Centre

CSFs=Critical Success Factors

USD=United States Dollar

D⁴ = Define, Discover, Develop, Demonstrate

DAFF: Department of Agriculture Forestry and Fisheries

DEFF: Department of Environmental, Forestry and Fisheries

DIY=DO It Yourself

DEA=Department of Environmental Affairs

Dti=Department of Trade and Industry

DWA=Department of Water Affairs

eNCA=eNews Channel Africa

EO=Extension Officer

PWP=Extended Public Works Programme

FAO=Food agriculture Organization

FCR=Food Conversion Ratio

FFR=Freshwater Fisheries Research Centre

FU=Feed used

GDPs=Gross Domestic Products

GPS=Global Positioning System

GSRCs=Greater Sekhukhune Region Secondary Cooperative

HoD=Head of Department

Human Resource Centre (HRC)

HRC=Human Rights Council
 IQ=Intelligence Quotient
 KPIs=Key Performance Indicators
 Labs=Phakisa Aquaculture Laboratories
 LIIN=Lyete Improvement and Innovation Network
 LLIP=Lyete Livestock Improvement Projects
 MEC=Member of Executive Committee
 MME=Measuring, Monitoring and Evaluation
 NASF= National Aquaculture Strategic Framework
 NDA=National Department of Agriculture
 National Regulator for Compulsory Specification (NRCS)
 NGO=Non Governmental Organization
 OQIO=Observation Questions Idea opportunities
 PDA=Plan, Do, Act
 PDSA=Plan, Do, Study and Action
 PTO=Permission to Occupy
 PTM=Productive Thinking Model
 UL=University of Limpopo
United States Agency for International Development (USAID)
 RAS=Recirculating Aquaculture Systems (RAS)
READ=Rural, Environment and Agricultural Development
 R & D=Research and Development)
 SA=South Africa
 SABPP=South African Beef Profit Partnership
 SEDA=Small Enterprise Development Agency
 SGR=Specific growth rate
 SI & I=Sustainable Improvement and Innovation
 SMARTT=Specific, Measurable, Achievable, Relevant, Targeted and Time-framed
 SMMEs=Small to Medium Enterprises
 SPSS=Statistical Package of Social Sciences
 SR=Survival ratio
 StatsSA=Statistics South Africa
 TPS=Toyota Production System
 TPS=Toyota Production System
 TQC=Total Quality Control
 TQM=Total Quality Management
 WFF – SASSI=World Wildlife Fund - Southern African Sustainable Seafood Institute ()
 WG=Weight Gain

WRC=Water Research Commission
WWII=World War II

CHAPTER 1: Introduction

1.1 Aquaculture Background

The population of the world is reaching an alarming number of 10 billion people, majority of which are undernourished or malnourished. One in seven new born babies suffer from stunting globally while obesity and overweight are also prevalent in pupils and adults. New innovative ways of producing more food and improving nutrition are essential. Fish is considered to be the healthiest food on the planet and less harmful to the environment. Aquaculture has played a critical role in global food security and has grown ever – since 1970 by 7.5% yearly. Production of aquaculture products has to be intensified by coming up with new sustainable strategies, and these strategies have to be cognizant of mixing the technical aspects of aquaculture (i.e. genetics, disease, feeds and digital innovation and many more) with business developments in investments and trades (FAO, 2019; FAO, 2020a).

According to FAO (2020b) the production of fish world-wide in 2018 was estimated to reach 179 million tons, with the estimated value USD 401 billion. About 82 million tons of the above mentioned estimates were contributed by aquaculture with an estimated value of USD 250 billion. A total of 156 million tons was collected from unconsumed food activities such as fish meal and fish oil production for manufacturing of pellets. China still leads in terms of global fish production estimated at 35% in 2018. Consumption of fish world-wide between 1961 - 2017 improved by 3.1% as compared to only 2.1% of animal food such as meat, dairy and milk. Fish supply per capita grew from 9kg in 1961 to 20.5kg in 2018, which is average of 1.5% growth yearly. Production of fish is anticipated to realize growth from 179-204 million tons by 2030 and aquaculture will continue to be the impetus behind this growth (FAO, 2020a).

Yearly growth of aquaculture is expected to reduce from 4.6% between 2007-2018 to 2.3% between 2019-2030. Factors that contribute to this tumble includes environmental regulations implementation; stringent water access, lack of proper production zones; increased aquatic animal diseases attributed by intensive production systems; declining aquaculture production returns (FAO 2019; FAO, 2020a).

Hunger is increasing in almost all African countries with a lot people suffering from malnutrition (FAO, 2019). The projection of aquaculture growth in Africa in 2030 remains low at 3.2 million tons, majority of which will be contributed by Egypt (2.2 million tons). Pangasius and carp species are projected to dominate the global aquatic scale by 62% in 2030. Species relying on artificial pellets will increase in price impacting on their availability and affordability. Highly priced feed impacted on the species structure making the focus to be on species that performs better on alternative food options (FAO, 2020b).

The rate of fish intake in Africa is projected to decline by 0.2% per annum until 2030 to increasing population growth outpacing growth in supply. This means that both locally

produced and imported fish will not be able to satisfy the growing market (FAO, 2020a). This drop in fish intake per person raises alarms towards sustainable access to sufficient in food due to high dominance of malnutrition cases in the African continent. The decline also impacts on the FAO's determination of eradicating poverty and promoting access to sufficient, affordable and nutritious food in order to sustain Agriculture (FAO, 2019).

In the face of deteriorating wild capture fisheries supply, aquaculture sector was identified as a priority to replenish this gap and also eradicate poverty, create jobs, improve food security and improve livelihood (Aquaculture Development Bill, 2018). Aquaculture in South Africa remains a young industry with significant potential for growth and development (Laboratory Report, 2014). The industry is supplying less than 1% of global production. Aquaculture in South Africa made of freshwater and marine has increased in the recent years. In 2012 production were 3926.89 tons, 4802.11 tons in 2013 and 5209.60 tons in 2014. An increase of 45 tons was achieved in 2015 with total production of 5418.15 tons (Department of Agriculture, Forestry and Fisheries DAFF, 2016). The powerhouse for marine aquaculture industry is alone with positive growth projections for the future (Britz, 2014).

The Department of Agriculture, Forestry and Fisheries (DAFF) as a leading fisheries agency embarked on a number of interventions to grow the industry including:

- The development and endorsement of National Aquaculture Strategic Framework (NASF) that provides a road map for DAFF and key role players to stimulate the aquaculture industry development in South Africa (DAFF, 2013).
- Aquaculture Development and Enhancement Programme (ADEP) launched through DAFF and the Department of Trade and Industry (the Dti) to promote and encourage investment opportunities into the aquaculture sector (DAFF, 2014)
- The launch of Operations Phakisa Delivery Unit by the presidency to unlock the economy of South Africa's ocean around 2014

Phakisa Aquaculture Laboratories (labs) was mandated by the presidency to drive the extensive deliberations held by key aquaculture role players from various institution, private sector, and public sector to outline all the barriers that hinders the growth of sector in the country. The team reported issues such as fragmented legislation and regulatory environment, difficulty in accessing finance, limited investor confidence, limited skills and knowledge-base, lack of market penetration and the lack of freshwater aquaculture policy (Laboratory Report, 2014; FAO, 2016), similar constraints were also reported in the previous years (Tisdell, 1999; Brink, 2003; DAFF, 2012). The freshwater sector is expected to speed up its yield and excite demand and supply both locally and internationally (Laboratory Report, 2014). The freshwater aquaculture bill policy was endorsed to enhance the growth of a fair, sustainable and affordable industry in order to foster responsible aquaculture sector (Aquaculture Development Bill, 2018).

The species currently farmed from inland aquaculture includes Rainbow trout (*Onchorynchus mykiss*) and Brown trout (*Salmo trutta*), crocodiles (*Crocodylus niloticus*), Ornamental fish (*Koi carp*), African sharptooth catfish (*Clarias gariepinus*), Mozambique and Nile tilapias (*Oreochromis mossambicus* and *Oreochromis niloticus*), Marron crayfish (*Cherax tenuimanus*) and Common carp (*Cyprinus Carpio* and *Ctenopharygodon idella*). The most important production areas for freshwater species include Limpopo, North West, Mpumalanga, Free State, Kwa-Zulu Natal and Western Cape provinces (DAFF, 2016a).

According to DAFF (2016a) freshwater aquaculture sector is attractive as fish can be produced in all nine provinces of South Africa. The sector that is leading in production was mussel with a record of 1758.47 tons, followed by trout sector with a production of 1497 tons. The catfish production was zero in 2015 and this was attributed by farms producing for export market rather than growing fish to market size. However, significant efforts in resuscitating the industry includes, 4.4 tons of catfish being exported to Botswana, Nigeria, Zambia. Vietnam catfish (*Pangasius*) also found a secured market and sold 11 tons to South Africa with the estimated value of R0.2 million.

The partnership between Department of Agriculture Forestry and Fisheries (DAFF) and Aquaculture Research Unit (ARU) based at University of Limpopo (UL) was mandated to produce catfish fingerling for demonstration and research. Local subsistence farmers benefited from the production of thousands of fingerlings from the same partnership. Furthermore, more current strides of catfish fingerling production, training and research were undertaken by the Agricultural Technology Demonstration Centre (ATDC), which is developed by the China Ministry of Commerce, DAFF and Department of Agriculture and Rural Development in the Free State. The types of production systems utilized are Aquaculture Recirculating Systems (RAS); floating cages and ponds. Some of the innovative and unique practices in the country were integrating rice production with aquaculture sustainability. More catfish (26 tons) were produced in one satellite project based in the Eastern Cape employing some form of fish processing and value adding (Britz, 2014).

The Free State Department of Agriculture also came up with a “master plan” to increase productivity and competitiveness of catfish production in the province. Subsistence projects from six towns were empowered to grow out catfish fingerlings in the RAS systems and sell the fish to the fish processing plant. All the mentioned efforts are not enough to make catfish industry locally and internationally competitive, since its production is still insignificant (DAFF, 2016a). James (2016a) refers to the sector as a troubled industry performing unsatisfactorily with no success stories. Therefore, the study is introducing a new approach that will enhance the manner in which catfish business owners think and act to achieve more improvements and innovation (Clark *et al.*, 2008b).

1.2. Problem Statement

The problem is that since the inception of catfish aquaculture farming in the 1980's, none of the producers became commercially viable due to lack of market research and product development. At that period, aquaculture production increased before a customer base was secured, but the high cost of feed also had a huge impact on the performance of the sector. In 2000, a second growth was reduced when a strengthening rand prevented the fish to be exported to Thailand. The emerging of too many laws from government caused the freshwater aquaculture sector to be ineffective and lag 25 years behind the rest of other African countries (James, 2015a; Sue, 2016; Aquaculture Development Bill, 2018).

Sue (2016) reported that since 2004, the amount of pilchard allowed to be netted from the sea has lowered below 80%, presenting an opportunity for an alternative freshwater fish to replenish this gap. This means that intensive aquaculture systems to increase production and proper processing facilities are required to address the shortfall. Catfish serves as a good candidate to be a replacement of pilchards as it possesses attractive characteristics such as fast-growth rates, high tolerance of wide range of temperature and water, ability to exhale oxygen, consume a variety of food and can be grown in high densities (Rouhani, 2010). Catfish also scored second after pilchard in the market acceptance survey indicating the potential of the species in South Africa. When catfish producers could grow what people want and deliver when they want at a price that warrants profit, they will succeed (Engle, 2012b; Beem, 2014; Sue, 2016). FAO (2020c) also reported that catfish is amongst the top ten species that grow fast and are cultured in almost all the countries in the world.

The number of resources invested in the indigenous catfish industry to boom in the country is startling and the productions remains at less than 1% dominated by fingerlings sales rather than market-sized fish sales (DAFF, 2016a). Most of the commercial successful catfish projects have closed down and only one was in operation mainly supplying their product to African foreign nationals, producing around 26 tons (Britz and Botes, 2009; DAFF, 2016a, Sue, 2016). The challenges that contributed to the decline in production of catfish includes; lack of commercial market; negative perceptions of the species; escalating feed costs; high operational and infrastructure costs; lack of fingerling supply; access to finance; lack of processing plant; high distribution logistics and lack of value chain (Britz and Botes, 2009; Quoc, *et al.*, 2012; Britz, 2014; Laboratory Report, 2014; Sue, 2016). Hautamäki and Oksanen (2016) emphasized necessities of finding solutions for “wicked problems” in businesses and defined them as complex issues that demands cooperation from the entire value chain for solutions, and when resolved the possibility of creating long term innovations will be realized. James (2016b) emphasized that aquaculture productivity promises from aquaculture technology experts are often misleading and fails to produce evidence-based production capacity creating unreliable customer expectations.

There is very scanty literature of Continuous Improvement and Innovation (CI & I)

methodology applied in fisheries and aquaculture industry so far. Investigation of the impact of CI & I approach in aquaculture by improving thinking and actions of individuals, partnership and network members has caught attention (Griffith and Mullen, 2009). Systems that foster quicker and simpler methods of technology adoption should be highly applied for businesses to enjoy the long term benefits (Griffith *et al.*, 2008). The approach of “business as usual” normally fails to reach the target outcomes of improved profits in any settings.

1.3. Contribution to Knowledge and Significance of the Study

The contribution to knowledge is that the Continuous Improvement and Innovation (CI & I) research approach has never been applied in aquaculture or fisheries before. Given that food insecurity are rising rapidly causing food prices to peak (Ter Morshuizen, 2014); South Africans are growing poorer (eNCA, 2019) and high costs of living for ordinary people in the country is one of the concerns of government aggravated by increased Value Added Tax (VAT) and fuel prices (Writer, 2018).

The approach of “business as usual” is no longer sufficient to supply people with healthy diets as wild stocks have severely deteriorated and cannot be recovered. People are in the constant search for alternative affordable food options that gives them healthy diets and farmed fish is the solution, and sharptooth catfish (*Clarias gariepinus*) form part of the solution (Ter Morshuizen, 2014). Alternative and new innovative ideas that fuels job creation in pragmatic ways to protect jobs are urgently needed to service the 9.6 million unemployed South Africans (Mahlakoana, 2018). Investigations in business management methods are not common in aquaculture and new methods capable of responding effectively to all kinds of challenges in the sector are needed (Joffe *et al.*, 2017), hence this type of study is critical.

The production of catfish in SA is low besides the given advantages of the species of been raised in highest densities; ability to breathe air; hardy nature of withstanding high metabolic wastes, attains best Food Conversion Ratio (FCR) (less than 1:1); requires less management; grows faster; reaches market size of 1kg in 6 months and also save costs of infrastructure. Sharptooth catfish is the simplest and most affordable fish to farm with. They can survive longer during transportation due to its air breathing ability and bigger-sized and boneless fillets can be achieved during slaughter converted into various culinary. This makes the marketing of the fish more versatile and it is already primary first class fish in other parts of African continent. Its consumption rate by people is slowly growing besides the fact that it suffers negative perceptions and remains an issue in many religions. It is inevitable that food prices are on the rise, sharptooth catfish is the cheaper alternative option and it is with no doubt that it is the fish for the future (Ter Morshuizen, 2014).

Writer (2018) indicated that the economy of SA is made of 89.5% of Small to Medium Enterprises (SMMEs) contributing 28% to employment creation. The goal of National

Development Plan (NDP) regarding SMMEs of creating 90% of employment by the year 2030 seemed to be farfetched since 70% of the emerging business fails within the first two years of being in operation. “To meet the objectives outlined in the NDP, a vastly improved understanding of the business dynamics of small firms, which includes their diversity, characteristics, needs and constraints is needed” (Writer, 2018). The study presents new systems that enhance thinking and action of resource owners to achieve more improvements and innovations in the real world (Gray *et al.*, 2015). Liker and Morgan (2006) reported that processes that reveals, resurfaces and uproots underlying problems in an organization encouraging problems to be resolved are fundamental. This type of research focuses on people as the main competitive resources in which effective training, motivation and management. The ancient proverb “give a man a fish feed him for a day, teach a man to fish and you feed for a life time” was the base for the current study (MJA, 2014).

This study is important because it empowered and capacitated people with suitable thinking, willpower, confidence and mechanisms to achieve ongoing improvements and innovations (Burrow, 2010). The study further assisted people to take action with a purpose to achieve better outcomes and it measured the current system to determine what made the real difference. According to Maital (2016) innovation is the manner of thinking that can be applied successfully by any individually with full commitment and effort in all spheres of their lives. Establishments that solely rely on R & D sectors for breakthroughs are missing out on the precious opportunities that could turn around situations for better. This type of study encouraged innovation to be harvested from rare places and dark corners of people’s lives where creative thinking was not expected. When this dark places are brought into the light, remarkable results could be achieved (Maital, 2016). Additionally, for a business to become innovative it starts with engaging with staff members, that is where creative ideas will emerge and more importantly, a conducive environment must be created where they feel they can talk about anything (van Rooyen *et al.*, 2017). This study contributed to UN Sustainable Development Goal 1– No Poverty; 2- Zero Hunger and 13- Climate Action (Constanza *et al.*, 2016).

1.4. Project Vision

Timms and Clark (2014) created the six main outcomes that CI & I process attains when practiced in any context:

1. “More success, improvements and innovations
2. Faster successes, improvements and innovations
3. Proof of successes, improvements and innovations
4. Confidence about how and why the results were achieved
5. Skills and confidence to continue to achieve results in the future

6. Satisfaction and enjoyments from using the process and achieving rewarding results”

This study began with the “end in mind” a concept that involves starting with a picture, statement or image of what the research is envisioning attaining at the end. The “end in mind” is defined as better as “knowing where you are going to better understand where you are now and so that the steps you take are always in the right direction”. It is very simple for people to be swamped by so many in their daily activities and yet become ineffective. This enquiry’s “end in mind” is to achieve real world improvements and innovations in profit in catfish aquaculture businesses through sharpening of thinking and action of individuals or teams (Burrow, 2010; Covey 2013).

The world is evolving and businesses have to apply effective strategies to embrace this shift. Figure 1.5 displays the mechanisms of enhancing thinking and action to keep up with the changes and enhance performance. The red bottom line displays that “business as usual – doing the same and getting the same” will attain no effective changes, unless some form of external information or technology is introduced, then some improvements and small impacts can occur. The rate of these improvements will solely rely on the pace of that technology. The green line shows the impacts of applying a system that combines continuous improvements and continuous innovations into one model, to achieve accelerated growth and returns (Gray, 2013; Timms and Clark, 2014). Gray *et al.* (2015) indicated that improvement and innovation would be achieved through repeated cycles of CI & I via application of clear mechanisms. Clark *et al.* (2008c) posed a critical question in his closing remarks as follows: “What is the cost of not implementing a clear, shared model for the design and management of projects to achieve sustainable outcomes, improvements and innovations?”(Griffith *et al.*, 2008).

Since just thinking alone is not enough to achieve outcomes of improvements and innovations, the strength of the mechanisms lies in the ability to render both thinking and action without causing strain between the two activities (Gray, 2013). Continuous Improvement and Innovation (CI & I) principle offers a solution to this gap whereby participants would be capacitated to meet frequently to evaluate their business performances and design targets that would be easily reached. The participants focus their thinking and action on the most key profit drivers that when implemented will have high impacts to improve the performance of catfish businesses.

The linear models of innovation operate under the traditional assumption that innovation mainly depends on scientists and researchers (Parnell *et al.*, 2008c). Workers on the ground are normally being ignored, starved from information and being ineffective beneficiaries of knowledge, while in reality they are more informed and are directly affected by this type of matters (Pannell *et al.*, 2006). Any ordinary persons have a store of impactful knowledge

developed through experience and memories that can be harnessed to improve methods continuously (Clark *et al.*, 2008b). In the past information regarding change would be communicated via media platforms and their effectiveness would still be in question. Normally these types of approaches are complicated and leaves farmers confused (Harrington, 1995). Ideas to improve and innovate can be derived from any source; critical thinking and new information regarding the current situation can be deduced from any situation (Nolan *et al.*, 1996).

Parnell *et al.* (2008c) emphasized that, Continuous Improvement and Innovation (CI & I) was practiced within the structures of partners' business to improve performance and this is the best capacity building opportunity that sustained enthusiasm levels to implement. Additional benefits included readiness to share openly about achievements which ultimately improves and breaks the spirit of complacency and being information dependent on others. These types of systems are very slow to be put into practice.

Sustainability of improvement and innovation, individuals have to possess personal mastery and be capable. This personal mastery will decide if the seven steps of Continuous Improvement and Innovation (CI & I) would be effective or not; it can also have an impact on how partnerships would be developed (Gray, 2013). Basic education sector does not offer this type of models in their curriculums and are also seldom found in practice at rural community projects. Empowering individuals with knowledge and ability to achieve continuous improvement and innovations proved challenging (Clark *et al.*, 2008b).

Around 2010, de Bono uttered a strong statement stating that a huge crisis facing humanity today is poor thinking and seldom climate change. Maital (2016) further reported that the distinction between innovators and complainers is that innovative people highlights red tapes, complains and incompetence in organizations, and then go an extra mile of taking actions and finding workable solutions. They do not consider their level of Intelligence Quotient (IQ), intelligence and influence but have the zeal to implement something against all odds. According to Clark *et al.* (2008b) individuals who are part of CI & I process need to be capacitated to manage their own systems and this must not be done on their behalf by for example extension practitioners and scientists. The goal of this research was to empower partners with information, mechanisms, technologies and necessary timeous support to achieve sustainable improvement in profit per individual business.

1.5. Aim

The aim of this study was to improve the profit drivers (i.e. price, throughput and cost) of the sharptooth catfish farming in South Africa by applying Continuous Improvement and Innovation (CI & I) approach to generate revenue.

1.6. Objectives

1. To determine the current status and the decision on whether to do Continuous Improvement and innovation (CI & I) or not in aquaculture sharptooth catfish farming
2. To acquire rapid and measurable improvements in profit drivers of sharptooth catfish farms that generates revenue.
3. To evaluate the effectiveness of mechanisms in enhancing thinking and action of business owners to achieve more improvements and innovations
4. To evaluate the effect of two alternative live food (earthworms and tilapia fish) on the growth rates of African catfish (*Clarias gariepinus*) fingerlings

1.7. Specific Objectives

Following Continuous Improvement and Innovation (CI & I) steps and methods, the following specific objectives were set:

1.7.1: To develop a focus for sharptooth catfish participants that achieves continuous improvement and innovation

1.7.2: To conduct situation analysis in the sharptooth catfish farming that impact on profit drivers of South Africa.

1.7.3: To conduct impact analysis to select priorities that will make a real difference in sharptooth catfish farms of South Africa

1.7.4: To conduct action design plan and determine Critical Success Factors (CSFs) and Key Performance indicators (KPIs) of selected opportunities

1.7.5: To implement the designed action and monitor progress

1.7.6: To conduct performance assessment in order to determine success and failures of targeted results

1.7.7: To conduct creation and synthesis in order to generate new ideas that feeds into subsequent cycle

1.7.8. To refocus on the new developed goal to achieve the desired results

1.8. Research Questions

Following Continuous Improvement and Innovation (CI & I) steps and methods the following specific research questions were set:

Question 1: What is the current status and decision of sharptooth catfish farms in doing CI & I or not in their enterprises?

Question 2: What are the rapid and measurable improvements in profit drivers of sharptooth catfish farms to generate revenue?

Sub question 2.1: In what areas does attention need to be concentrated and what are the goals?

Sub question 2.2: What is the current situation and what are the ideas and opportunities to

achieve the goal?

Sub question 2.3: Which opportunities will make a real difference and what criteria will be used to select opportunities to invest in?

Sub question 2.4: For each opportunity what specific actions need to be implemented and how will the effects of the action measured?

Sub question 2.5: What specific actions are being taken and how are the effects of the action being tracked?

Sub question 2.6: What results were achieved; what worked well and what did not achieve the results being targeted?

Sub question 2.7: What are new ideas and opportunities and is “outside the box” thinking happening and who could help?

Sub question 2.8: What areas need attention now and what are the goals?

Question 3: Which mechanisms enhanced thinking and action of sharptooth catfish participants to achieve improvements and innovations?

Question 4: What is the effect of live earthworms and tilapia fish as an alternative food option on the growth performance of African catfish (*Clarias gariepinus*) fingerlings?

1.9. Summary of the Chapter

This chapter introduced the background information of aquaculture in South Africa. A brief history of continuous improvement and innovations including its steps, tools, focusing frameworks, timing and monitoring, critical success factors, reporting, use of technology, language and thinking and action design were outlined. The conceptual framework, problem statement, aims, objectives and research questions were also outlined in details and the chapter closed with contribution to knowledge and significance of the study.

CHAPTER 2: Literature Review

2.1. Introduction

2.1.1. Historical Account of Aquaculture Industrial Developments in South Africa

2.1.1.1. Colonial Days (1811 - 1960)

In 1811, the collection of animal and plant specimens around Southern Africa resulted into identification of the first two freshwater species namely smallmouth yellowfish (*Labaeobarbus aenus*) and barbell or sharptooth catfish (*Clarias gariepinus*). The first museum was established in Cape Town in the year 1825, and the first public show case of the internal museum was conducted between 1834-1845. The first graphic designs of many animals and few other freshwater fish species were published in scientific journals between 1840-1845 (Skelton, 2001).

Fish hatcheries and inland fisheries departments were incorporated into nature conservation authorities and began to conduct surveys, biological studies of the species and distributing specimens to the museum. The South African Museum in Cape Town managed the taxonomic studies of freshwater fishes in Southern Africa until 1959s. After 1959, the research was carried forth by the J.L.B Smith Institute of Ichthyology that broaden their focus to revisions and studies of phylogenetic relationships. Furthermore, studies of early life history, behavior, chromosomes and biochemical characters of fishes were also looked into by the institute (Skelton, 2001).

2.1.1.2. Apartheid Days (1960 - 1994)

Aquaculture in South Africa was initiated in the 1980's by the Apartheid government mainly for sports and recreational purposes through stocking of local dams with exotic species such as trout and bass (Skeleton, 2001). The recreational body permitted species catch and release activity only and prohibited catch for home consumption. Then, government shifted from supporting recreational aquaculture into promoting aquaculture for food security by constructing state led facilities in reservoirs based in Venda, Lebowa, Gazankulu and Transkei. Commercial farming ventures for trout, catfish, ornamentals and marine species were then developed. Furthermore, emerging farmers and black economic empowerment were supported in a small - scale level (Rouhani and Britz, 2004; Rouhani, 2010).

Commercial farmers began to be more actively involved in carp farming due to availability of state funds and infrastructure support from the former Transvaal Nature Conservation Department. However, low species demand and market price caused yearly production of carp to reduce from 30.0 tons to 1.2 tons (Hetch and Britz, 1990). It was in this period that most of the freshwater species had low market penetration and insignificant revenue (Britz, 2014; James, 2015a). Additionally, Hetch (2001) reported that the feasibility of commercializing aquaculture was decreased due to low fish prices, high production costs and lack of financial capital.

On the contrary commercial trout farming was doing well due to farmers taking initiatives to develop innovative products, marketing strategies such as collaborating with Woolworths store. The first hatcheries were built in Jonkershoek, Pirie, in the Western Cape for production of game and fodderfish for angling purposes. This initiative resulted into annual production of 750 tons valued at R11 million per annum from 30 major producers of trout species located in Mpumalanga, Western and Eastern Cape (Skelton, 2001). This led to the new government in 1999 redirecting resources to trout industry by building more hatcheries in de Kuilen and Lydenburg to meet market demands. The trout private sector improved financial sustainability and viability of the projects. Trout commercial farmers possessed better education and personal capital investment that played a huge role in having successful business (Rouhani and Britz, 2004).

2.1.1.3. Aquaculture Initiatives in South Africa Post - Apartheid (1980's)

In 1990, the production and stocking of exotic species into local dams were terminated by provincial nature conservation leading into closure and privatization of many state led aquaculture facilities due to lack of support. The situation deteriorated further during political transition in 1990s resulting in lack of policy and financial support for aquaculture (Rouhani and Britz, 2004; James, 2015a). Since then, Department of Agriculture, Forestry and Fisheries (DAFF) took several steps in attempts to resolve the challenges in aquaculture such as development of marine policy, national aquaculture strategic framework policy and aquaculture draft bill amongst others. Initiatives of establishing public private partnerships between governments, private, institutions and farmers were also accomplished by the same department (DAFF, 2013; 2016).

Rouhani (2010) also reported that, aquaculture marketing is very important and mostly requires attention. When a farmer can supply the market on time, in the correct form and correct price, the enterprise can be successful. He further indicated that, projects without good business plans experience operational challenges that could have been resolved on paper and investors mostly requires a business plan before funding any project. The entry of small business enterprises into aquaculture prove to be problematic due to projects failing to be profitable or experienced unresolved governing barriers (Britz, *et al.*, 2009).

Sustainability of aquaculture enterprises requires farmers to have certain skills such as maintenance, fish husbandry, office management, human resource management and marketing. However, the three major concerns in aquaculture includes, who will be interested in the product, what will be the cheaper alternative production methods and how much revenue will be generated? On the other hand, local markets such as restaurants, wholesalers and supermarkets are willing to purchase fish based on good quality, freshness, quantity, attractiveness and a good price. The species that are highly desired in aquaculture locally and internationally includes salmon, prawns, mussels and abalone (Britz, *et al.*,

2009).

The presidency in the period of Mr. Jacob Zuma launched Operation Phakisa in 2014, with the aim of achieving target outcomes faster and unlocks the ocean's capability to improve economy of scale in South Africa. Aquaculture was amongst one of the initiatives of Operations Phakisa mandated to address poverty and unemployment. The Phakisa Aquaculture Laboratories (labs) is a service provider contracted to facilitate the six weeks of discussions and planning amongst government, industry, academia and Non-Government Organizations (NGO's) hosted in Durban, South Africa. The Phakisa Aquaculture Laboratories (labs) is also responsible for effective implementation of the plans by all stakeholders, monitoring and reporting. Many issues emerged from the gathering and the Phakisa Aquaculture Lab categorized them into two major issues namely; the project related issues and the enabler issues (Laboratory Report, 2014).

The Phakisa Aquaculture Laboratories (labs) defined project related issues as issues that were exclusively limited to self-owned projects and species type such as lack of infrastructure, access to quality inputs, disintegration of research and lack of inclusivity. Enabler issues were defined as cross cutting issues affecting the industry as a whole such as unsupportive legislative and regulatory environment, lack of skills and knowledge base, access to finance and lack of formal market penetration. National aquaculture sector initiatives provided solutions that addressed the project related issues and enabler issues, which were critical towards implementation of successful and sustainable future projects (Laboratory Report, 2014).

2.2. Catfish Farming in South Africa

2.2.1. Biology of Sharptooth Catfish

Sharptooth catfish, commonly known as 'barbel' is a warm water species cultured throughout Southern Africa. It can tolerate wide temperatures of between 20-30°C and does not have scales, making handling much easier. The species can be cultured in high densities mainly due to its hardy nature. The species also have nostrils used for breathing air in and outside the water. The fish can be mobile on land as long as the skin remains moist (Rouhani, 2010; Sue, 2016). They are widespread nation-wide and can be located in any river system, dams, weirs and flooded land (Fish The Fly, South Africa, 2018).

Sharptooth catfish are omnivorous bottom feeders, prey on small fish, rodents, birds and frogs and can be fed a variety of feeds. At water temperatures of 18 - 22°C, spawning can occur especially during spring and summer seasons. Catfish reproduce at 1 - 4 years at an estimated length of 150 – 750 mm with possible fecundity between 20000 - 25000 eggs/kg fish. Since natural spawning is unsystematic and uncontrollable, artificial spawning is mostly used. The milt from males and eggs from females are not released simultaneously, therefore, an injection of pituitary extracts is recommended. The larvae develop into juveniles and transferred to outdoor system at a stocking density of 2000 fry per m².

Producers prefer to purchase catfish when they are between 4 - 5 g (Pillay, 1993; Rouhani, 2010).

Catfish have high dietary requirements; therefore feeding with artificial diets is of paramount importance for intensive culture systems. Fish diets containing 35 - 42% crude protein achieves best growth performance and food conversion ratio. They are composed of both plant and animal feedstuffs supplemented with vitamins and minerals. Fixed levels of feed formulation for a balanced diet vary depending on the availability and price of feedstuff on the market (Rouhani, 2010; Sue, 2016).

2.2.2. Catfish Farming Industry

Catfish farming started in the 1980's, but its development was low due to low selling prices and lack of market availability (Britz, 2014). Substantial growth and production of 100 tons from catfish industry was realized until 1992 supported by Foundation Research Development. The industry also collapsed due to low prices and lack of market availability (Rohani and Britz, 2004; Britz, 2014). The collapse was also attributed by lack of proper coordination, lack of skills in farming and promotion, and available stock has poor genetics with no intentions of improved strains such as fast growth and cold tolerance (Rouhani, 2010).

Catfish farming was reported to be a rapidly growing industry with the potential of sharptooth catfish (*Clarias gariepinus*) becoming the major locally produced species. Sharptooth catfish has good characteristics such as extreme hardiness, bred artificially, consume all kinds of food, fast growth and offer large fillet. In 2001, production of sharptooth catfish was estimated around 120 tons per annum valued at over R1 million (Skelton, 2001). The catfish industry has the potential to address unemployment, provide sustainable livelihood and feed the rapidly growing population in South Africa (StatsSA, 2016).

2.3. Continuous Improvement (CI_m)

Introduction of Continuous Improvements (CI_m) was recorded in 1871 in Scotland and 1894 in USA as an award scheme to develop, encourage and reward employee's in order to improve working conditions (Schroder and Robison, 1991). Although the initial recognition and use of CI_m was never agreed upon, plenty of evidence supported that the concept was in use for long periods (Gray, 2013). Additionally, CI_m were not widely practiced in the animal production sector and there was a need to embark on a search for types of tools and techniques required to encourage its adoption (Hyland and Clark, 2008).

In accordance with the work of Imai (1986), Kaizen was another CI_m Programme established in Japan in the late 1940's. Kaizen refers to continuous improvement for all with clearly defined roles, responsibilities, measurements and standards to achieve greater efficiency in process management. During mass production of 1950s-60s, a number of

organizations diverted their resources towards curbing potential problems and putting preventative measures into place. This led to reduction of CIm programmes giving rise to the applications of the total system approach through Total Quality Control (TQC) concept. Hafeez (2007) intimated that CIm programmes were revived again in the 1980's.

Quality programmes post World War II (WWII) occurred in three waves. The initial wave concentrated on the forefront employees, refining labor conditions and practices. The second wave moved attention to top executives and their working styles, improving their thinking and action. The third wave capacitated both management and employees while encouraging a culture of learning in organizations (Senge, 1992). Jha and Kurma (2010) emphasized that Juran, Crosby and Deming made significant contributions to quality management, which was successfully adopted into various organizations. Jha and Kurma (2010) also stated that each author developed his own exclusive philosophies regarding quality management. Juran's concept was that all employees must partake in the creation of products and services. Crosby's concept focused on doing right the first time with zero defects. Deming's approach focused on capacity building and skills transfer for all employees rather than solely focusing on outcomes alone.

The shift of CIm focus from detection to prevention demanded new methodologies, new quality tools, new operational systems and a change in company management styles. CIm with hundred years history was developed on proven and reliable methods applied various sectors including public sector; Healthcare; Large Product Institutes; Small and Medium Enterprises (SMMEs); Research and Development (R & D) and Manufacturing Industry (Radawski, 1999).

2.3.1. Continuous Improvements (CIm) Concepts and Principles

According to Roberts and Sergesketter (1993), Continuous Improvement (CIm) evolved and developed gradually beyond specific improvements, to focus on transforming organizations and organizational cultures. Hill and Wilkinson (1995) reported three principles of improvements as customer focus; process focus and both products and process focus. Jha *et al.* (1996) reported that improvement concepts are savvy, streamlining and refining, regulating, integrating and monitoring performance. Clark and Timms (1999) defined CIm "as a process that enabled individuals in teams to regularly and frequently focus their thinking and action to achieve impact on their performance through improving their practices, processes, systems, products and/or services".

The past CIm activities focused on enhancing work conditions while the current CIm activities involved structured and widespread approaches. CIm can be applied across all spectrums including personal life management, economic issues, production and consumption (Mulej *et al.*, 2004; Bhuiyan and Baghel, 2005). During implementation, CIm should not only be acknowledged just as set of techniques regularly applied to achieve

something but rather as a set of useful and decisive insights flexible enough to accustom to any institutional requirements (Wycoff, 2004). CIm activities were primarily implemented in the manufacturing sector and have widespread into sectors such as public sectors, Healthcare, Small and Medium-sized Entities (SMEs) and Research and Development (R & D). However, Agriculture did not vastly discover the concept of CIm early enough (Clark, 2008b).

In the past, CIm in the field of Agriculture did not survive for long and was resurged in the 1970s through the implementation of improved research based farming and soft technology systems. Pertersen (1999) indicated that this reported failure of CIm before 1970 was alarming since Department of Agriculture in the United States employed and promoted by Deming (co-founder of CIm concept) during the period between 1927-1934.

2.3.2 Continuous Improvement Success

Shortell *et al.* (1998) in assessing CIm on clinical practice captured mixed feelings of both positive and negative experiences. Reported evidences indicated that 8% of total quality programs were not achieved, 30% of enterprises failed to achieve improvement and 50% lacked information on performance. The negative CIm experiences were attributed by sloppy execution of cultural differences, insufficient planning and limited knowledge-base. These authors suggested that limitation of improvement process is not embedded in the approach alone but in the social resources needed to obtain success. Studies have shown that improvement program is a tedious process that required ample time during implementation and have implications on people psychologically, mentally, intellectually and religiously (Imai, 1986; O'Brien *et al.*, 1995; Gieskes and ten Broeke, 2000; Plesk, 2003; Ovretveit, 2005).

In British manufacturing enterprises, Bessant *et al.* (1993) articulated substantial growth in profit, throughput, and quality and employee ethics after CIm application. Companies that applied CIm activities achieved increased profits and better remunerations (Zairi *et al.*, 1994), high employee involvement (Bessant and Caffyn, 1997); effective interaction (Anjard, 1998); and competitiveness (Anthony *et al.*, 2002). In Canadian food industry study, it was reported that major motivating factors that influenced the implementation of CIm were minimizing number of abnormalities and enhancing quality operations. Success factors analyzed to determine whether continuous improvement implementing companies have reduced cost of goods sold, number of recalls and production cycle time indicated that participating companies received minimal product return requests than companies that did not implement (Scott *et al.*, 2009). Toyota motor company is a well-known dedicated specialist of Continuous Improvement principles and has designed higher quality vehicles quicker, cheaper attaining greater revenue and managed more vehicle launches yearly than their competitors. Toyota's success was based on a Toyota Production System (TPS)

model that fitted all the required elements together into a daily operational system, practiced every day, and in a consistent manner. The principle was not only limited to the shop floor but was also practiced in white-collar offices including service industries. This is a model that incorporated people, processes and technology into one (Liker and Morgan, 2006).

Madzivhandila *et al.* (2008a) reported that, from 100 farmers involved in a participatory research, 95 indicated an increase in gross margins and 89 from similar sample reported market improvement. This success was achieved through improvement of market security, cost entry of specific goods into market and, market knowledge distribution mechanism. Zain and Kassim (2012) postulate that continuous improvements in the form of new market method involving significant changes in the end product implemented in firms had meaningful certainty effects on the ability of the performance of those firms.

2.3.3. Quality Evolution

The notion of quality in Clm is unclear due to its flexibility to fluctuate in meanings whenever a new perspective comes into play (Zabada *et al.*, 1998). For example, quality refers to the standard of the produce or performance that achieves customer satisfaction, while quality from producer's point of view is ensuring low production costs while meeting product or service specifications. Radawski (1999) clarified the concept by exploring the historical development of quality management methods; it was firstly quality guarantee meaning constant development of a product that satisfied the end-users. In the medical field, Weiner *et al.* (2006) explained that quality as an upgraded structured method towards development and execution of continuous improvement during operations.

2.3.4. Measurement in Continuous Improvement

Reber and Wallin (1984) reported enhanced business operations when informed outcomes for instance KPIs and identification of a focus were applied together. Perrin (1998) was of the opinion that performance reports derived from direct Clm operators were not relevant for outcome evaluation or future predictions but rather suitable for monitoring purposes only and detection of gaps necessary for management consideration.

Kaplan and Norton (1996) further contributed in the development of scorecards as a new performance measurement. Scorecards have four criteria; monetary, clientele, strategic planning and capacity building. The authors emphasized that scorecards are no longer relevant to old-fashioned way of managing behavior and monitoring previous performances, but are currently applied as a tool to strengthen communication, relay of information and knowledge-based system to express selected methods aimed to achieve specific goals in a business. The authors emphasized that for sustainable continuous improvement, it is critical for end-results to be realistic, achievable, and measurable for participants to remain inspired

and fulfilled by their actions.

Sila and Ebrahimpour (2002) studied the association amongst Critical Success Factors (CSFs) and performance measures to categorize applications that participated largely to implementation of improvement, and reported that interactions must be generated between the factors. Quality improvement as a measurement tool of CIm on safety in hospitals uses labor force that is well-vested with statistical and diagnostic skills to analyses, interpret and make recommendations derived from the collected information to improve work activities (Weiner *et al.*, 2006).

Tovey *et al.* (2010) summarized improvement steps as follows:

- 1) goal setting;
- 2) key Performance Indicators (KPI) outline;
- 3) action performance plan to achieve the set goals;
- 4) performance standards;
- 5) monitor, analyses and assess the action;
- 6) review the performance to improve the goal to attain more improvements.

2.4. Critical Success Factors for Continuous Improvements

Rockart (1979) defined Critical Success Factors (CSFs) as scarce scope in which fulfilling results will enable competitiveness in enterprises. It is critical to note that CSFs are closely related with Key Performance Indicators (KPIs). The assessment standards of CSFs and KPIs should be timeous, consistent and frequent i.e. rapidly indicate as to whether actions are accomplishing desired impacts or not and provide significant feedbacks.

Gray (2013) further emphasized that, to measure performance in CI & I; CSFs and KPIs must be closely monitored to achieve the anticipated results and increase the rate and scale of profitability. For CSFs and KPIs to be significant to organizations, they need to be meaningful and clearly communicated to highlight and stimulate actions that achieve success. The advantages of incorporating CSFs and KPIs in organizations includes:

- 1) improved reliable information;
- 2) information deadline warning system;
- 3) improved management attention to CIm;
- 4) support interaction transparency;
- 5) participants will be inspired because of clear performance benchmarks and timeous feedbacks (Rockart, 1979; Radawski, 1999; de Waal, 2002).

The most commonly applied CSFs includes

- 1) teaching and skills development;
- 2) reliable variables, appraisal and feedback;
- 3) supervisory and executive responsibilities;
- 4) consumer contentment target;

- 5) subordinate participation and skills development;
- 6) partner collaboration, interaction and
- 7) system administration.

2.4.1. Purpose of Continuous Improvement (CI)

Schroeder and Robinson (1991) reported the purposes of CI as organizational success, profitability, improved consumer contentment, cost curtailment, willingness to change, with short implementation periods. The success of CI relies on clear and transparent methods aimed at reaching the targeted improvement. The emphasis of the technique is to pay attention on the manner of thinking and action rather than focusing on the tools alone. The main basis of CI is for individuals not to point fingers at each other but to work together as teams to generate new ideas that enhance productivity (Antony *et al.*, 2002). The process of thinking is appreciated by everyone to succeed in all dimensions of life. However, there would normally be invisible and visible powerful forces that counteract people from achieving their desired future. Development of the ability to think and act better eliminates these types of forces and it is critical for achievement of improvement and innovation (Gray, 2013).

2.4.2. Continuous Improvement Mechanism

The following instruments have contributed significantly to the evolution of CI. The first version is the Shewhart cycle developed in 1939, as cited by Gray (2013) (Figure. 2.1).

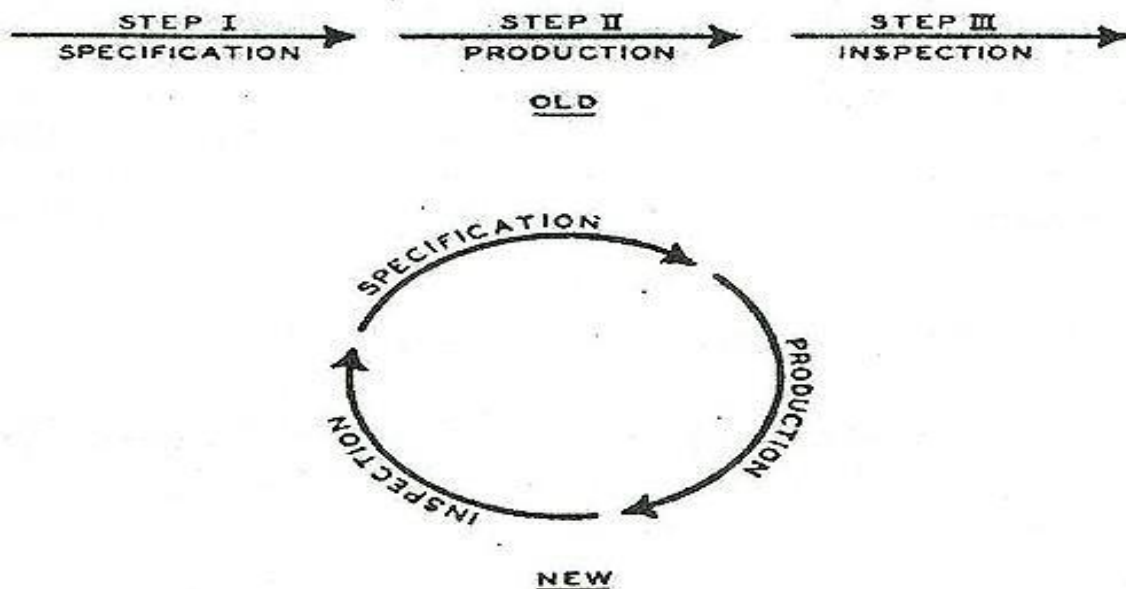


Figure 2.1. Shewhart cycle 1939 (culled from Gray, 2013)

In 1950s, Deming improved the Shewhart Cycle by coming up with “step 4 – redesign through marketing research, to become the Deming Wheel (Figure 2.2).

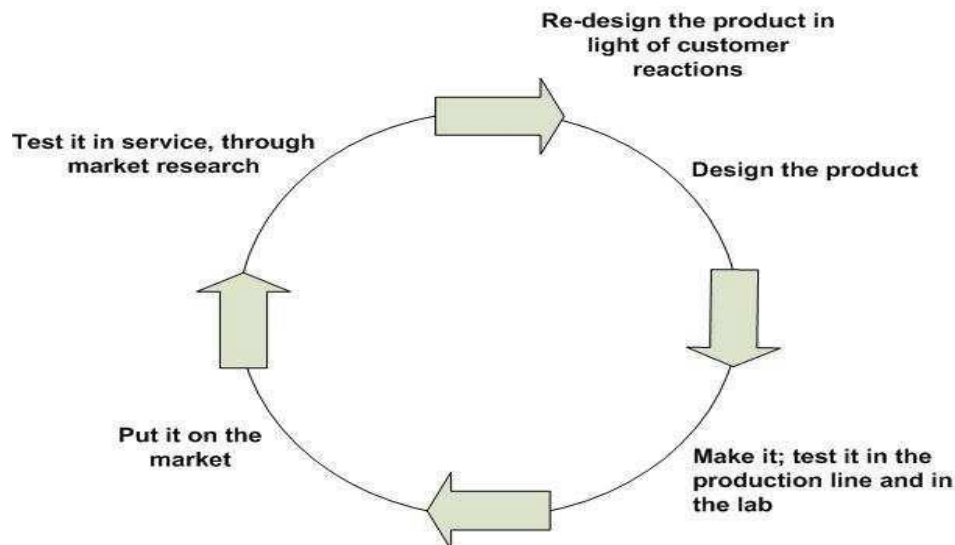


Figure 2.2. The Deming Wheel 1951 (culled from Imai, 1986)

Various studies have been conducted to prove the workability of Deming Wheel of Plan – Do – Act - Check (PDCA) cycle (Imai, 1986; Gray, 2013) (Figure 2.3). In 1960's the Japanese adopted PDCA cycle to become the main source of Kaizen (Moen and Norman, 2010) where improvements were applied in small scales and monitored.

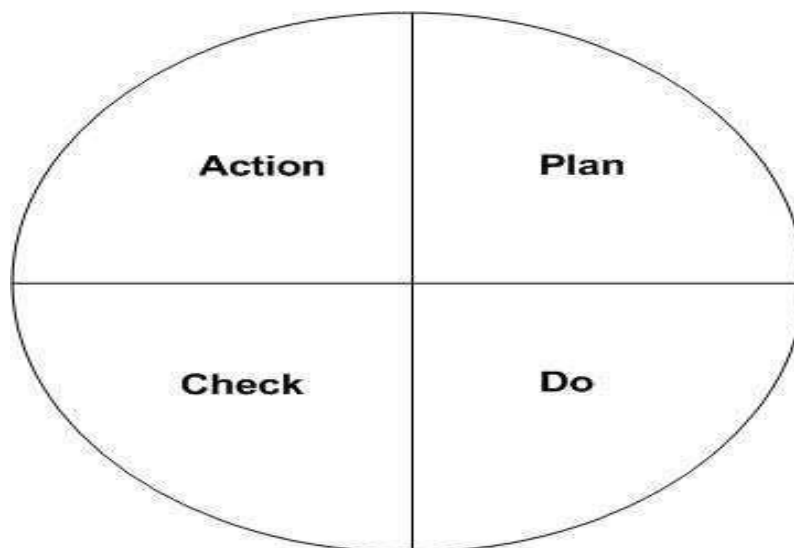


Figure 2.3. Plan – Do – Act - Check (DCA) cycle 1951 (culled from Imai, 1986)

Deming in 1994 modified the Plan, Do, Check, Action (PDCA) cycle into Plan, Do, Study and Action (PDSA) cycle. The “c” for check was substituted by an “s” for study simply because he was of the view that that English interpretation of check is to “hold back”. The PDSA cycle was perceived as a teaching chart tool aimed at continuously developing a system or products. The PDSA plan helps to determine, describe and develop the sphere, costs and

plan project related activities pertaining improvements (Aartsengel and Kurtoglu, 2013; Gray, 2013).

Rapid cycle improvement as shown in Figure (2.4) was developed in 1994 emphasizing fast tracking implementation of the process (Plsek, 1999; Martin, 2002; Langley *et al.*, 2009). The objective of the rapid cycle improvement is not only focused on doing things quicker but also doing things better. The rapid cycle improvement is established on to the PDSA cycle with further three critical questions:

- (i) “what are we trying to accomplish?”
- (ii) how will we know that a change is an improvement?
- (iii) what changes can we make that will result in improvement?”

The questions describe the results, once responded upon, the PDSA cycle is applied to change brainstormed concepts into actions and align those actions into knowledge. This method was holistically developed in reaction to the inflexibility of improvement methodologies. The mechanism for improvement advocates that nothing happens if action is not taken, for enjoyment of positive impacts emanates from taking actions (Langley *et al.*, 2009).

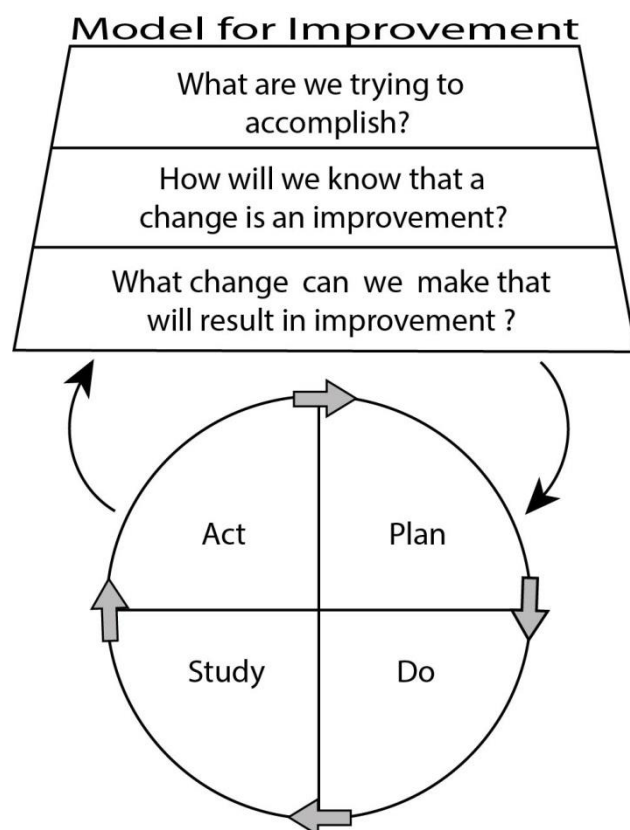


Figure 2.4. Model of improvement (Langley *et al.*, 2009)

According to Liker and Morgan, (2006) the Toyota Company's technology is an instrument that can be applied to empower people to work and improve a system. Technology cannot work efficiently in an environment where a lot of effort is not put into defining the project, diagnosing the problems, creating suitable resolutions, liaising with relevant people and adhering to time-frames. Furthermore, constraints can be concealed by technology and remain untapped. Toyota does not rely on technology to come up with good ideas or apply good thinking. This was also emphasized by the Toyota Vice President Fujio Cho that "Computer technology does not change the way we work. It simply helps to do what we do faster (Liker and Morgan, 2006)".

Liker and Morgan (2006) reported that, The Toyota Production System (TPS) was developed to be the base for viable manufacturing worldwide. Although the Toyota way hindered people from compiling their experiences, effective education was derived from action taken at the bottom where most work is – "gemba" referring to the area where operations are carried out. The concept that supported TPS was illustrated as a house which became traditional model in the manufacturing industries as shown in Figure 2.5. A house built on a weak foundation and weak pillars will not last long even other parts could be strong. The parts functions together to become one whole house. In TPS the parts of the house are explained as is illustrated in Liker and Morgan (2006):

2.5. The Toyota Production System House

2.5.1. Just in time

This portion of the house is responsible for making materials available quickly, user-friendly car part inventory and easier access to correct delivery location timeously. The transition of raw supplies from one operation to the other must be smooth and uninterrupted. Supermarkets apply a system of managing inventory by replacing only what the customer has purchased. The system that is triggered by instructions from customers to replace the stock is known as-*kanban*.

2.5.2. Jidoka

Jidoka- is an unpopular and multifaceted process because it utilizes artificial intelligence to identify a deviation from standard procedure, stops itself and waits for assistance. In a manual system, an operator will pull the plug and stop production if problems are detected and call for help. An andon uses beams and noises to signal for assistance. Once the plug is pulled, an andon is triggered and lights up, plays music and one of the group leader will come to the rescue as soon as in a few seconds as opposed to few hours. This method assists in containing the problem in one area before they spread to other areas, creating flaws for the end user. As problems are slowly resurfacing, continuous improvement is attained.

2.5.3. Heijunka and Stable, Standardized Processes

Heijunka refers to leveling, meaning developing a level work load. Chances of regulating the system can occur when the work load is leveled. Leveled work load can also indicate how much inventory to store in supermarkets. Stable, standardized processes are critical and there will be nothing produced in the just-in-time.

2.5.4. People Engaged in Kaizen

When the inventory is lowered problems can shut down the operation and stop delivering parts to down-stream system. *Jidoka* refers to the use of artificial intelligence or humans to shut down the operation if problems are detected. This will reveal problems and it would be beneficial if staff is well capacitated and confident to fix the problems in a quicker manner. Other-wise outcomes could be result into attrition of production viability.

Toyota system operates similarly to people sailing across the water while the water level is getting lower to reveal the rocks. Inventory system is similar to the water levels and the rocks are the problems. When they inventory is lowered problems will surface and if they remain unresolved the boat will crash. *Jidoka* has a responsibility of revealing problems all day long. Revealing problems is only essential if operators have the equipments and are confident enough to manage the problems and then solve them at the roots. The improvements will be on a continuous basis.

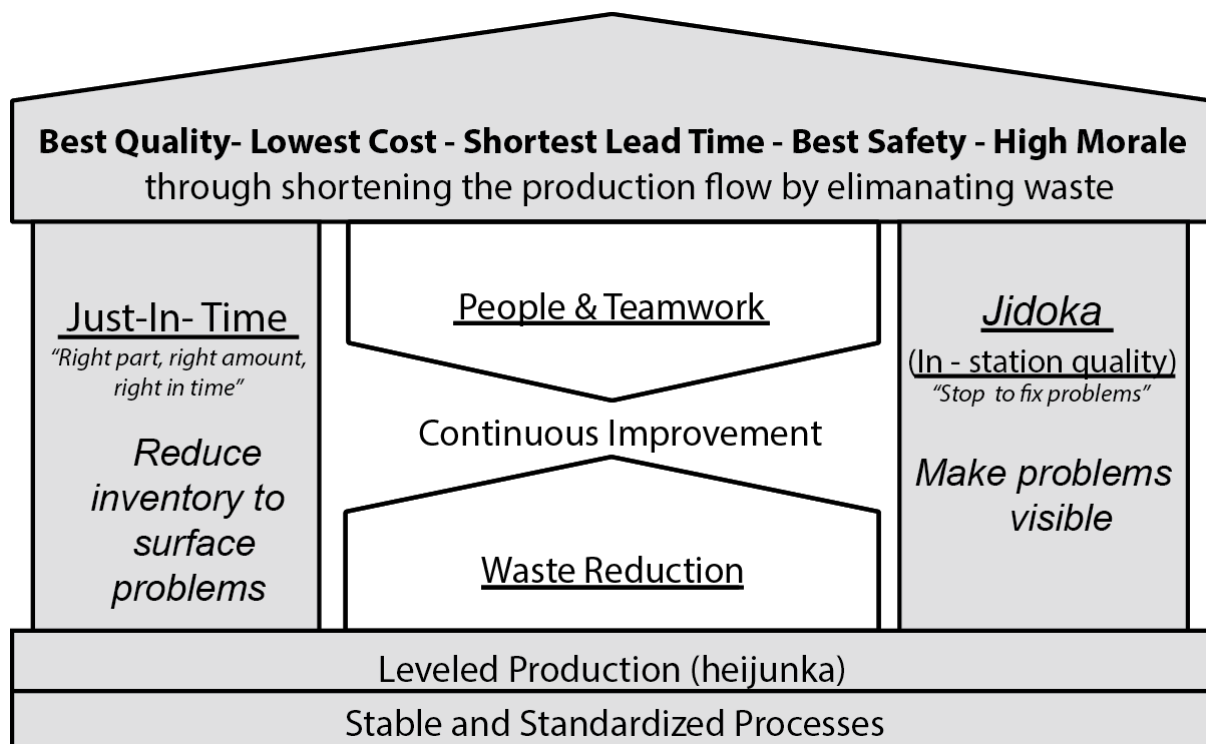


Figure 2.5. Elimination of waste to improve efficiency at Toyota Company (Liker and Morgan, 2006)

2.6. Continuous Improvement (CI) by Individuals

Literature in Continuous Improvement (CI) concentrated on the benefits of organizations rather than individuals. There is scanty literature on the impact and essence of CI on the functioning of single people. The Japanese begun to shift their focus to people as their major competitive resource and that effective training, motivation and management is critical. From the 14 points of CI introduced by Deming, point 6 (institute training) and 13 (institute a vigorous program of education and self-improvement) referred to continuous education and improvement for all (Radawski, 1999; Clark, 2008b); that achieves increased rates and scale of profitability (Gray, 2013).

2.6.1. Continuous Innovation

The definition and interpretation of the word “innovation” is cited in more literatures applied across various industries. The most common theme amply expressed in these literatures is that innovation is inevitable. The significant role played by innovation in unlocking economic potential in business firms and social spheres existed for as long as 70 years (Schumpeter, 1942). Many ages earlier, Bessant and Caffyn (1997) restated this significance by reporting that to fulfill the recent uneven business conditions, innovation is of fundamental value. It is a continuous process that targets of yielding satisfactory results through great inputs and initiatives (Hyland and Clark, 2008; Gray *et al.*, 2015).

Plsek (1997) also emphasized that in our rapidly changing world, critical thinking in the form of soft technology to generate unique innovative products is vital for imminent attainments. Furthermore, the author documented five critical factors that drive the need for creative thinking and innovation as follows:

- sustainable financial performance is linked with innovation;
- end-users are gradually insisting on innovation;
- competitors are comprehending smarter ways of replicating historical innovation;
- recent expertise facilitate innovation and
- what performed well in the past, may not any more

The tumble of Australia’s competitiveness from 5th to 8th position in the global economic competitiveness records was resolved via changing the thinking that innovation is not only limited to technological enquiry but more a manner of discernment and finding innovative breakthroughs within an organization (Hidalgo and Albers, 2008; Runnalls *et al.*, 2009). Furthermore, Agricultural industries had to shift their focus from conducting innovative technology transfer to adjusting their brainstorming and capacity building sessions. Brazilian furniture sector also confirmed to continually optimize product innovation in pursuit of customer’s satisfaction and comforts in order to improve financial performance (de

Guimarães *et al.*, 2016). Continuous innovation can be applied within markets without causing disruptions within plans of any organization (Griffith *et al.*, 2008). Innovation is moving away from spreading the use of new technology into bringing tangible and meaningful real world outcomes (Hautamäki and Oksanen, 2016).

2.6.2. Innovation Views and Values

Innovation is closely related to change either as a tool to effect change or respond to change (Damanpour, 1992) and the change could be specifically related to innovative discoveries, new proceedings, supply chain and overall management (Ettlie and Reza, 1992). This type of innovation changes has sparked interest of practitioners and researchers in various business management disciplines.

There were five generations of innovations that were discovered by Rothwel (1992). In the 1st generation, innovation begun as technology drive/force with scientific breakthroughs solely contributed by specialized expertise. The focus in the 2nd generation shifted to marketing, where market was used as a fountain of generating new ideas to guide Research and Development (R & D). The 3rd generation focused on improving and mastering innovation methods to identify and minimize events that could lead to wastefulness. The 4th and 5th generation incorporated social conditions into the process of innovation causing personnel to be actively involved during planning and implementation (Leeuwis, 2004). A lot of value chain participation and collaboration amongst clients, specialists and managers was required to empower and energize participants in this 4th and 5th generation of R & D (Clark *et al.*, 2012a).

2.6.3. Sources of Innovation

Innovation is interlinked with change either as tools to effect change or respond to change (Drucker, 1985; Plsek, 2003; Bessant and Tidd, 2011). In Australia, source of innovation was observed and limited to scientists with white coats in laboratories and this analogy created major gaps in innovation (Walmsely and Tanousis, 2008). Additionally, the basic concept of who should carry the responsibility of innovation created severe impact on innovation research as a whole and government policies (von Hippel, 1988).

Drucker (1985) explained that successful innovation can be derived from embarking on a conscious search for innovation in seven situations such as: unforeseen incidences; incompatibilities; process requirement; business and sales fluctuations; population variations and altered perceptions contributing to fresh perspectives. The author believed that innovators should search, observe, question and be highly attentive. The enormous range of new products on the marketplace comes from the customer preferences; hence the end user innovation was developed, tested and acknowledged. Implementation of innovation in

manufacturing is critical to organizational survival and growth if costs exceed investment returns (Bessant and Grunt, 1985; von Hippel, 1988).

Johnson (2010) was of the view that the space of innovation where the environment is not conducive, a sequence of common possessions and patterns can persist several times producing an innovating environment. This resulted in the origin of seven patterns namely:

- 1) the adjacent possible – possible invention of patterns, accumulating into extensive pool of ideas and restored into new ideas
- 2) liquid networks – ideas need smoothness and flexibility;
- 3) slow hunch – ideas can take longer to develop;
- 4) serendipity – a conducive environment should be created that produces new ideas that connect smoothly with the old ideas, allowing a platform of new ideas to emerge;
- 5) error – giving space for multiple errors, as errors normally do occur in the path of innovation;
- 6) exaptation – copy and designate fresh concepts from outside surroundings and act in a fresh setting; and
- 7) platforms – conducive condition where any form of generated thinking and creativity could be effective.

The adoption and daily application of these seven patterns in the private and work environment enable people to tap into extraordinary abilities of innovative thinking. Vast array of innovation is enormously derived from individuals who are responsible for implementing and utilizing those technologies as part of their daily routines (Johnson, 2010). Bessant *et al.* (2001) believed firmly that competitiveness in businesses is brought about its knowledge base and behavior patterns rather than machinery, position, infrastructure and resources. The ability to identify innovation indicators that can be grown into favorable circumstances is of paramount importance. Hence determinants such as stimulation, publicity, knowledge push, need pull, users as innovators, discovering other prospects that result into various opportunities, regulation, recombinant innovation, behavioral observation, process mishaps and surprises were determined (Bessant and Tidd, 2011). There are two categories of sources of innovation that have long being reported; knowledge push and need pull which operate simultaneously in harmony. Characteristics such as expertise, customs and beliefs are the ones that contribute to valuable competitive advantage. The research conducted by Zain and Kassim (2012) reported a positive correlation amongst creativity, performance, conducive environments that enabled creativity and inner working conditions in Qatari firms.

Innovative thoughts utilized for improvement and innovation can be derived from any individual irrespective of background and rapidly acted upon (Plsek, 1997; de Bono, 2004; Gray, 2013). The statement was reemphasized further in business innovation where everyone has the creative and innovative ability (Dyer *et al.*, 2011). Bernáth *et al.* (2016) discovered that individual competencies and career growth path were the chief cornerstones

of innovation enablers to enhance innovation in a Brazilian software firm.

2.6.4. Purpose of Innovation

The intention of innovation is to come up with real turn-round strategies that will boost the company's overall economic and social revenue (Drucker, 1985). The main objective of innovation is to attain outcomes such as new concepts, systems, operations, businesses, regulatory frameworks, softwares, technologies, instruments and equipments (Hansen and Birkinshaw, 2007). This was evident in a new business opportunity identified by a cleaner that successfully turned R68 investment into a business worth R25 million turnover (van Rooyen *et al.*, 2017).

2.6.5. Innovation Mechanisms

The first innovation mechanism developed was linear model which created a better understanding of the linkage between science discipline, software technology and advertising (Figure 2.6). The process initiates by primary research, then pragmatic and marketing research, and concludes on distribution. It was assumed that innovation was increased by more application of Research and Development (R & D) basic research (Andersson and Karlsson, 2006).

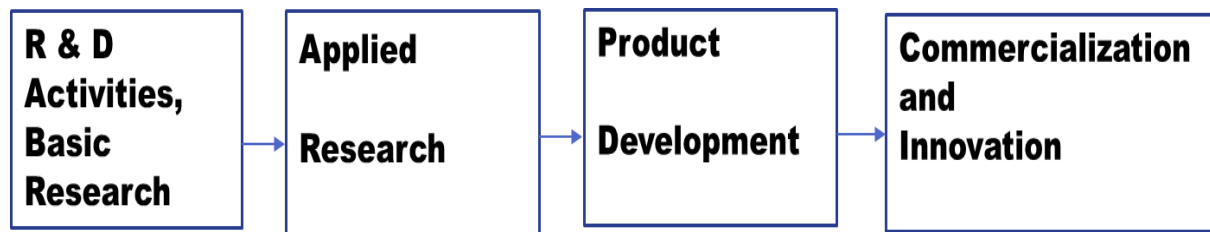


Figure 2.6. The linear model of innovation (Andersson and Karlsson, 2006)

Another innovation process developed was known as D⁴ i.e. Define – Discover – Develop - Demonstrate (Silverstein *et al.*, 2009). The D⁴ process was designed to provide relevant support involving various steps of creating new products and services that can be profitable (Figure 2.7). This process is very practical in making the likelihood of innovation real and sustainable.

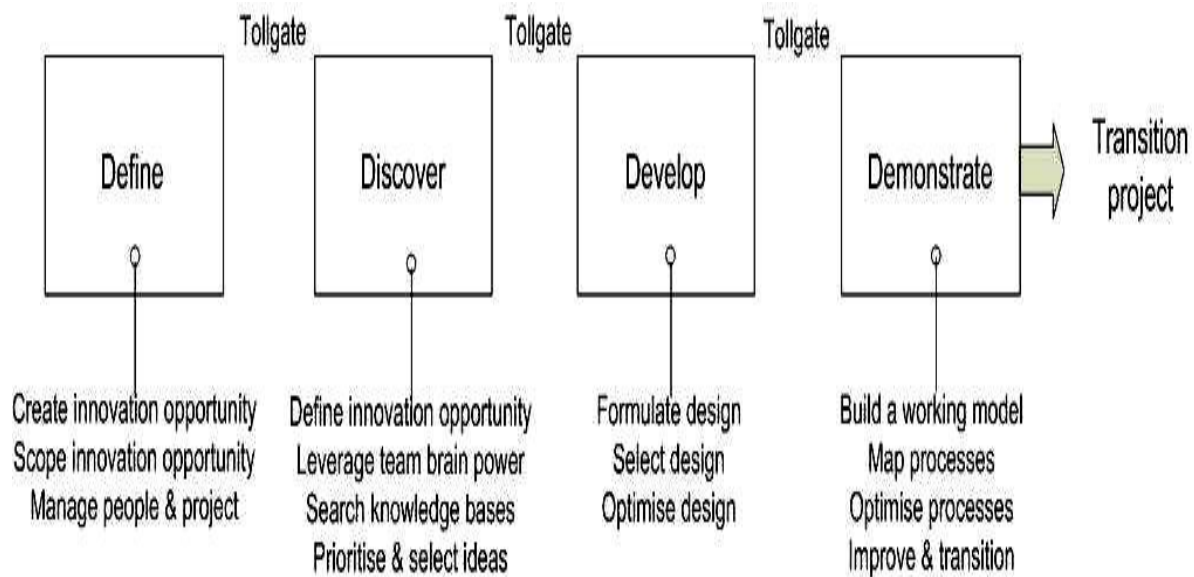


Figure 2.7. D⁴ Define – Discover – Develop - Demonstrate linkages (Siverstein et al., 2009)

Bessant and Tidd (2011) established complete model for innovation which brings to light that innovation should be understood as a comprehensive set of events and actions beginning from basic thinking until enactment (Figure 2.8). The system can be effectively empowered by an active and creative network of individuals. The authors also noted that there are three perspectives that drives the success of innovation where focus will be on creativity and capability to evaluate and generate new innovative thinking and theories; participant suggestions are relevant to transform raw ideas and concepts into new marketable products; focus on availability of resources to support creativity and ability to grow innovation (Bessant and Tidd, 2011).

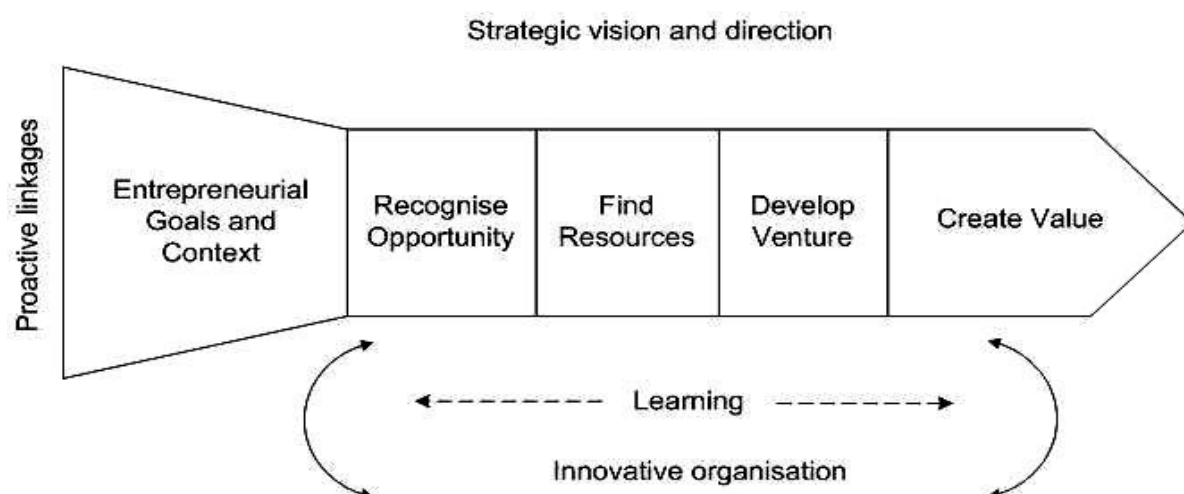


Figure 2.8. Complete model of innovation (Bessant and Tidd, 2011)

A study conducted where ideas were bounced in a workplace reported that all innovative ideas did not take place in laboratory, but occurred in symposium sessions, weekly

gatherings where employees exchanged substantial information and hindrances. Innovation occurs when ideas from other places are taken and transformed into new ideas using different people with diverse backgrounds (Johnson, 2010). Other authors emphasized that individual people and also teams need to be trained on innovation (Buzan and Buzan, 1993), because most people have the ability to generate new thoughts, but a small number know how to assess, improve and execute those thoughts (Silverstein *et al.*, 2009; Bessant and Tidd, 2011).

2.6.6. Creativity

These days, creativity is well appreciated and has shifted away from the analogy that people can perform better than others. Models of creativity have been revised to challenge this perception (Plsek, 1996). The results indicated that few authors attested that creativity could not be expressed as it involves subliminal ideas that were above the management of the inventor. The major concepts favored the theory that creative thoughts were derived from cognitive exertion of maintaining innovative and intellectual capacity. As explained by Osborn (1953), the idea of balancing creative and analytic thinking was supported and resulted in the development of Creative Problem Solving (CPS) model (Figure 2.9).

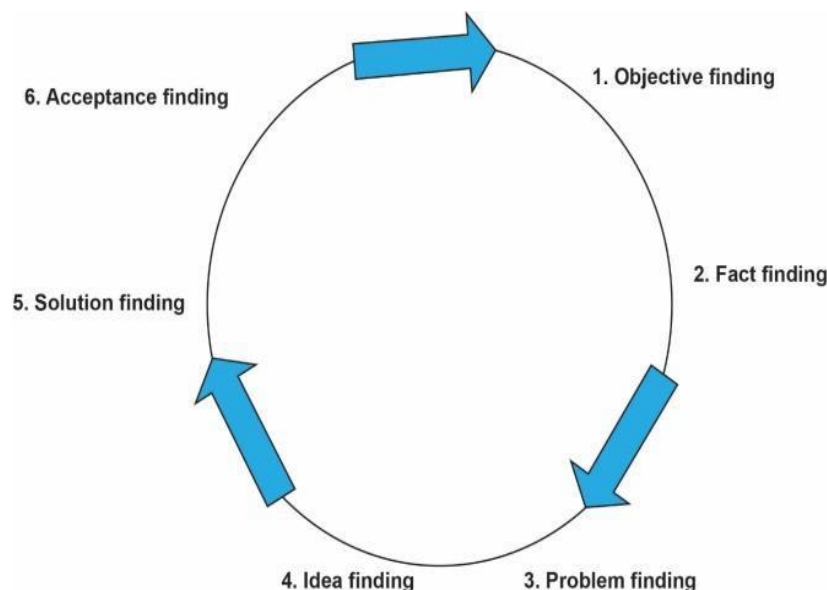


Figure 2.9. Creative Problem Solving (CPS) model (Parnes, 1992)

Hurson (2008) developed the Productive Thinking Model (PTM) which is made of six steps with various tools and detailed end results for each step (Figure 2.10). This PTM emphasizes the importance to stabilize various forms of reflections and utilizes divergent creative thinking and convergent critical thinking. He indicated the significance of alienating the above mentioned thinking techniques as they can easily be entwined into same area of interest. Often creation of new ideas through thoughts and careful critic of those ideas can ultimately impair the flow of good ideas. Participants begin with “what’s going on?” the first

stage of deliberating current situations to create a focus; followed by arranging resources; defining the actions; allocating resources and implement solutions. He further emphasized that this model can easily be applied and studied and can assist ordinary individuals to think creatively, plan better and accomplish innovation.



Figure 2.10. Productive Thinking Model (Culled from Hurson, 2008)

Other authors investigated social advancement creativity within institutions and benefits from exploration of creative habits in multifaceted social structures. For example, creativity study explored variables such as creative system, creative goods, creator and creative environment and creativity impact factors such as conducts, opinions and emotional intelligence (Woodman *et al.*, 1993; Ekvall and Ryhammar, 1999).

Creative ideas can be generated also from behavioral skills and not only genetic traits and cognitive skills (Dyer *et al.*, 2011). The authors identified four critical behavioral skills by innovation experts as the following:

- *Questioning* - Innovators are excellent questioners and passionate about investigations. Their inquisitive nature mostly challenges the status quo, e.g. Mr. Jobs from Apple Company once questioned "Why does a computer need a fan?" "This type of questioning spring new ideas, possibilities and directions"
- *Observing* - Innovators also possess extreme observation skills. They carefully observe the happenings around world in terms of consumers, inventions, contractual obligations, blueprints and businesses. The intense remarks assisted the businesses to increase knowledge and generate fresh concepts that will change their normal routines.
- *Networking* - Innovators put more effort in generating and testing ideas through various network individuals from different backgrounds and outlooks. They actively embarked on a quest to generate new ideas by liaising with various individuals

capable of proposing profoundly unique opinions.

- *Experimenting* - Innovators continuously test new experiences insights and steering new ideas. Explorers constantly investigate the world cognitively and experientially carefully putting opinions confined and testing hypothesis along the journey. Experimenters explores different locations, test unique ideas, hunt newly published material and research to acquire different opinions.

2.6.7. Innovation by individuals

The improvement and innovation publications reported largely on organizational teams and very seldom on the individuals as sources of improvement and innovation. It was reported that successful innovation is centered on “key individuals” with excellent qualities and abilities

i.e. individuals with natural ability, strong personal obligation to innovation and creative skills. Innovative individuals purposefully partake in enquiring, discerning, collaborating and investigating behaviors to rejuvenate new ideas (Dyer *et al.*, 2011; Gray, 2013).

The plans of improvement and innovation are likely brought into fruitful implementation (Covey, 2008). Mostly people lack the skill to foster new ideas and to arrange the much needed resources in order to complete the assigned task. However, innovation is a skill that can be taught and its use can be mastered through practice but only if they know what to do and be cognizant that education system does not offer courses on idea generation or creativity (Gray, 2013). Innovation involves radical change of systems, markets, customers or the manner in which a business is managed. Innovation causes disruptions to the operational management of the farm. The disruptions could happen in two ways, incremental or radical changes. Incremental changes could be for example beef producer slowly improving pastures or introducing a new genetically improved breed to the program; whole radical changes could be selling the available cattle and purchasing a new breed that would be better suitable for the local conditions (Hyland and Clark, 2008).

Black and Gregersen (2008) promoted the application of the “individual out” strategy as a replacement to “organization in” strategy. The “organization in” strategy describes a list of devices that should be uprooted to acquire change in organization. This approach assumes that change occurs in organization first and then in individuals. The results indicated that individuals are the once that initiate improvement and innovation rather than organization- hence promoting ‘individual out’ strategy. Individuals are the ones that drive organizations to attain improvement and innovation change (Black and Gregersen, 2008). First change the mindset and conducts of individuals since the ability to generate new ideas lies within individuals (Gray, 2013). To generate an idea is one thing and converting it into a sustainable business is another, and feasibility of an idea depends on the marketing strategy (Roelofse, 2012).

If organization from the beginning created conducive environment to fit in individuals, the outcomes would have been better. Changes will be driven by passionate individuals who will promote a platform to assist others to reach their maximum abilities and achieve outputs they would not be capable to attain by themselves (Hagel *et al.*, 2010). Young *et al.* (2016) advocated that group discussions during fishing outings generated and implemented ideas such as creation of a play area for community based children and supported social cohesion. Furthermore, business environments that promoted culture of understanding and transparency regarding brainstormed views respond quickly to changes that secures market value (Donate and Guadamillas, 2011). Patanakul *et al.* (2012) also made a proposition that people whether individually or in teams can directly optimize product innovation and conspicuous innovation was observed in teams that operated in ambiguous, composite innovative projects.

2.6.8. Continuous Improvements and Innovation (CI & I)

A lot of literature that contributed immensely on improvement alone or innovation exists, however, only a few integrated the two concepts into one (Kaplan and Norton, 1992; Buckler 1996) as illustrated in Figure 2.11. Continuous improvement and continuous innovation were merged into a single model namely continuous improvement and innovation (CI & I) by Clark and Timms (1999). Continuous improvement and innovation (CI&I) concept hypothesizes that using appropriate planned systems including setting series of walks, habits with well clarified tools, chances of obtaining targeted improvement and innovation are high. In practice, a plethora of literature and evidence indicating successes of realizing improvements and innovation exists (Imai, 1986; Bessant and Francis; 1999; Radawski 1999). Successful businesses have in many occasions implemented continuous improvement, breakthrough improvement followed by continuous innovation.

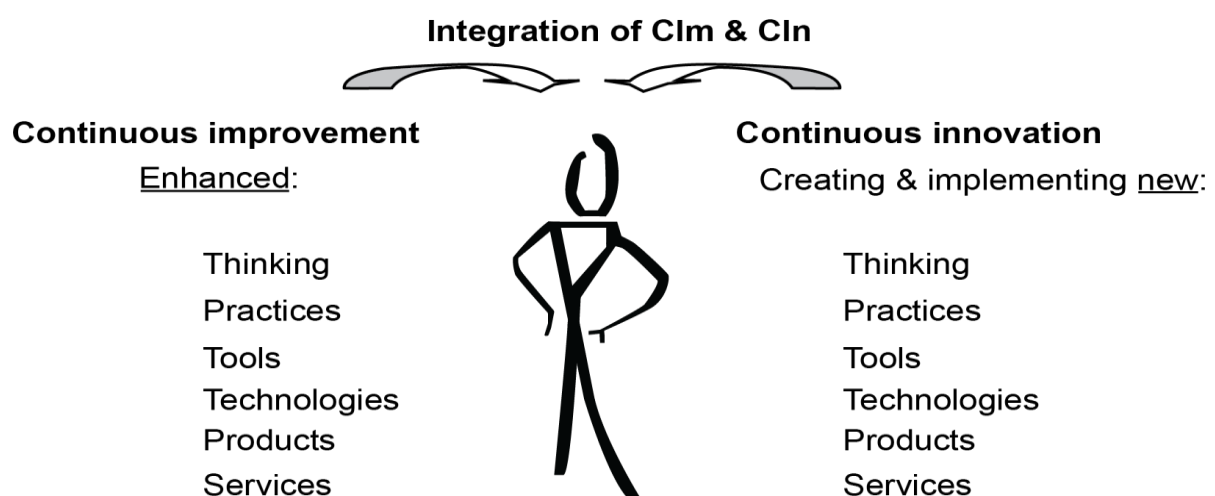


Figure 2.11. Combination of Continuous Improvements and Continuous Innovations to improve thinking and action of individuals (Culled from Gray *et al.*, 2015)

It has been advocated that businesses should begin with CI as starting point and then developed to incorporate innovation. CI concentrated on establishing labor systems required improvement ultimately leading to innovation (Harrington, 1995; Samaha, 1996). Application of both improvement and innovation is promoted in order to increase chances of success. CI provided businesses with the motivation and obligation for creating innovation (Zairi *et al.*, 1994; Jha *et al.*, 1996).

CI does not hamper innovation and factors including consumer target, capacity building, liberation and team work, manufacturing investigation and standardization could enable businesses to achieve innovation (Lorente *et al.*, 1999). McAdam *et al.* (2000) also examined the relationship of CI and innovation system. Their results displayed strong association between CI and innovation after scores were drawn on line graph (Figure 2.12).

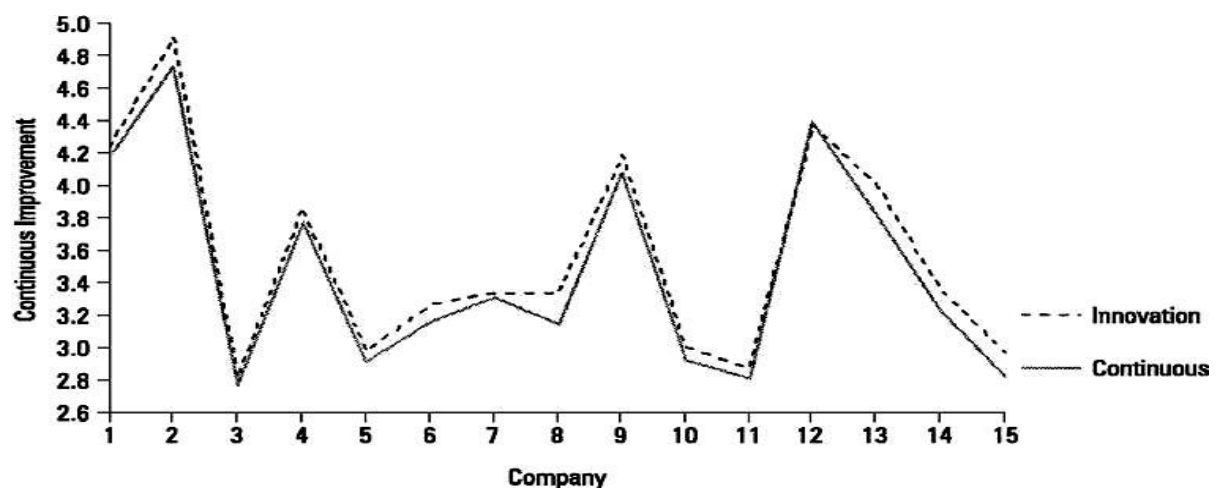


Figure 2.12. Comparison between continuous improvement and innovation scores (McAdam *et al.*, 2000)

Bossink (2002) outlined various cases that described the manner in which CI assisted in handling innovation. Incorporating CI and I thinking and actions with an assumption that it was impractical to intellectually isolate improvements from innovations have been studied. Furthermore, isolation of these two concepts had possible implications for the applier. Simultaneous development of individual discernment and action is achievable and encouraged in order to apply new thinking and action. The opportunities are not limited to scientists but available to all humankind (Clark, 2008; Gray, 2013).

Clark and Timms (1998) developed CI & I process from results obtained from innovation, Total Quality Management (TQM) system dimensions and experiential learning literature. CI & I is defined as a collective method that empowers people in groups, systems and organizations with tools to concentrate thoughts and plans to attain improvements and innovations on a regular basis. The process was also extracted from applying methods such as action research, action discovery and standardization (Clark *et al.*, 2012a). The process is highly appreciated for being able to work directly within environments that are unique to any

individual businesses to improve and innovate (Griffith and Mullen, 2016).

The standard of CI & I is to create a purposeful system that produces enormous results that has the ability to solve existing global challenges. For example, the application of CI in business partnership produced a series of small significant achievements necessary to drive the next outcome in an integrated series. The manner in which outcomes of step by step CI & I process interacts and accumulate meaningfully is displayed in (Figure 2.13). The underlying forces of thinking and actions are effective in bringing change to achieve improvement and innovation. “After all, if you keep on thinking the same way and acting the same way, you will obtain the same results as in the past. Additionally, you can think as much as you like, if you do not take action, nothing will happen (Gray, 2013).”

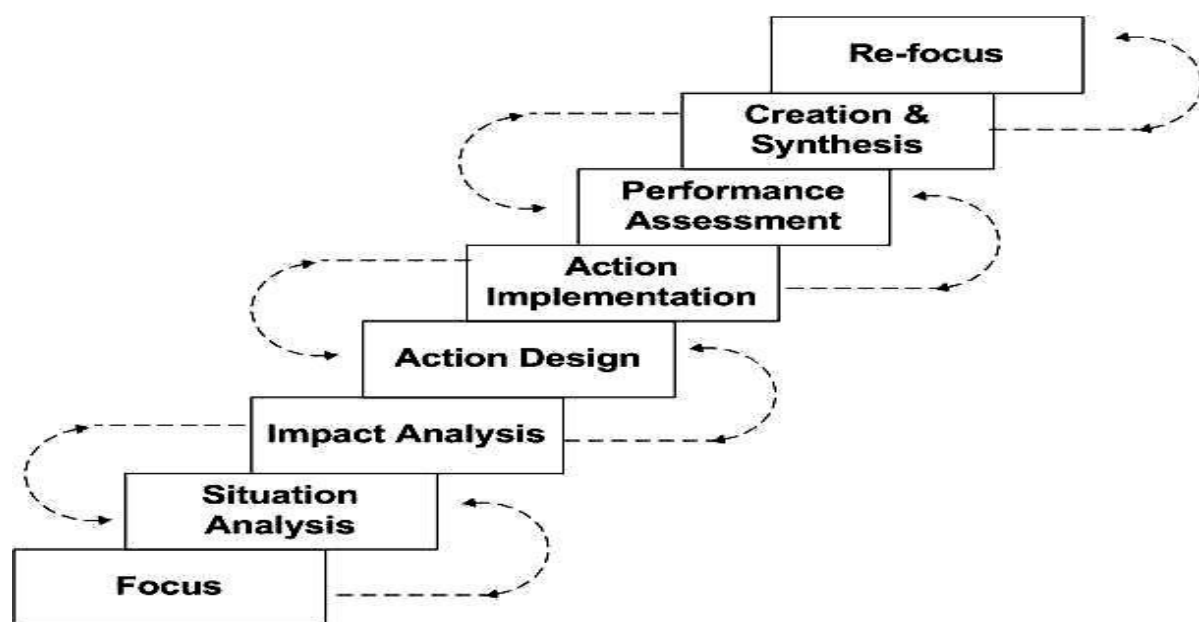


Figure 2.13. Series of incorporated vibrant thoughts and plans of CI & I system (Timms and Clark, 2008)

2.7. Continuous Improvement and Innovation (CI & I) in Agriculture

According to Griffith *et al.* (2008) the existing research and development (R & D) approaches in beef industries have been unproductive and which mainly serve as extension support services have been returning poor revenue. The authors suggested a different method of implementation was required. The Continuous Improvement and Innovation (CI & I) was entrusted to be the new solution and the new approach. However, it has not been explored much in agricultural sector as compared to other sectors such as health and manufacturing. Application of CI & I in the Lyete Improvement and Innovation Network (LIIN) assisted pig farmers to be profitable and successfully manage their own farms in a sustainable manner. In the Lyete Livestock Improvement Projects (LLIP) pig farmers obtained 5% improvement in gross margins and reduction in feed costs and total costs. The South African Beef Profit Partnership (SABPP) achieved significant improvements in district market penetration, sales

costs, stock throughputs, reduction in transportation expenses, increase in breeding, growth performance and reduction in mortality rates, when CI&I concept was applied (Clark *et al.*, 2008).

A hypothetical example of CI & I application in Agriculture was outlined in Griffith *et al.* (2007) as follows: partners wanted “To improve reproduction rates from 70 to 80% in the commencing breeding season”. Upon application CI & I partners were encouraged to give feedback regarding the progress regarding this goal. In the initial 90 - days partners reported on their situation analysis, e.g. “I identified specific data on the reproductive performance of my herd and I identified the alternative inputs, tools and technologies that might help me meet my target”. Partners were encouraged again to give feedback on how they implemented impact analysis and how they compiled action design, e.g. “I used a gross margin calculator to compare the alternate actions, tools and technologies, and I chose a particular option for these reasons... then... I developed a plan to implement my selected actions, with descriptions of KPIs, tools and technologies, and I designed a recording system so that I could compare the results when they occur with those of the current practice”. Partners were encouraged again to give feedback on how they implemented impact analysis and how they compiled action design; e.g. “I used a checklist of actions, tools and technologies, and a chart of progress with Key Performance Indicators (KPIs)” (Griffith *et al.*, 2007).

In any enterprise the only attribute that enables organizations to outperform their competitors was constantly improving performance faster (Clark *et al.*, 2001). Continuous Improvement and Innovation (CI & I) approach was designed to operate within individual businesses to fast-track achievement of improvements and innovations to meet the outcome of 5% profit. The partners in this Agricultural research were inspired to follow CI & I approach as designed to evaluate their success and failures during implementation. Beef partners had CI & I facilitator, budget, mechanisms, economists and other technical expertise and support made available as needed. The major focus was to commercialize research outputs into business outcomes that improve productivity gains. The process is able to capacitate individuals with relevant information, expertise and resources to attain, maintain and enhance their business to function and realize profit and improve productivity (Griffith *et al.*, 2008).

Once the performance is assessed and profits are realized, other developed prospects would be explored to achieve further improvements or innovations, this could exist team or a new team joining the process (Griffith *et al.*, 2008).

Continuous Improvement and Innovation (CI & I) is made of eight steps that projects in Beef Profit Partnerships (BPP) were requested to apply in order to achieve improvements and innovations in their businesses (see Figure 2.14). The process begins in the middle of the cycle due to the tendency of people being swamped by so many life activities happening

around them, and also to focus thinking on activities that would improve and innovate businesses. The focuses investigated the situation in projects and develop opportunities that would bring tangible change to performance (Gray, 2013).

The opportunities were taken further to action design stage because they would remain meaningless without being implemented. The action or performance is assessed to determine if they are having the desired impact on the focus. Individuals would reflect and draw conclusions on the level of achievements being reached; and determine if the goal has been achieved. Then another cycle would be developed with new information to improve performance for successful impacts (Gray, 2013).

The process could be applied to report project findings and also to cause improvements in the design and management of projects (Griffith *et al.*, 2008). Several authors reported that, beef projects were asked to apply CI & I to achieve improvements and innovations in business planning and management and also to report achievements and failures. As outlined below, exactly the same process was applied to make improvements and innovations to project planning and style of management. The exact process was also used to report achievements and failures in the project (Griffith *et al.*, 2008). The ultimate outcomes of CI & I process on individuals is improved control over thinking and action and further empowers them in the use of this arranged and ordered method. It is further characterized as a “thinking person’s process” rather than a process that enforces directives.

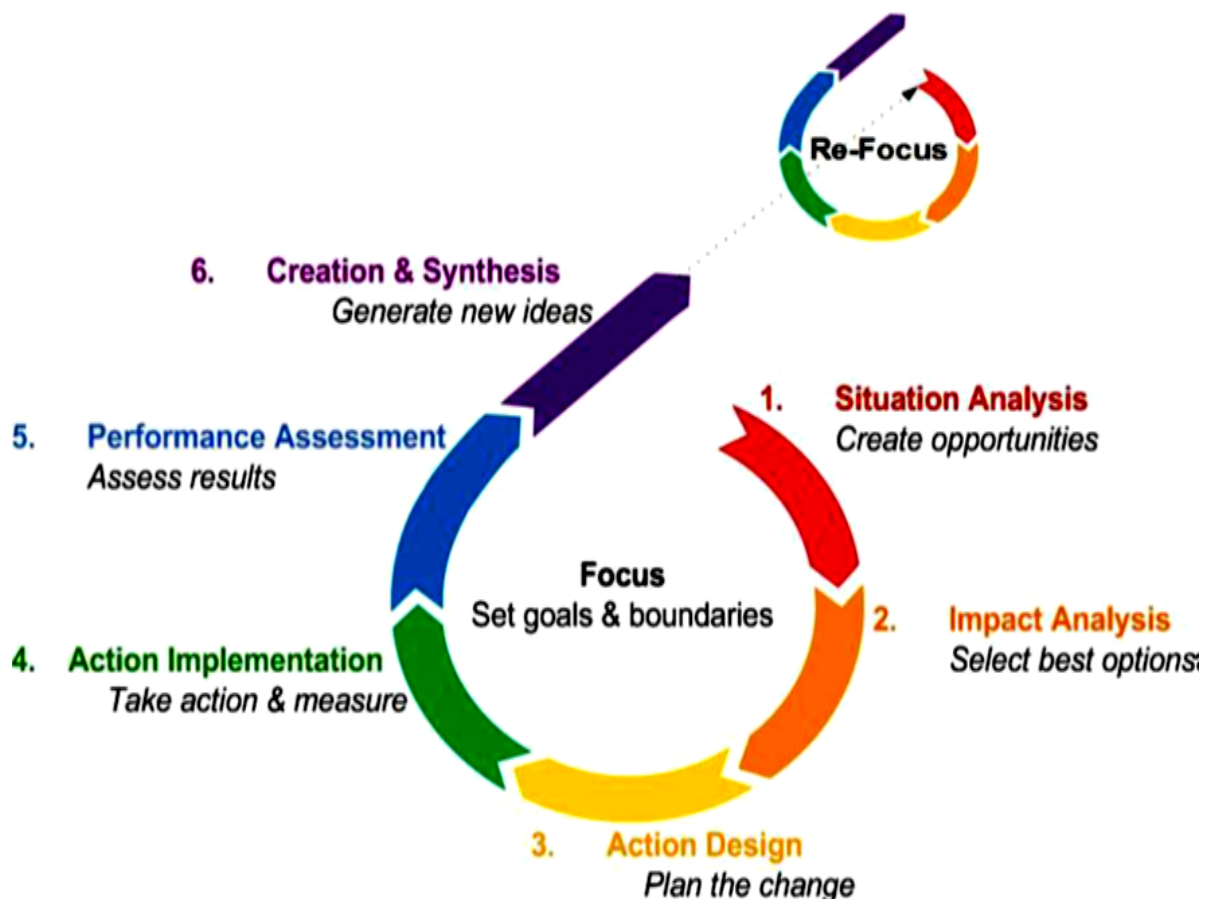


Figure 2.14. The Steps of CI and I applied in beef industry projects (Griffith *et al.*, 2008)

According to Parnell *et al.* (2008a), there were 341 businesses and 34 Beef Profit Partnership (BPPs) in the system, owning 268,000 cattle and more than 1.3 million ha of feeding space. From the 34 BPPs, 21 were completely functional projects with developed focuses and KPIs recorded statistics, comprising of 180 businesses and 200 000 cattle. There were additional 12 BPPs that were not developed fully yet (i.e. from public and private sector and supply chain BPPs).

The Beef Profit Partnerships (BPPs) created units of measurements in their profitability and productivity variables to select focuses of their choice for implementation (Griffith *et al.*, 2008). Sustainable Improvement and Innovation (SI & I) prototype strategies, manages and monitors progress in businesses to obtain sustainable improvements and innovation (Clark, 2008b). The goal was for business of beef Cooperative Research Centre (CRC) to apply a viable methodology that continues achieving outcomes even after the completion of the project. What is critical is for accelerated adoption, application and frequent feed-back concerning improvement of project including re-designing of project system where necessary to achieve fast tracked outcomes with evidence (Clark *et al.*, 2008).

The most essential Critical Success Factors (CSFs) were for businesses to implement solutions to issues that are pertinent in their local communities (Fawcett *et al.*, 2000). It is crucial to create goals that are specific, measurable, actionable, realistic, and targeted and time- framed (SMARTT) that would be assessed frequently and outcomes celebrated (Fawcett *et al.*, 2000; Hill 2002; Weiner *et al.*, 2006). To boost self-confidence and enthusiasm, small achievements need to be celebrated frequently for participants to keep implementing and achieve more outcomes (Mays *et al.*, 1998).

The Beef Profit Partnerships (BPP) Communication, Information and Marketing Strategy was given a responsibility of ensuring effective communication and to keep informing the team concerning progress made, together with the resources required to continue implementing. The focus of the strategy was to improve the business profile and management of team to attain 15% increase in awareness of the BPP website (Mulholland and Griffith, 2008).

Farmers were working together with researchers to assess their situations on – farm and select focuses for improvement. Farmers from different places were also working together testing ideas together and sharing information that enhanced their knowledge base. Furthermore, farmers were able to access a wide range of expertise that small business would normally struggle to access or to also pay for. As they are equipped with business management competencies, revenue in terms of decreasing input costs and increasing profitability would be evident (Hyland and Clark, 2008). Coordinators were experts in their fields of animal and land management areas and they were still in the process of being capacitated with knowledge and skills in Continuous Improvement and Innovation (CI & I) problem solving and ability to identify possible solutions (Parnell *et al.*, 2008a). The project of beef partnership had a potential to contribute to real-world methods of research and

development to achieve better performances (Clark, 2008b).

Parnell *et al.* (2008b) reported that the short term focus was for all partnerships “to achieve additional 5% improvement in annual business profit among Beef Profit Partners within two years”. Partnerships selected to implement short term actions involving pasture management rather than cattle breeding. Commercial business in cattle farming were influenced to join the network in order to achieve the overarching target outcomes since it was only partners in the small to medium enterprises that joined (Parnell *et al.*, 2008b).

In Australia Gray *et al.* (2015) reported that teams in the study became empowered and competent users of CI & I tools and method generating 95 improvements and 62 innovations over 15 months. Teams were capacitated to think, act and sustain improvements and innovation; they had an instrument that measured performance and celebrated achievement. Towards the end of this study, the author further evaluated the reasons why some people attained more improvements and innovations, while others failed. People with “personal mastery” – steadfast mental attitude involving beliefs, feelings and values that determined how they interpreted and responded to situations, attained more outcomes and became proficient users of mechanisms. It was based on the principle that pursuing a goal was especially critical when people took full responsibility of their actions and applied corrective measures whenever they experienced any deficits during implementation.

Figure 1.10 displays the relationship between inner personal mastery; the seven steps of Continuous Improvement and Innovation (CI & I) and the external forces recommended that to be integral part towards the road to success. Influencing factors are items such as policy; environmental legislations and socioeconomics information that are beyond control of individuals. The “personal mastery” Critical Success Factors (CSF) was introduced late in her study, had scanty data and partners required further support to apply this in their businesses (Gray, 2013). The current study focuses on the fully developed CI & I model with its mechanisms and focused questions as updated by Timms and Clark in 2014.

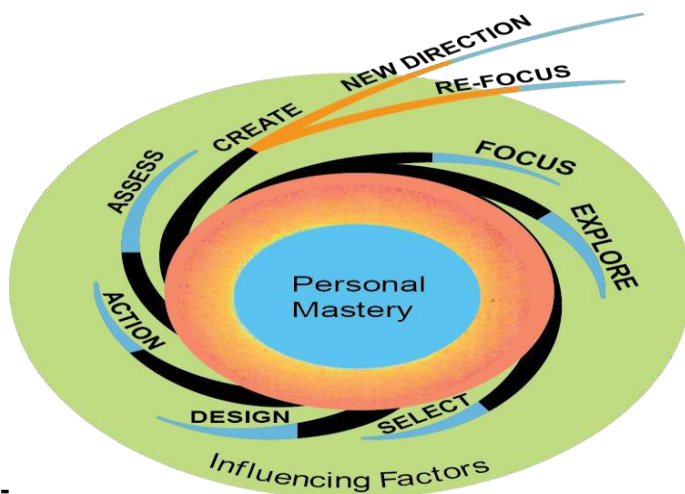


Figure 2.15. Improved CI & I model with interaction between inner personal mastery and CI and I steps (Culled from Gray, 2013).

Improvements and Innovations in Aquaculture

There is scanty literature on innovation based on the performance of individual business management in aquaculture, more literature is reported on external factors / fish - focused amongst others including reducing infections and epidemics, market sized fish enhancement, creation of specie-specific pellets and breeding and water monitoring. Currently attainment of competitiveness is derived from biotechnology and technological innovation interventions. For example, genetic improvement programmes have been applied to increase production in small number of farmed aquatic species. Biotechnology was discovered as another innovation to improve breeding and early larval maturation and increased periods of seed and larval readiness (Subasinghe *et al.*, 2003).

Aquaponics is also new technological innovation whereby both vegetables and fish are raised simultaneously in one production unit in which waste from fish is used as food for plant growth (Engle, 2012b; Joly *et al.*, 2015). The plants use the fish wastes for growth and purify the water for re-use by the fish. The advantages of been sustainable includes obtaining fast market sized fish, improved productivity, less disease outbreak, less water usage, two income streams, environmentally conscious and good tasting plants. This type of farming method is potent in combating world hunger (Ter Moshuizen, 2018). Joly *et al.* (2015) further elaborated that this innovative fish production system can yield sustainable food produce with less land use; minimal input costs and waste.

Joffre *et al.* (2017) reported that aquaculture production and economics are mainly published topics or articles in the sector and non - related journal to aquaculture are focused on system innovations, value adding and business management. Innovation in aquaculture is largely approached from a linear and technology point of view and business and management methods are not commonly practiced. Application of various innovation angles can assist in producing stronger knowledge that responds better to multifaceted challenges in aquaculture. The impetus on technology studies on innovation is growing and becoming essential mainly due to funders shifting focus to subsistence projects to alleviate hunger and improve native economy in developing countries. An approach is needed in aquaculture research that associates technology design with persuasion of general alterations to drive in technology that provide solutions to intricate challenges that are not solely technical but also considers social, ecological and institutional areas of aquaculture innovations (Joffre *et al.*, 2017).

Bellmann *et al.* (2016) reported that the development of aquaculture faces limitations such as water shortages, lack of land availability, and the ever increasing prices of fishmeal, fish oil and manufactured pellets. These authors emphasized that total fish and fisheries products exported has increased significantly attributed by copious legislations, high-tech innovations, value-adding and shipping strategy development, also fluctuations in delivery and product advertising.

In aquaculture, authors concentrate on improvement and innovation of the species and seldom on individual's ability to be creative and generate new ideas to realize economic emancipation. Furthermore, the ability of one to generate new ideas is not dependent on the effective functionality of the mind but also on the function of behaviors (Subasinghe *et al.*, 2003; Dyer *et al.*, 2011; Bellmann *et al.*, 2016).

Improvement of fisheries/aquaculture is cited on technical issues such as successful dietary improvements to prevent cyst disinfection and decapsulation in shrimp culture (García-Ortega *et al.*, 2001); dietary assessment of fatty acids in artemia via bio encapsulation, endurance, growth and disease handling mechanisms of larviculture (Merchie *et al.*, 1995). These improvements were implemented to create innovative products acceptable to consumers in market-places. Furthermore, the poor flesh quality of Atlantic Bluefin tuna was improved by being kept in floating cages during spawning periods to meet high market demands.

Programmable freezing technique was found to be suitable for use as an improvement tool in sperm cryopreservation of Common carp (*Cyprinus carpio*) (Bernáth *et al.*, 2016). Feeding of finfish on detritus material via innovative principle known as Multi – Trophic Aquaculture (MTA) is also in practice (Alexander *et al.*, 2016) and the methodology was designed to resolve significant environmental alarms derived from aquaculture activities such as sedimentation and eutrophication (Barrington *et al.*, 2010). Other cited improvements in shrimp species were applied solely on genetic improvement in order to achieve spontaneous selection for better rearing processes (Moullac *et al.*, 2003).

Recently improvements on reproduction, cultivation and feed developments of Channel catfish (*Ictalurus punctatus*) from China were prioritized due to enormous market demands (Zhong *et al.*, 2016). In America, oceanic aquaculture legislation and nationwide shellfish initiatives advocated the necessity for enhancements of equipments used for aquaculture zoning with minimal obstacles (Bricker *et al.*, 2016). Further improvements approaches have been applied in fish health management programs to search for deeper knowledge of the interaction of host – parasite for effective management of Atlantic salmon lice in open waters (Little and Bunting, 2016).

In Australia, aquaculture is constraint by absence of appropriate land-based farming and the information to function efficiently in distant ocean based activities. The Blue Economy and Cooperative Research Centre (CRC) were designed and managed as a solution to intensify seafood production and ocean renewable energy via improving innovative and sustainable offshore organizations. New technology that can tolerate the harsh offshore conditions

becomes commercially viable and delivers competitive energy are being investigated (Blue Economy Cooperative Research Centre, CRC 2020).

China's policies are targeting to adopt environmentally sound high – technology innovations that accelerate productivity through integrating production with the environment, mitigating the projected deceleration in aquaculture production in 2030. Other innovations include fishing technologies that focus on improving efficiency by lowering the costs and saving energy of instruments such as Global Positioning System (GPS), fish finders, mapping technology and fish aggregating devices (FAO, 2020a). Innovation also includes type of fishing gear to reduce by – catch of sea fish hunting, modern digital camera with excellent resolution used for monitoring of underwater fishing; however adoption by small – scale fishers is lagged (FAO, 2019).

In South Africa, most Research and Development (R & D) are focusing amongst others on the development of broodstock conditioning programmes and hatchery methods to breed competitive species that reach market size faster with an improved Food Conversion Ratio (FCR) and affordable manufactured feeds (DAFF, 2016). Other innovations were observed in the development of newly improved fish smoking ovens in Sri Lanka by FAO (2020b). The oven consisted of smoke-capturing chimney, oil – catching ovens which allows various other components to be inserted and improves fuel – efficiency. This type of technology also protected women against health hazards caused by the traditional methods of smoking (FAO, 2020b).

The development of “transformation” fish vaccinating robots is another form of latest innovation technology in aquaculture. The robot vaccinates fish below 20g as compared to the common weight of between 30 and 120g. This will give farmers opportunities to increase productivity and grow fish that reach market size faster. The robot will vaccinate larger number of fish quicker. The robot will also improve fish quality by applying artificial intelligence and deep learning algorithms to increase vaccination accuracy and improve fish grading. New solutions to reduce fish mortalities must be prioritized in order to increase economy of scale (Fish Farmer Magazine, 2020).

Fish Farmer Magazine (2020), reported that some of the innovations suppliers in aquaculture are based on improving the performance of equipments such as floating waders that uplifts the body when one is in water; sustainable and innovative fry feeders that supply essential nutrients during trout larval stages; some offer disinfectants for fish eggs, some are solely of improving processing equipments and packaging of about 200 fish per minute; some are focused on net technology including repairing, sterilizing, washing, repairs, renovations and anti-foulant retreatments; feeding robotics and genetic solution and innovative food value chains.

Beltrán Meza (2017) indicated for businesses in aquaculture to remain sustainable and competitive in a global market, new innovative ideas and new methods of implementations to make end products appealing to customers are required. Currently coalition strategies of R & Ds and innovation businesses are identified as new approaches to boost business efficiency and effectiveness. The weaknesses of one business can become the strength of another through collaboration, so that businesses in aquaculture can remain sustainable and competitive in a global market by generating new innovative ideas, identifying new methods of implementation to make end products appealing to customers. Currently coalition strategies of R & Ds and innovation businesses are identified as new approaches to boost business efficiency and effectiveness. The weaknesses of one business can become the strength of another through collaboration.

2.8. Conceptual Framework

Conceptual framework remains essential in research to direct data collection and data analysis methods (Maxwell, 2013). It defines in words and frequently in graphs the significant theories, critical factors and variables under investigation and the assumed link amongst them (Miles *et al.*, 2013). In this study the conceptual framework organized the flow of thinking that guided the focus of the research project. Theories, concepts, beliefs, assumptions, research outcomes, policies and expertise knowledge are what underpinned the research (Maxwell, 2013, Rossman and Rallis, 2017).

The conceptual framework and advanced methods to improve thinking and action applied in this project are displayed in Figure 2.16. The systems, processes and practices level of focus have the ability to successfully transform inputs into outcomes in CI & I process. System level focus has a major influence in achieving improvements the most, while minimal improvement occurs if the focus is on the process and practice level only. Improvements are realized the most when the three levels are all interlinked and improved. A practical and combined strategy explores mechanisms at a system level dropping to process and practice stage simultaneously achieving outputs within real world settings (Gray, 2013; Timms and Clark, 2014).

Conscious mind consist of four stages within each and every cycle of CI & I to realize improved thinking and action namely: Level 1) Routine- this is the level of thinking that makes one to react to impetus in an ordinary or expected routinely manner and depends heavily on the regular echoes of thoughts. Opinions are formed on the ordinary modeling activity of the mind. These are supplied to the next level. Level 2) learned- this is the level of thinking where learned thoughts and actions are duplicated intentionally to attain expected outcomes. This type of thinking remembers verified tactics to plan rapid and effective methods. Thoughts are developed to reach a well-established resolution. Level 3) Improvement- this is the level of

thinking that monitors standard and substantiated designs while constantly searching for ways to improve them. Level 4) Innovation-here thinking is done with new understandings that assist in reshaping the manner of thinking in terms of philosophies, beliefs and concepts generating new information instead of replicating existing information and knowledge prerogatives. This type of thinking generates new discoveries that transform innovation (Gray, 2013; Gray *et al.*, 2015).

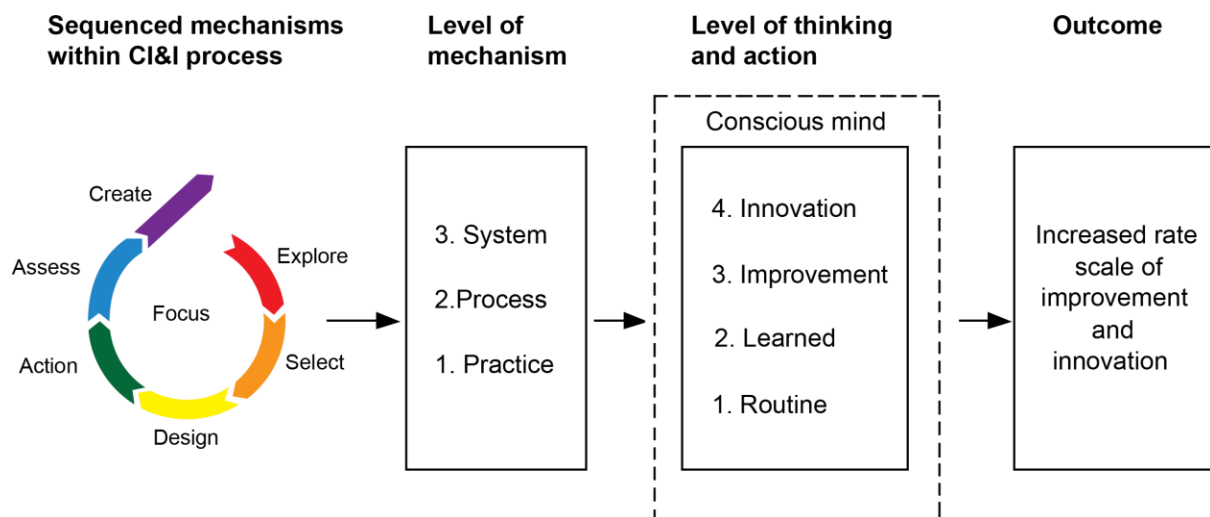


Figure 2.16. Conceptual framework (Wertheimer, 1966, de Bono 1969, 1990, 1993, 2015; Moseley *et al* 2005; Hurson 2008; Gray 2013; Timms and Clark 2014)

2.8.1 Aquaculture production in South Africa

Global aquaculture development is influenced by many factors that includes: environmental, biological, cultural, socio-economic and human behavioral to realize income generation (Brunton *et al.*, 2019). South Africa is no exception as constrains such as inadequately coordinated institutions, fragmented legislations, inappropriate technology, access to suitable culture sites, high costs of production, access to water, overestimation of production capacity and poor management amongst others are prevalent (Laboratory Report 2014; Njokweni, 2015).

Aquaculture in South Africa consists of both marine and freshwater species. There are four marine species produced- abalone, dusky kob, mussels and oysters and seven freshwater species- tilapia, trout, catfish, marron crayfish, carp, koi-carp and ornamental species. Catfish production is a rapidly growing industry, with Sharptooth catfish becoming the major locally produced species in South Africa (Skelton, 2001). The study that quantitatively analyzed Strengths, Weaknesses, Opportunities and Threats (SWOT) of major aquaculture

species, mussels and catfish fell in the fourth quadrant due to both species having competitive strengths but are facing more threats than opportunities. Catfish recorded the highest competitive strengths due to internal assessment factors such as low Food Conversion Ratio (FCR), ability to tolerate very high stocking density, rapid growth rate, high survival rate, hardiness and versatility of production systems and locations (Babatunde *et al.*, 2021). Given these attractive above-mentioned, attributes, it is surprising that sector is still dominated by smallholder farmers producing under 100 tons (DAFF, 2017), mainly focusing on export market rather than growing catfish to table size (DAFF, 2018).

Although fisheries and aquaculture are recognized as potential areas for economic growth by South African government, the sector is under developed, its growth potential is expected to increase production of fish for human consumption and reduce pressure on the natural fish resources and it is also included in the Ocean Economy Operation Phakisa (South Africa Yearbook, 2018). Aquaculture smallholder ponds are often used to produce catfish to improve household nutrition and are not sold for cash (Hecht, 2013). Nevertheless, doing aquaculture at a small-scale is more desirable as it requires minimal investments and carries lower operational costs (Dasgupta and Durborow, 2009).

Mamniski *et al.* (2020) emphasised that, the extent to which small-scale farmers and impoverished people are allowed to be involved and benefit from economic growth linked with aquaculture development is still a debatable topic. The traditional top-down innovations approaches that promote that innovation should come from only scientists and disseminated to people continue to be applied (Venter, 2018). Even the agricultural research institution in South Africa applies this type of an approach, by carrying out researches in isolation and shares their discoveries at a later stage (Agriculture Year Book, 2018). This current study came with a paradigm shift of placing people in the centre of innovation for the creation of improvements and innovations in aquaculture.

According to Poole *et al.* (2013), a holistic and multifaceted understanding of models that aims to capacitate smallholder farmers and agribusiness entrepreneurs to commercialize including value-chain systems, power dynamics and real-world perceptions are very critical. Business-related and social innovations approaches are also significant rather than those that only focus on the technical aspects of aquaculture (Joffree *et al.*, 2017)

Very little is written about aquaculture farming businesses in South Africa compared to its counterparts such as poultry, pigs amongst others, and government, industries and researchers are in the process of improving that. Catfish thriving businesses can assist to address challenges of food insecurities and malnutrition and if fish is unavailable, then

children will continue to suffer from deficiencies that affect growth and cognitive development as reported in the National Development Plan (NDP) 2030 (Agriculture Year Book, 2018).

2.8.2. Aquaculture participatory researches

FAO (2000) reported that aquaculture case studies where participatory approaches were applied did not only enhance general understanding concerning the role of aquaculture development, but end-users were also capacitated to make decisions about aquaculture and improve their livelihood strategies. Additionally, the understanding of participants' attitudes and perceptions were also improved and yielded better outcomes as opposed to focusing on the technical aspects only. Even in other agricultural fields small-holder farmers who participated in programs that applied CI& I were able to generate higher incomes and improve performance (Clark *et al.*, 2008; Nengovhela, 2010; Gray *et al.*, 2015; Agriculture Year Book, 2018), however, there is a gap in South African aquaculture literature.

Research approaches that are participatory in nature and involve thinking systems have the ability to dig deeper into complex issues while incorporating views from stakeholder. In Egypt such an approach was applied in Nile tilapia (*Oreochromis niloticus*) to diseases that caused anti-biotic resistance to pathogens, then people developed a system map was to identify hotspots of antibiotic use and described effective and efficient methods that promoted fish health (Desbois *et al.*, 2021). The system thinking approach was also applied with Vietnam striped catfish and white leg shrimp stakeholders to identify hotspot areas and come up with fish health solutions (Bruton *et al.*, 2019). However, in South Africa, improvements of thinking and action studies are rare and focus more on genetic and characteristics of a fish, core nutrient replacement with cheaper alternative feeds, alteration and optimization of the environmental conditions in an attempt to increase productivity. However, one participatory case study approach was applied in marine and freshwater aquaculture communities to unpack the farming culture and boost economic performances (Njokweni, 2015).

This current study was further inspired by the best phrase from Obiero *et al.* (2016) as follows: "paradoxically, too much potentially valuable knowledge produced by committed researchers languishes (waste away) in libraries, unused by society; and too many of society's greatest needs for new knowledge remains relatively unexplored by researchers". In making aquaculture business people to be actively involved in issues of their enterprises and seek solutions, capacitating them to put generated insights into use was new in aquaculture.

Models that deals with perception, creative thinking, learning from action and creating useful outcomes was what was in the center of CI & I. Real world researches are significant in empowering people with problem solving and decision making competencies to achieve

innovation with evidence (Taylor and Jordan, 2011). Lack of managerial skills is one of the challenges that aquaculture business are faced with to realize success (Madibana *et al.*, 2020), especially management of analyzing financial tools such as income budgets and enterprise statements to assess profits from aquaculture businesses (Engle, 2012a). Extension and agricultural research support services employed and tasked by the government to provide technical expertise and advice in aquaculture farming seldom have these specialized requisite skills to perform this function (Agriculture Year Book, 2018). This leaves the prospective aquaculture farmers starved of information necessary for their business successes.

2.8.3. Improving systems, processes and practices

Focus is defined as goals on which thinking and action are concentrated. Focus can occur at different levels: system, process and practice level. In any single system, there are a number of key processes and in single process; there is a number of key practices. Systems, processes and practices that are designed on purpose convert inputs into outcomes most effectively and efficiently. The systems level focus often provides the greatest leverage if you want to improve performance. If the system needs improving, then any improvements made at the process or practice levels will probably not achieve their full potential. However, focusing only at the systems level is also not effective. Improvements are often needed at all the levels (Timms and Clark, 2014).

Production of marine and freshwater aquaculture species by small-holder farmers are currently key priorities of government and are receiving various types of financial and technical support, however, this type of support excludes business management and soft skills capacities (Agriculture Year Book, 2018). Systems in aquaculture includes improvement of production systems to create a better habitat similar to what species would experience in their natural environments such as ponds and aquaculture recirculating systems (Masser *et al.*, 1992; Engle, 2015). Tucker and Hargreaves (2008) explained practices in aquaculture as environmental best management practices and literature is silent on topics of focusing systems that enhance thinking and implementation. Good aquacultural practices are defined as activities and procedures that maximize environmental and economic sustainability, product quality and safety, animal health, and worker safety, while also decreasing the likelihood of disease outbreak on the farm (Schwarz *et al.*, 2017).

2.8.4. Thinking and Action

CI& I is capable of educating and training on techniques and processes to solve problems that are operational in order to support and meet any business objectives. CI& I makes people identify what they have and maximize those scarce resources before any business can be drawn. According to Fadee and Alzahrh (2014), creativity occurs when people are

willing to take a new resolution to their problems and this is not something that is inherited during birth but is imbedded in everyone. The importance of gaining creativity skills is for people to be able to break mental patterns with effective methods such as: 1) avoiding immediate judgemental comments: this is a very critical skill in creativity because immediate judgement on a solution can kill innovation. 2) removing self-doubt: creativity requires people not to be apprehended by norms and traditions and embrace change. 3) imagination is responsible for many innovations and inventions today, for example the reality today is shaped by many fictions observed on television, therefore, people are allowed to apply imaginations. 4) creative people determine traits of a situation or an existing problem (Fadee and Alzahrh, 2014). Therefore, the mind and the ability to think is the foundation of creating improvements and innovations (Gray, 2013).

Enhanced thinking refers to causing thinking function more rapidly, effectively, precisely and proficiently than ever before (Beyer, 1998). When the mind is activated on purpose, people will be able to make decisions and solve problems more efficiently (Gray, 2013). Although there is plethora of definitions on thinking, many authors do agree that thinking is a skill and it can be enhanced (de Bono, 1993; Moore, 2005; Hurson, 2008; Costa and Kallick, 2009; Gray, 2013). These authors displayed a growing interest in capacitating people to learn to think than just simply providing them with information- 'teaching them to fish rather than just giving them fish'.

De Bono (2017) further emphasized that thinking is not complex and definitely not boring and people don't have to be intelligent to be able to be good thinkers. Group discussions that grant people freedom to explore without deviating from the main objectives create good ideas (Hurson, 2008). Therefore, improving the relationship between thinking and action and recognizing that thinking is a skill that can be advanced (Gray, 2013) was critical in this study. Innovation is a process where people are allowed to make their ideas marketable and come to fruition with a launch of a business to keep up with global competition, economic growth and increased demands and supply (Fadee and Alzahrh, 2014; de Bono, 2017). Innovation in South African aquaculture is in the form of blending the production of fish and plants in a single production system, which yielded a vast array of knowledge in the body of science (Masser *et al.*, 1992) and value-adding in the form of variety of culinary products to boost sales (Ter moihuzen, 2014). Innovation studies that mix thinking systems, taking action and capacity development are seldom in aquaculture.

Thinking is explored as a problem solving concept and it is comprised of productive and reproductive thinking (Sarris, 2020). Reproductive thinking repeats past patterns and productive thinking creates new ideas (Milchalgo, 2003; Hurson, 2008). The first level of reproductive thinking is "routine"-here challenges are resolved according to past experiences and knowledge, a manner of thinking that creates estimated reactions (Hurson, 2008). Thoughts are already processed in the background without people being aware of this

process (Gray, 2013). This is a process that occurs underneath the level of consciousness and is a common mental activity found only in all human beings and is critical in the development of understanding and information that ultimately enhance global knowledge (Michalko, 2003).

The second level of reproductive thinking is where learned thoughts and actions are replicated consciously to attain predicted outcomes. This type of thinking evokes evidenced-based methods that are effective when in-use. The third level of reproductive thinking, consciously applies sound and reputable methods while searching for ways to improve them (Hurson, 2008). The fourth level of productive thinking pertains to resolving constraints with new acumen (Stenber, 2006) while being aware of these patterns of thinking (Mumford and Gustafon, 1989), and productive thinking creates ideas and discoveries of different kinds (Hurson, 2008). In this stage, the unconscious mind combines various concepts that are of particular interest developed from a set of experiences and blends them in the unconsciousness which bubble up into the conscious mind as ideas and insights. This is the only way thinking of ideas and insights can be created ((Michalko, 2003), leading to increased rates of improvements and innovations (Gray, 2013). Timms and Clark (2014) emphasized that to obtain improvements and innovations different thinking is required to do things differently.

2.8.5. Aquaculture implications to food security

Poverty is caused by food insecurities and malnutrition and the impoverished people have lesser means of guaranteeing food security, and this leads to many kinds of illnesses (Cochrane *et al.*, 2009). Aquaculture sector can make significant contribution to income, employment and food security (Eltholth *et al.*, 2015). Fish is food that contains high levels of protein, low in calories, total fat and saturated fat. Fish are high in vitamins and minerals and have proven nutritional benefits that reduce the risk of cardiac diseases (Reams, 2012). Increasing availability and consumption of fish to improve food security and nutrition requires diversified interventions tailored for the needs of the marginalized and extremely poor communities to improve livelihoods (Pant *et al.*, 2014). Eltholth *et al.* (2015) reported that most of the fish producers are considered to fall in the small-scale category. Meaning that empowerment of small-scale farmers is also critical in the development of aquaculture. A more robust analysis of rural small-scale aquaculture farming is required to improve understanding of current status and trajectory of the sector (Kaminskia *et al.*, 2018). The key features of CI & I model is making real world difference to performance at any given situation (Timms and Clark, 2014) and this was key to this study.

2.9. Conclusion

This study is in support of the emphasis that continuous improvement and innovation mechanisms are important to attain economical emancipation since success is not based solely on technology but more in the manner of focusing and obtaining sustainable resolutions in an enterprise (Hidalgo and Albours, 2008). The “innovation out” principle is recommended for use to transform the mindset and habits of individuals before obtaining improvement and innovation creativity (Black and Gregersen, 2008). The traditional behavior of people in business and their existing mindset are challenged by innovation models to succeed (Hautamäki and Oksanen, 2016).

Since aquaculture is growing rapidly globally, there is a need for organizations to invest in soft technology capacity of individuals mandated to achieve business improvement and innovation success and competitiveness. Innovator’s DNA is embedded in all kinds of people capable of coming up with new innovative ideas that impacts their circumstances positively (Dyer *et al.*, 2011).

The radical shift of management focus capacitating people with problem solving skills is needed since individuals are the ones that drive the success of improvement and innovation rather than organizations. Furthermore, clearly communicated organizational goals can assist people to learn and master improvement and innovation skills regularly and on a frequent basis (Dyer *et al.*, 2011).

2.10. Summary

The chapter began with a historical account of the progress made in aquaculture from colonial era, Apartheid era and post-Apartheid era and the key contributions made by South African government to the development of aquaculture in-general. The chapter also narrated the rich history of catfish farming in South Africa and its potential to effectively address and eradicate poverty and unemployment in the country. A detailed history of continuous improvement and continuous innovation were provided and also its integration into continuous improvement and innovation and its applications in the agricultural sector. A brief explanation on fragmented efforts achieved in aquaculture regarding improvements and innovations were provided, mainly specie-related and not people centred. The integrated model of continuous improvement and innovation that is focused on improving the thinking and action of people were explained and the manner in which it offered solutions to the catfish small business in South Africa involved in this study. The chapter concluded with the concepts and theories in aquaculture both in South Africa and abroad.

CHAPTER 3: Continuous Improvement and Innovation (CI & I) model

3.1. Background

The concept of Continuous Improvement and Innovation (CI & I) as a model was introduced and documented in 1998, constantly improved and informed by experiences from various fields. CI & I is capable of achieving tangible results in any given environment (Timms and Clark, 2014). It also plays a vital role in providing management guidance in the procedure and design of any organization. The process of CI & I grants an opportunity for individuals or organizations to troubleshoot their unique situations to achieve more improvements (Clark *et al.*, 2008a).

3.1.1. Series of CI & I Steps

CI & I is an upward spiraling process that consists of eight steps and focusing questions to enable thinking and action to be focused in each step. The main steps are Situation Analysis; Impact Analysis; Action Design; Action Implementation; Performance Assessment. Focus and Refocus were included both in front and at the back of the process as displayed in Figure 3.1 (Clark *et al.*, 2008b).



Figure 3.1. The Continuous Improvement and Innovation steps with focused questions applied during design, implementation and assessment of opportunities (culled from Timms and Clark, 2008a; Timms and Clark, 2014)

Focus- This is the initial stage of any CI & I principle. “Focus” refers to concentrating thinking and action to determine a clear desire for improvement and develop end – results that responds to the specific need. Focusing thinking and action refers to designing well defined options that offer some kind of advantages required to meet the goals. A well – defined focus that people mutually agreed upon saves time, finances and other resources. What is of paramount importance is that focus must be Specific, Measurable, Achievable, Relevant, Targeted and Time-framed (SMARTT). Furthermore, focus has an effect in all areas of the CI & I process (Clark *et al.*, 2008b; Timms and Clark, 2014; Griffith and Mullen, 2016). Development of a “Focus” is critical because individuals can easily be engulfed by the demands of business, life and many other activities that they have to accomplish. Having a focus can be of value to people (Timms and Clark, 2014). An example of the reported short term focus was when all partnerships focused “to achieve additional 5% improvement in annual business profit among Beef Profit Partners (BPP) within two years, teams outlined the following target outcomes according to Parnell *et al.* (2008b):

- “Rapid accelerated and measurable detectable improvements in productivity production, profit income and growth development
- Supportive helpful network system of rewarding remunerating partnerships, contributing impacting to accelerated rapid industry growth development
- Partners equipped to achieve sustainable improvement and innovation”

Additionally, Parnell *et al.* (2008b) emphasized that a system of achieving rapid short term improvements and innovations was not in practice in these partnerships before. Most business implemented long term focuses such as “rotational grazing, improved pasture management systems, improved animal health and parasite management”.

Situation Analysis: The main aim of this step was to assess the business initial state of affairs in accordance with the focus and determine possibilities to improve. The development and selection of prospects that were in relation to the real needs rather than symptoms was key. In this step it was critical not to constrain flow of ideas and possibilities as ideas could vary from simple to complex. What was critical was for these ideas to be able to have an impact on the focus. Constrains, challenges and issues could all be rethought or changed to opportunities for improvement and a list of this opportunities should be created at the end of the step (Clark *et al.*, 2008b; Timms and Clark, 2014, Griffith and Mullen, 2016).

Impact Analysis: In this step, the previously developed opportunities were assessed on a scale of 1-10 (1=low; 10=high) in order to identify which ones to act on. The tools applied here guarantee that funds were solely devoted to those opportunities that would have the highest impact towards achieving the targets. The step also assisted in spotting opportunities that were out of reach to avoid spending time and money on them specifically (Clark *et al.*, 2008b; Timms

and Clark, 2014, Griffith and Mullen, 2016).

Action Design: This step involved developing a strategy or plan to implement opportunities that achieves the focus. The CI & I process stressed the need to design action because for a new goal to be attained, then different action must be taken contrary to the norm. If one keeps implementing similar things, then similar results would be achieved, however, if different action was done then different outcomes would be realized. Critical Success Factors (CSFs) and Key Performance Indicators (KPIs) were developed in order to identify whenever the implementation was achieving the targets (Clark *et al.*, 2008b; Timms and Clark, 2014 and Griffith and Mullen, 2016).

Action Implementation: In this step the teams executed the action developed from the previous step. There were three factors that were critical to be performed and that included assessing the action; giving report back frequently and offering support to keep been motivated to implement. Within CI & I individuals must be able to prove their achievements and also receive support from one another to continue achieving more improvements and innovation within specified periods (Clark *et al.*, 2008b; Timms and Clark, 2014, Griffith and Mullen, 2016).

Performance Assessment: The step involved assessing and interpreting performance in line with the developed focus and target outcomes. The step also identified which approaches achieved results or failed to achieve results. Better outcomes were achieved when established KPIs were scrutinized during action implementation stage (Clark *et al.*, 2008b; Timms and Clark, 2014, and Griffith and Mullen, 2016). For improvement and innovation to be continually maintained, there should be evidence based outcomes essential for keeping people rewarded and motivated (Clark *et al.*, 2008c).

Creation and Synthesis: This step teams have assessed the results and would now draw from lesson learned to create new knowledge and thinking. New questions and ideas that achieved improvements were created. The outcomes from Performance Assessment were applied to create new opportunities to achieve improvements and innovations currently leading into the future (Clark *et al.*, 2008b; Timms and Clark, 2014, Griffith and Mullen, 2016).

Re-Focus: Whenever the cyclic process was concluded, other numerous improvements and innovations were created from the new condition. The purpose of this step was to focus thinking and action of individuals into further cycles of improvement and innovation (Clark *et al.*, 2008b; Timms and Clark, 2014; Griffith and Mullen, 2016).

3.2. Continuous Improvement and Innovation (CI & I) Application of Tools

Timms and Clark, (2008b) reported that CI & I tools are designed and developed specifically for each step to achieve successful outcomes relevant for each step and participants are also given an opportunity to select the tools of their choice to apply (see Table 3.1). CI & I process was prominently enhanced by suitable control of steps and tools providing a smooth transition between the steps timeously (Timms and Clark, 2014). Various mechanisms would be required to obtain different goals per CI & I stepwise stage. CI & I tools remained effective and efficient when put into practice and literature proved that there was a high connection between successful outcomes of CI & I and specialist knowledge. However, even the highly experienced people still required to follow a process that can assess and duplicate performance. The significance of methods of selection, application and practice of mechanisms to achieve improvements and innovations were advocated by several authors (Imai, 1986; Plsek, 1999; Plsek, 2003; Gray, 2013).

Chapman and Hyland (2000) reported that although the process of achieving radical change takes time and cumbersome, when technologies show signs of failing to produce valuable outcomes, organizations need to CI & I those technologies. Caffyn (1999) took into cognizant that application of tools would not automatically achieve CI because tools remain just that, tools; they require complementary action to have significant impact. Tools assisted in identifying gaps in an organization and do not impose by giving advice on what should happen. They are critical because they make users to think deeply about what is going on in their business and what must be done to improve.

Table 3.1: Appropriate tools per CI & I stepwise stage (Timms and Clark, 2014)

Focus	Focusing Frameworks, CSFS and KPIs, Focus Types, SMARTT focus
Situation Analysis	Brainstorming, Specialist Questioning, Profit Driver Tree, System Thinking, System Design & Analysis, Process Design & Analysis, Local Best Practices, Inverse Thinking, Fishbone, Force Field Analysis, Stop Doing, PMI
Impact Analysis	Impact and Influence, 8Criteria, Gross-Margin, Impact Criteria, Systems Modeling, Sensitivity Analysis, Specialist Questioning, Force-Field Analysis, Decision Trees, SWOT
Action Design	SMARTT focus; 5Ws & 1H, PMI, CSF Frameworks, How-How Technique, Performance Management Frameworks, Timelines, Gantt Charts, PERT Diagrams, Budgets
Action Implementation	Action Checks, Reporting Frameworks, Charts, Recording Frameworks, Trial & Control, Specialist Questioning, Critical Friend
Result Assessment	Key Performance Indicators, Repetitive Why, Critical Friend, Reporting Frameworks, Performance Management Frameworks, Achievement Stackers, Learning Log
Creation & Synthesis	Observations; Questions, Ideas & Opportunities, Six Thinking Hats, Inverse Thinking, Brainstorming, Why-why Diagram, Skills-Audit
Refocus	Balanced scorecard, Balanced Wheel of life, CSFs/KPIs/KAS, Front End Tool, Short/Medium/ Long-term Goals, SMARTT Goal Tool, Stakeholder/Partner Roles & Responsibilities, Vision/Mission/Principles

3.3. Focusing Frameworks

There is plethora of factors that can distract one's attention to focus on activities that achieves the goal. Tools that assist in focusing on the critical improvement driver can save resources and yield higher returns (Timms and Clark, 2014). The profit driver tool empowers individuals to develop clear and achievable targets with Critical Success Factors (CSFs) and timeous Key Performance Indicators (KPIs) to pay attention to thoughts those results into implementation (see Figure 3.2). The tool also enabled participants to give feedback and support that impact on the goals. When focusing frameworks are applied on common theoretical grounds, they enrich the collective exertions to reach targets. Furthermore, development of common focus, CSFs and KPIs demands high input costs initially and lessen as the process unfolds and understanding is improved (Clark *et al.*, 2008b; Timms and Clark, 2008b). The sole mandate of this profitability framework is to evaluate the possible effects of new technology and provide a focus for implementation (Griffith *et al.*, 2007).

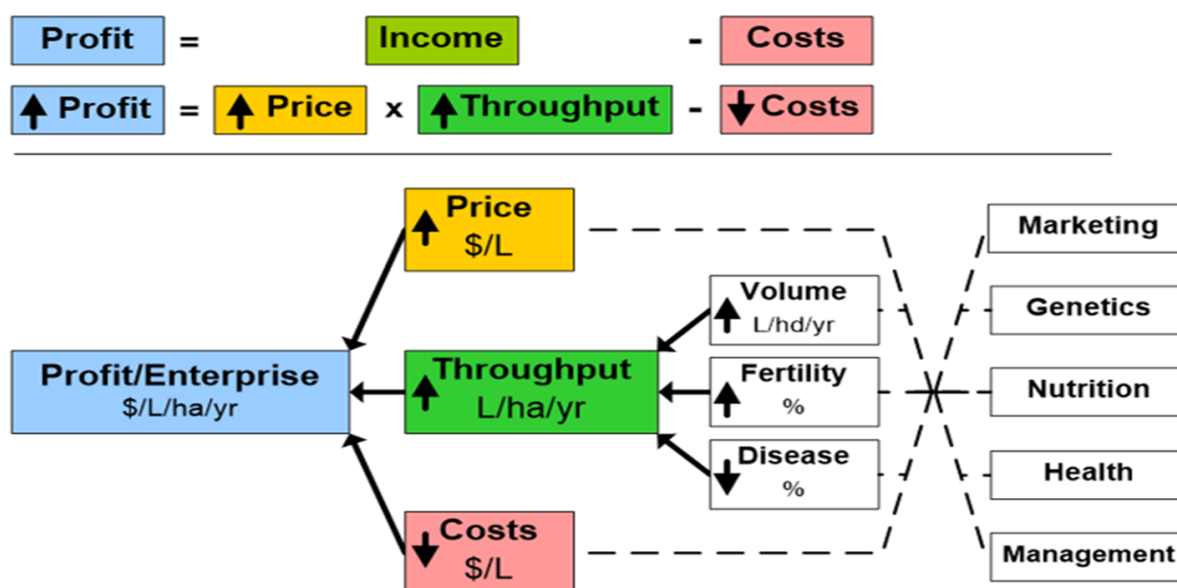


Figure 3.2. Profit driver tree applied in beef industry (Clark et al., 2008b)

3.4. Continuous improvement and Innovation (CI & I) Timing and Monitoring

Time and effort are valuable assets that require effective management to realize improvements and innovations. Normally it is always challenging for individuals to fully commit and manage time effectively; and also costly not to apply business improvements and innovation quite frequently in the effort of Continuous Improvement and Innovation (CI & I) process to encourage participants to develop a certain focus. Partakers are also inspired to meet regularly, share their outcomes and offer support to one another frequently every 30, 90 and 180 days as illustrated in Figure 3.3 (Alford et al., 2008a; Parnell et al., 2008b).

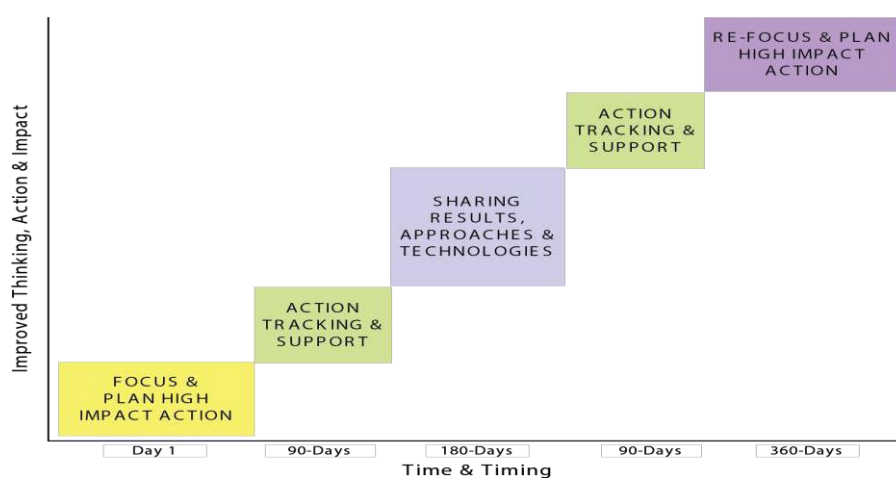


Figure 3.3. Suggested Beef Profit Partnership (BPP) team schedule (Culled from Clark et al., 2008a)

3.5. Critical Success Factors (CSFs)

For the Continuous Improvement and Innovation (CI & I) process to be effective, goals, Critical Success Factors (CSFs) and Key Performance Indicators (KPIs) should be prioritized and simply shared in order to detect and endorse winning approaches. KPIs should alert quickly whether action is impactful on the goal (Clark *et al.*, 2008b). Clark (2008b) emphasized that “if you can’t measure it, you can’t manage it”, well developed CSFs and KPIs are fundamental during system planning and monitoring that delivers satisfactory outcomes in partnerships or networks. Alford *et al* (2008a) reported that analysis and interpretation of results stage – performance assessment is key to the achievement of the goal. Authors stressed that the fundamental action have to be strategized and linked to KPIs that impact on CSFs. KPIs must be significant and clearly assigned to improve ways of achieving success. KPIs should be timeous so that they will be able to indicate whether action is impactful on the targets. KPIs must be able to give proper outcomes from implementation and proper strategy to keep implementing.

3.6. Reporting and Support Framework

Measuring, Monitoring and Evaluation (MME) System during planning was developed to empower individuals with the ability to achieve improved outcomes and to receive inputs that sustains further improvement and innovation for six months. The attainment of accelerated improvements and innovations requires constant evaluation of financial performances in a business rather than checking the changes at the end of a process. Assessment checkpoints are needed to prove that improvement is happening in a process to achieve profitability. Hence, flow chart was created that monitors the work-flow of Beef Profit Partnership (BPP) partnership in the Continuous Improvement Innovation (CI & I) methodology (Alford *et al*, 2008b; Clark *et al.*, 2008b). According to literature in rapid cycle improvement, the speed at which a cycle runs is of outmost importance. The more cycles partners implement opportunities the more they gain insight, therefore shorter cycles are easily manageable and report outcomes sooner than longer lagging cycles (Parnell *et al.*, 2008a).

An example of a flow chart by Alford *et al.* (2008b) of a proposed cattle producer who bought 120 weaners for grow-out purposes was as follows: The problem was that the processor brought a complain of cattles with high level of bruising amounting to 8% of all carcasses. The producer received a price of \$2.00/kg of bruised cattle reduced by \$0.30/kg; while the non-bruised were sold for \$2.30/kg/kg. The short term focus was to reduce the amount of bruising in the cattles.

In the impact analysis step, the farmer assessed some opportunities to lower the level of bruising in cattles. The opportunities were to construct new yards; construct new watering points and enroll for animal handling short – course to enhance capacity. The famer was confident to be able to reduce this bruising by 3%. A partial budget was confirmed to see which of the three options would be viable to invest in. The new input cost of the activities

was assumed to be around \$20,000 which could create an additional income of \$66/steer in estimation. The farmer decided to pursue this investment on the basis of the estimated profitability (Alford *et al.*, 2008b).

The farmer procured all the materials needed to construct the new yards and watering systems; enrolls for a livestock handling short-course, and also searched for further professional assistance regarding handling techniques. When the animals were taken in to be soaked with liquid type medicine, the farmer noticed that labor time was saved by 30 minutes because of the new upgrades of the plots (Alford *et al.*, 2008b).

During the sale of the cattles the farmers were told by the producer that the level of injury was reduced by 4% and the price for the cattles had increased to \$2.25/kg. The amount of profit made after the associated costs were deducted was increased to \$40/steer. Therefore, this action could be considered to have met the outcomes of objective: “To design and implement effective and efficient Measuring, Monitoring and Evaluation (MME) mechanisms that will demonstrate rapid and measurable improvement in productivity, profit and growth” (Alford *et al.*, 2008b).

The farmers scored high on value of the support gained from other participants. The sessions resulted in the farmer having high confidence and motivation in the Continuous Improvement and Innovation (CI & I) tools and the support received from other partners to keep implementing. These elements have resulted in the best decision that improved profit and production of cattles in this business. The reporting and support framework provided enough flexible information with simple tools that conveys changes in businesses and achieved results on profit and production (Alford *et al.*, 2008b).

3.8. Use of Technology

Access to technology alone in carefully designed and viable communities cannot stimulate the growth of Gross Domestic Products (GDPs) and achieve continuous throughputs, but prudent implementation, modifications and functions of those technologies are more critical. For improvement and innovation to be sustainable new information and technology should be developed on a constant basis (Clark *et al.*, 2008b), and derives contributions from everyone and not only from white collar scientists (Clark *et al.*, 2008c). The mushrooming of technology in aquaculture in the form of recirculating systems is evident looking impressive; however, evidence of their efficacy is unavoidable (James, 2016a).

3.9. Continuous Improvement and Innovation (CI& I) Language and Communication

According to Clark *et al.* (2012a), language and process of Continuous Improvement and Innovation (CI & I) is quite challenging and there are also disparities in the level of knowledge and skills in the targeted businesses to achieve improvements and innovations. These types of competencies are not offered in the curriculum of Agriculture. Therefore, CI & I founders have developed short training workshops ranging from one day to five days

accredited programmes focusing on factors critical to succeed and also failure points in a project. These courses are expensive to be offered and often receive low participants numbers. Therefore, a number of ways were found to communicate the core concepts and mechanisms of CI & I such as compiling what was designed, implemented and achieved in a formal report (Clark *et al.*, 2012a).

3.10. Thinking and Action Defined

According to de Bono (2010), thinking and communication investigations have not been tapped into for 2400 years. Beyer (1998) indicated that people do think all the time but they can learn to think effectively and achieve more success from where they are currently. Thinking differs considerably from enhanced thinking. The latter offers once off solution to temporary constraints and provide relieve from experiencing a difficult task of thinking. Enhanced thinking refers to making the process of thinking in the long run to be efficient, quick, precise and proficiently incorporated into daily learning. Samier (2019) defined thinking as the “ability to understand reality, analyses it logically and intellectually and the ability to create concepts”. Ability to think is one of the soft competencies that can be imparted and implemented willingly by people from various backgrounds. It involves activities such as “cognition (knowing), affect (feeling) and conation (wanting and willing)” in order to have improved outcomes.

People ignore activities that prompt them to think deeply about their settings. Many believe that thinking is a talent that one is born with and seldom consider it as a skill that can be sharpened (Hurson, 2008). New ideas do not spring from individuals who sit in a tranquil place like a river bank and begin thinking, but from careful learning of the thinking techniques (de Bono, 2010). According to Costa and Kellick (2009), for enhanced thinking to be of value it has to be incorporated into people’s daily routines, however, in most cases it is not prioritized and often utilized with incorrect methods that fails to yield improved outcomes. Furthermore, as much as the ability to think and solve problems is given to mankind as one of the greatest mental orders utilized for survival and creating success, it also houses elements of destructions ever experimented in human species (Sternberg and Funke, 2019). Some companies are constantly searching for new methods of perfecting service excellence while minimizing waste thorough encouraging employees to think and act innovatively. It is always challenging to bring change in an environment where people believe that they are already performing excellently and are clueless about ways of generating new ideas. If people have access to different information, chances are high that they will be able to perform differently (Plsek, 2014). This research provided an opportunity to business owners in aquaculture to be empowered with tools that enhances thinking and action by developing new ideas, new things and create new goals and assess their effectiveness. De Bono (2010) further placed emphasis on handling new ideas with the similar amount of care to legal and financial issues. It is not enough to only seek to comprehend the manner in which farmers

gain insight, contemplate and create knowledge, but requires close monitoring to act creatively (Major *et al.*, 2018). Billions of ideas in a person's mind fail to generate income, they just quickly pass by in the mind with no follow – up plan and are forgotten tomorrow. People are also not skilled to act on their ideas, while others are of the view that they are expensive and time consuming and this leaves the gap open in the market for any individual who can create profit-making ideas (Roelofse, 2012). The use of CI & I assisted in preventing introduction of frameworks that partakers find complex and irrelevant to them, as it addresses issues that are real to them (Madzivhandila *et al.*, 2008b).

CHAPTER 4: Theoretical framework and model specifications

4.1. Introduction

This chapter addresses the project vision and theoretical questions of the methodology.

4.2. Methodology

The type of research methodology employed is a mixed-method and its elements, benefits, research paradigms and end in mind are presented in Figure 4.1. The components consist of outcome achievement; research paradigms; methodologies; core methods and mechanisms (Robson, 2002; Gray, 2013). These components will be discussed fully in the subsequent section.

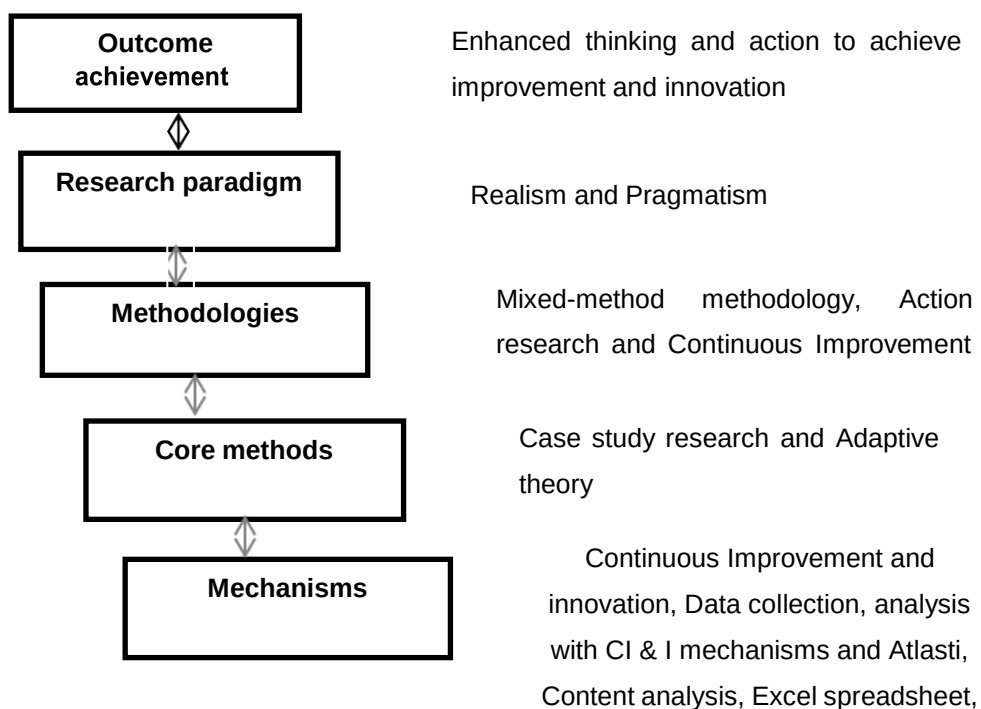


Figure 4.1. Mixed-method research methodology (Culled from Gray, 2013)

4.2.1. Research Paradigms

There is plethora of articulated research definitions; this study restricts it to the definition given by Cohen *et al.* (2018) as “Activities and undertakings aimed at developing science for behavior”. The authors further explained social research as “Systematic and Scholarly application of the principles of science of behavior to the problems of people within their social contexts”. The perfect method to plan and conduct research does not exist and there is no single truth to be discovered. Cohen *et al.* (2018) further emphasized that the world we live in is pluralistic, full of many possibilities to research on, lot of realities and lived experiences, many theories and reasoning's and many discoveries to be created.

Research philosophies refer to “system of beliefs and assumptions about the development of knowledge’. This means that the research philosophy carries critical assumptions about the manner in which the researcher views the world. These assumptions direct all the features of the research. Paradigm is defined as “a set of basic and taken-for granted assumptions

which underwrites the frame of reference". All research philosophies consist of three major types of assumptions: ontological, epistemological, and axiological (Saunders *et al.*, 2016; 2019)

- Ontology is defined as "the nature of the world and reality". Ontological assumptions shape the type of research objects, phenomena and approach the researcher focuses on. This study inclined towards critical theory, which is more concerned about outcomes that transforms and empowers communities to sustain and manage themselves and their projects. It also inclined towards pragmatism, a justified viewpoint that debates that theories are solely significant when they reinforce the deeds. (Jonson and Onwuegbuze 2004; Tashakkori and Teddlie, 2010; Saunders *et al.*, 2016;). This leads to epistemology.
- Epistemology - The manner in which people recognize what they say they recognize, what comprises satisfactory, legal and genuine facts and the manner in which we disseminate the findings to others. A critical theorist, pragmatism fits this research best because its intention is to transform activities via the interchange of thinking and action. This leads to Axiology.
- Axiology deals with the ethical behavior of the researcher towards themselves, participants and animals during the process of the research. The value for this research has been outlined in chapter 1. Axiology leads to methodological considerations.
- Methodology - the outline of the comprehensive research strategy taken in a research based on the theoretical and philosophical assumptions in order to solve a particular problem. The study implemented mixed-method methodology, CI & I and action research. Methodology produces the matters of instrumentations and data collections.
- Methods: refers to the scientific techniques applied in the collection and analysis of research data. This study in particular employed case study and adaptive theory.

Critical realism and pragmatism were two philosophical stances that reinforced this research. Critical realism pays attention to revealing the reported observed reality that shaped events according to what is seen and experienced. Critical realist tends to delve deeper into the history of a society with the aim of employing various techniques to end existing problems (Gray, 2013; Saunders *et al.*, 2016; 2019).

Pragmatism is directed by the type of a research problem and employs different approaches to answer the research question. It also takes a philosophical position that ideas are paramount only when they are underpinned by execution. It emphasizes the significance of outlining the research problem in order to offer real world solutions that inform a better tomorrow. This depends on two laws: first the most potent orientation of life is gathered from lived experiences of those engaged in a problem; such experiences are critical when given

enough attention and acted upon to improve more life exposure (Gray, 2013; Saunders *et al.*, 2016; 2019).

Critical realism and pragmatism emphasize more on communal obligations that pay attention on outcomes generating profit; have methods that are capable to monitor project execution in order to handle improvement and innovation; are reactive and attentive to the now and the tomorrow (Gray, 2013; Saunders *et al.*, 2016; 2019).

This study burrows from western way of life the opinion that participants are untouched fountains of knowledge and it's noble to enquire their thinking on how to develop their operations. Participants are masters of their destinies and way of living. The researcher held a position of an instructor and an assistant researcher. Participants were only given support and not suggestions as they evaluated their ideas, developed prospects via searching hidden acumens and influences creating compacted foundations for continuous dedication and engagements (Gray, 2013).

4.2.2. Mixed - Method

Mixed method academics deliberated extensively about what to name this research method. Some of the key developed and applied terms includes: *mixed methods research* (with no hyphen); *mixed - methods research* (with hyphen); *mixed method research* (no s); *mixed methodology*; *methodological triangulation*; *multi-method research*; *integrated research*; *combined research* and *mixed research*. Each of these terms commonly express that both quantitative and qualitative research traditions integrate or mixes together in a single study (Plano Clark and Ivankova, 2016). Teddlie and Tashakkori (2010) indicated that there is no better suitable definition of mixed methods research over the other.

This study applies mixed - method methodology articulated by Tashakkori and Teddlie (1998). Mixed - method methodology is defined as “a class of research in which the researcher mixes or combines research techniques, methods, approaches, concepts or language into a single research and across studies”. The term methodology depicts the comprehensive procedure from articulating research questions to inferring conclusion of the study. This means that the methodology comprises of methods, conceptualization and analysis stages of the research process (Johnson and Onwuegbuzie, 2004; Tashakkori and Teddlie; 2010; Gray, 2013; Plano Clark and Ivankova, 2016). The critical characteristics of mixed methods research is embedded in its methodological eclecticism or pluralism mixing quantitative or qualitative methods in tandem (Jason and Glenwick, 2016).

The rational for employing this approach in this study is that, one research method alone is inadequate to address the research problem and purpose, combination of quantitative and qualitative methods will provide a better understanding (Creswell and Garrett, 2008; Plano Clark and Invankova, 2016); it is a vast and innovative type of an investigation (Johnson and Onwuegbuzie; 2004); it is positioned in the pragmatic approach (Laws and McLeod, 2004)

and critical realist paradigm (Clark, 2008).

Mixed-method methodology is potent to investigating complex problems that results in rich outcomes, especially where one research method fails to address the problem fully. It brings people from diverse philosophical backgrounds to work together and answer one research question (Cresswell and Garrett, 2008). It offers a complete toolkit for researchers to investigate wicked problems and contribute to a better world. Rich and in - depth data regarding a certain phenomenon is gathered via rigorous and integrated research methods such as this one (Blank, 2013). Teddlie and Tashakkori (2009) also indicated that mixed method methodology addresses both confirmatory and exploratory questions and verify and generate theory in similar study. Johnson and Onwuegbuzie (2004) emphasized that “the bottom line is that research approaches should be mixed in ways that offer the best opportunity for answering important research questions”. This approach should employ the technique and theories that endeavor to cater for the generated information from both quantitative and qualitative into a practical resolution. Mixed-method methodology remains open to the possibility of addressing emerging of new rationale because of the new insights derived from the initial results (Bryman, 2006). Table 4.1 provide a brief information regarding the advantages and limitations of this type of an approach (Johnson and Onwuegbuzie; 2004; Gray 2013).

Table 4.1: Advantages and limitations of mixed-method methodology investigation

Advantages	Limitations
• Able to accommodate multiple research questions in one study and the researcher is not limited to one technique • The powers of the extra technique can be applied in one study to address the limitations of the other approach • Provide additional neglected information and knowledge during application of one method • Detailed discussions, images and descriptions can provide further sense to numbers, and numbers can be employed to enhance accuracy to discussions, images and descriptions • Capable of offering greater verification to draw deduction via merging and validations of results for imparting larger variety of different interpretations. Source reliable data to derive final comments within a research through convergence and divergent analysis • Identifies the reality and significance of the universe together with communal and mental world; prioritizing the existence and effect of the private world of person's lived encounters • Capable of being employed to proliferate	• The investigator has to study various techniques and methodologies and comprehend the manner in which they can be mixed properly • Research methods traditionalists argue that researcher should constantly employ either qualitative or quantitative paradigm • Extra labor - intensive • Costly and particulars of the investigation has to be determined by the researcher on the ground "(e.g. e.g. problems of paradigm mixing, how to interpret conflicting results)"

4.2.3. Action Research

The definition of action research that this study is employing is derived from the work of Coghlan and Shani (2018) as follows:

“An emergent inquiry process in which applied behavioral science knowledge is integrated with existing organizational knowledge and applied to address real organizational issues. It is simultaneously concerned with bringing about change in organizations, in developing self-help competencies in organizational members and in adding to scientific knowledge. Finally, it is evolving process that is undertaken in a spirit of collaboration and co-inquiry”.

The current research finds the above description useful in that as an evolving research, it takes part in a developing narrative where information change as a result of intercession in areas where it is impossible to standardize what is happening with the highest degree of accuracy. It builds from previous experiences while occurring in the current situation aiming to positively influence prospects that deal with tangible business matters instead of being developed solely for research intentions. Key characteristics of action research involves addressing the dual responsibilities of providing a difference in establishments and creating solid, executable insights within an ongoing activity assumed in the atmosphere of teamwork, where inquiry is developed with societies instead of on their behalf (Coghlan and Shani, 2018).

Lewin (1947) invented the term action research and described it as a tool that advances science while simultaneously addressing practical societal problems. He further, elaborated that the importance of not only explaining things but also to try and change them. Coghlan and Shani (2018) also emphasized that for any system to change, a basic understanding of the entity and its dynamic interface with its environment is required. Schein (2010) reflected on Lewin’s notion and recognized that insights that developed social structures may possibly transform if affiliates of those structures are research participants themselves. The cornerstone of action research is that, firstly, it involves clients in their real worlds besides the fact that it generates informed insights, it also provide accurate information on how the process actually functions. Secondly, people understands the organization better when they attempt to transform on their own, since social structures changes from time to time and cannot be managed by old-fashioned research paradigms (Schein, 2010).

Coghlan (2019) refers action research to “an approach to research which aims at both taking action and creating knowledge or theory about that action as the action unfolds; the outcomes are both an action and knowledge outcome”. It consists of four major purposeful components such as planning action; implementing; observing and contemplating steering to additional planning in the subsequent process (see Figure 4.2) (Coghlan, 2019). It involved human as contributors pursuing their thinking, designing, execution, reflection and identifying

things that succeeded and those that failed and why. It focuses more on obtaining long lasting sustainable changes than quick fixes while assisting the organizations to adapt to those changes (Coghlan and Shani, 2018). Gray (2013) underpins the notion that action research should not only focus on transforming people's conducts but should focus on transforming their mind so that their conducts are well informed. Cohen *et al.* (2018) emphasized that action research may possibly be applied in every environment at which societies are experiencing problems situated in systems or work place and require intervention. It holds both problem diagnosis and problem solving. It can assist in the growth and development of self-governing bodies, inspire transformation, capacitate people with skills of self-mastery and become a foundation of brainstorming for new ideas and take them to action (Creswell, 2012).

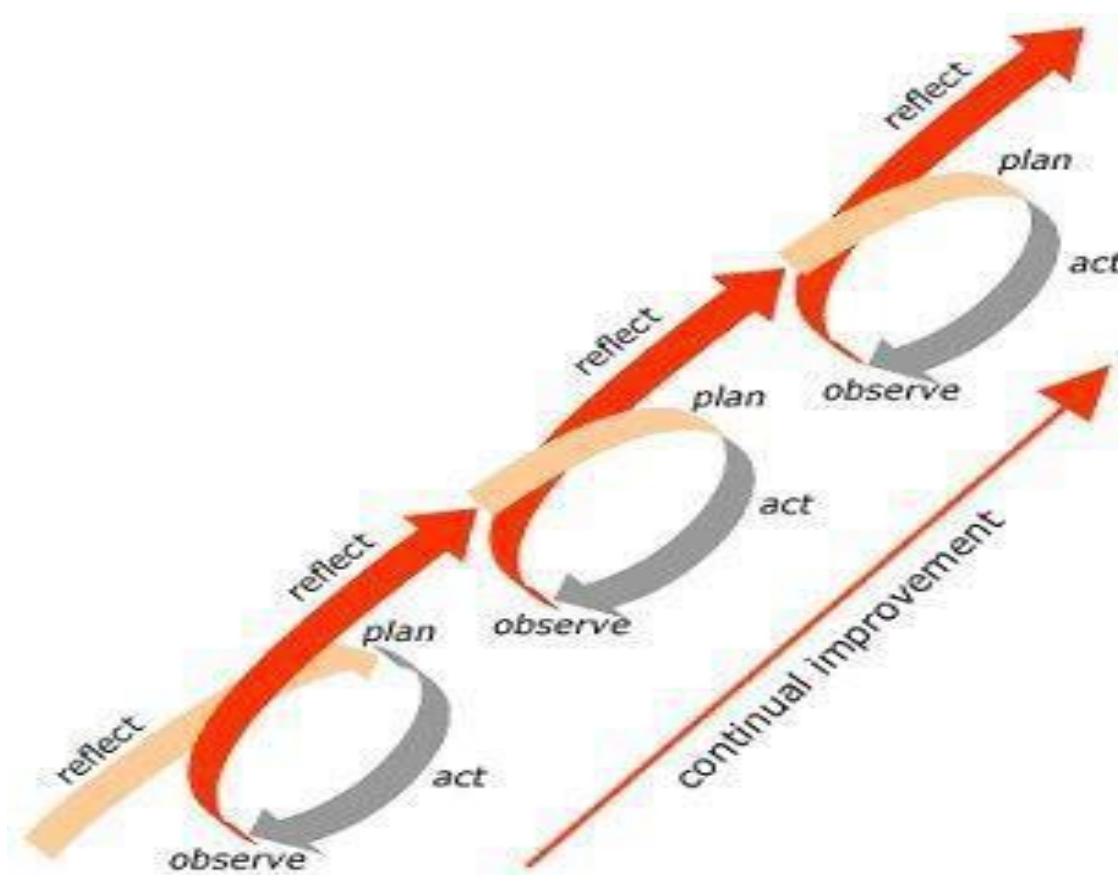


Figure 4.2. Spiral of action research cycles (Swanepoel, 2016)

Ferrance (2000) resonating Wadsworth (1984) in contending that the most potent reasoning for action research is that people will:

- 1) produce best outcomes from self-diagnosed problem;
- 2) easily inspired to evaluate their own actions and come up with different approaches;
- 3) assist one another through collaborative work and
- 4) assist one another by working as a team of professionals.

The notion that action research lacks quality is incorrect; however, action researchers have to ensure that their research is sound. Quality in action research is referred to as rigor (i.e. quality, validity, accuracy and credibility of action research and its findings (Mertler, 2017). Rigor in action research is attained in the following manner:

- It is by nature cyclic, proceeding through a number of cycles and generate more insight with greater credibility
- Gather more in-depth information via “prolonged engagements and persistent observations” to assist participants to fully grasp the outcomes
- Uses multiple sources of data and other information; this gives the researcher an opportunity to verify the accuracy of data and to clarify meanings or misconceptions held by participants
- Participants have the opportunity to assess the raw data, interpretations and final reports through member checking to enhance the rigor
- Members have the opportunity to address their emotions that might have clouded their interpretations of events through participant debriefing
- Lived experiences and perspectives of participants should be reflected and should be communicated in their native language to assert understanding (Melrose, 2001; Stringer, 2007; Mills, 2011, 2014; Mertler, 2017).

4.2.3. Choice of Action Research

Action research was a suitable research method for the current investigation due to its intention to focus on local context with the aim of adding value to practices, which vary from traditional research that seek generalizability. It is underpinned by a simple premise that communities have within its powers to considerable opportunities to influence their economic potential and job creation. This methodology is a cycle of continuous learning, continuous action, continuous participation, continuous reflection and continuous improvement (Venter, 2018). The sample consists of appropriate participants in the field, contrary to being randomly selected from the broader population. It has real-world significance rather than hypothetical significance (Cohen *et al.*, 2018). Contributions developed to generate new knowledge is put into practice rather than been shelved (Gray, 2013). Action research entails learning from action through the investigation and trying to learn the change process, conceptualizing what worked, what did not, how, why and identifying what can be better (Zuber - Skerritt, 2018).

Somekh (2006) opposes the existing condemnation that refers action research as inappropriate, simply because it abides by robust research principles such as hypothesis testing, new methods of viewing constraints, production of new facts, meticulous inquiry and it profits the knowledge of participants. The research has the benefit of been carried out by

someone who is innate to the field and action occurs on-site where the problem is existing (Casey, 2013). Ideas pop up at any given point in the process which could influence implementation and the subsequent cycle could move in a new direction (Gray, 2013).

Key features of action research is that participants and the researcher collaboratively focus on improving thinking, understanding, situation and practices, while learning from these changes (Kemmis and McTaggart, 1992). Gray (2013) further alluded that the meaning of experiences could be interpreted by participants; on their own making them part and parcel of their daily activities. Kemmis and McTaggart (1992) put it so well, indicating that “action research promotes emancipation, empowerment and social justice in participants”. Participant’s ideas, assumptions and values were sources of data for this study. It can start on a small scale and spiral out to involve others in communities. Morrison (1998) indicated that participants living in the vicinity of constraints are suitable to recognize them and work towards resolving them. In support of this view, David (2002) alluded that decision making process should involve people faced with a problem especially those with insignificant voices.

Project owners were partners in this research as their views and articulations were an integral part to obtaining improvement and innovation. A lot of effort was put in the design stage of the Continuous Improvement and Innovation (CI & I) process to bring different experience to partners from the usual extension summits. The researcher was not seen as an expert sitting outside and just merely conducting research but as a partner who conducts research for the people involved. All people saw each other as equal partners contributing to the scientific investigation. Phenomenal outcomes of action research relied upon observations and understanding regarding participants rather than giving ultimate answers to research questions (Zuber - Skerritt, 2018). Venter (2018) put emphasis that communities often welcome a top-down approach with a lot of resistance while bottom-up approach produces more sustainable change.

4.2.4. Continuous Improvement and Innovation (CI & I) as a Methodology

Improving and innovating can be regarded as an imperative requirement of life. In all aspects of life, opportunities to improve and innovate exist and this is reliant on people’s willingness to embrace change (Timms and Clark, 2014). Lewin and Grabbe (1945) described three fundamentals needed to transform people’s behavior: 1) the necessity to reason in a different manner; 2) the need to critic and assess uniquely and 3) the need to conduct oneself uniquely. Terziovski and Samson (2000) established that one of the key forecasters of improved performance is the endorsement of CI & I management strategy in small

businesses. CI & I is a different model to create helpful transformation within aquaculture catfish businesses (Gray, 2013).

CI & I is designed both as a standard model for action and planning in business management to empower participants to obtain improvements and innovation in any given area (Clark *et al.*, 2008d). CI & I can be applied to people in groups, clubs, networks, companies, organizations, communities, industries and regions to achieve both improvements and innovations continuously (Timms and Clark, 2014). It empowers people to

- 1) concentrate thinking and action on things that make the most difference concept;
- 2) focus attention on profit and key drivers that aquaculture catfish business can manipulate to achieve improved profit;
- 3) select the most appropriate tools to achieve goals;
- 4) sustain motivation and interest from proof of successful outcomes;
- 5) improve and implement their insights, expertise and intelligence to increase operations (Clark *et al.*, 2008d).

CI & I methodology consist of a logical set and sequence of steps that when completed deliver desired results (Timms and Clark, 2014). Gray *et al.* (2015) emphasized that CI & I provides proof of success attained from sequenced and leveled mechanisms. These authors explained that key features of this approach begins with an end goal; functions in cycles of knowledge and change; equips partners with tools to execute and reach goals; ignites brainstorming of ideas and creativity; focuses on generating relevant concepts for achieving improvements and innovation; transforms old thinking pattern and drives partners to be active in thinking and action.

The role of researcher was that of a coach / co-researcher or active partner to assist people to achieve long lasting results. This includes empowering participants in the application of CI & I tools and giving them backing (Gray, 2013).

4.3. Core Methods

There are three reasoning to research approaches that can be adopted: deductive reasoning, inductive reasoning and abductive reasoning. The latter is not been widely applied or acknowledged (Yu, 1994). Deductive reasoning happens when inferences are made logically from the premise of theory. For example, a research that is focusing on electronic marketing auctions of new mobile phones about to be released may have three assumptions: 1) that electronic marketers were assigned small mobile phones stocks by the manufacturer: 2) demand and supply of the phones is high; 3) customers are permitted to do pre-orders of the phone. If these premises are valid, it can be deduced that the conclusion

that the entire stock of new mobile phones would be sold before the launch would be valid. Inductive inference is that therein exist a logical reason amongst deduction and the experimented phenomenon.

For example, the observed premises regarding the electronic marketing auctions of about to be released mobile phones could be:

- 1: that journalists are stating that electronic marketers have a grumble regarding receiving inadequate stock of mobile phones;
- 2) news media is reporting that demand and supply of mobile phones is high;
- 3) electronic marketers are permitting pre-orders of the phone from customers.

According to these observations, there is high chance that electronic marketers would have been out of stock of new mobile phones before launch time. Even when this inference is backed by evidence, it remains uncertain (Saunders *et al.*, 2016; 2019). Abduction involves detection of unexpected new information from the data (Ketokivi and Mantere, 2010) and this unexpected new information is the inference instead of assumption. Returning the previous example, it is a surprising fact that electronic marketers are told on media platforms that their new cell phones would be out of stock on the launch day. Again, if electronic marketers allow clients customers to order mobile phones before their available for purchase, then it would be astonishing that allocation of phones would be sold out. Therefore applying abductive thinking, the likelihood that electronic marketers would be out of stock of mobile phones at the time of the launch is satisfactory (Saunders *et al.*, 2016; 2019).

Abductive approach explores data, discover ideas and rationalize patterns to create fresh or revise the current theory verified via surplus process of collecting and analyzing data. Deduction involves the development of a concept exposed to meticulous test via a sequence of proposals. In an inductive approach theory follows data (Yu, 1994; Saunders *et al.*, 2016, 2019). Although deductive and inductive reasoning are essential they are not enough to build theory without abductive method (Noe, 2000). The plan of action in this study applies interplay of abduction, deduction and induction. Mixing adaptive theory and case study research enabled the development of the “research-then-theory-then-research-then-theory” approach (Gray, 2013).

4.3.1. Adaptive Theory

Adaptive theory merges current philosophy with the philosophy produced from data testing. Adaptive word suggests that the philosophy adjusts and influenced by arriving information while the data is concurrently categorized and adjusted by previous theories appropriate to

their examinations (Layder, 1998). Sources of information were reviewed at the beginning to stimulate thinking and improve the design of this research.

4.3.2. Case Study Research

Yin (2016) refers to case study as an in-depth inquiry into a topic or phenomenon within its real-life setting. The “case” in case study research may refer to a person (e.g. a manager), a group (e.g. a work team), an organization (e.g. a business), an association (e.g... a joint-venture), a change process (e.g. restructuring a company), an event (e.g. an annual general meeting) and many others. Case study can be designed to identify what is happening and why and to understand the effects of the situation and the implication for the action. Case study research draws on data, both qualitative and quantitative from a range of sources to understand fully the dynamics of the case (Saunders *et al.*, 2016, 2019). Robson (2002) indicated that case study research is unique with its own design.

Case study research concentrates on responding to the questions that probes how and why, where the investigator has limited influence over incidences occurring in real - life setting and the focus is a temporary phenomenon (Yin, 2014; Aberdeen, 2013). The study employed Yin’s 2014 two-fold description:

1. “A case study is an empirical inquiry that investigates a contemporary phenomenon in-depth and within its real-world context, especially when the boundaries between phenomenon and context are not clearly evident;
2. The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulation fashion, and as another result benefits from prior development of theoretical propositions to guide data collection and analysis”

Quality in experimental social research is determined through four frequently employed examinations. Yin (2014) justifies several tactics of dealing with design tests (see Table 4.2). Construct validity; recognizes the accurate effective procedures for the phenomenon being investigated. Internal validity; strives to create a cause and effect association where particular circumstances are assumed to have control over other situations. External validity; describes the area at which the outcomes of an investigation may be generalized within the real world experiences. Reliability; display that the method of the investigation is repetitive and will yield the exact outcomes (Yin, 2014).

Table 4.2: Case Study Tactics for Four Design Tests (Yin 2014)

Tests	Case Study Tactic	Phase of Research in which Tactic Occurs
Construct validity	Employ numerous bases as proof	Data collection
	Create series of proof	Data Collection
	Allows significant informants analyses draft case study articles	Composition
Internal validity	Do pattern matching	Data analysis
	Do explanation building	Data analysis
	Address rival explanation	Data analysis
	Use logic models	Data analysis
External validity	Use theory in single-case studies	Research design
	Use replication logic in multiple-case studies	Research design
Reliability	Use case study protocol	Data collection
	Develop case study database	Data collection

Yin (2014) addresses traditional concerns regarding case study such as; it is not rigorous enough; get confused with the teaching cases; finding have limited generalizability; unmanageable level of effort such as taking too long and resulting in long unreadable data and it has unclear comparative advantage.

The advantages of case study research are that it explores an existing event comprehensively inside its real world circumstances, to get close to the case being studied. There are no boundaries in which the investigation should occur. Employ various techniques to collect both qualitative and quantitative data. It constructs upon real - world knowledge (Yin, 2014). Case study research enabled the investigator to be close and understand the complex issues of aquaculture business owners.

The case in this research was aquaculture catfish business owners who responded positively to the CI & I methodology and their individual projects as a focus. They met the criteria of being: interested in what the study had to offer: they understood their businesses and were willing to implement and assess the effectiveness of the methodology in their farms. It was also important that the participants become committed to learning and sharing in their individual businesses. There were 30 cases that the researcher worked with across provinces in South Africa; collecting data and assessing insights for 12 months (October

2017 to October 2018) to gain in-depth insight to continuous improvement and innovation methods. During the completion of each cycle, data was evaluated and assessed, while insights updated subsequent phase. Multiple-case design with a single unit of analysis was employed (Gray, 2013). Multiple cases assisted in revealing the researcher's own bias and enhanced external validity. There was one commercial and 29 small businesses involved in the study.

4.3.3. Continuous Improvement and Innovation (CI& I) Process

Continuous Improvement and Innovation (CI & I) was improved by experiences from people in different context. Its development was also attributed by suggestions from been employed in approaches such as action research, action learning, benchmarking, total quality management, system dynamics, theory development and experiential learning (Timms and Clark, 2014). The core of this current study was action research intertwined with CI & I process as displayed in Figure 4.3. (Gay, 2013). Each business was encouraged to use CI & I process with its mechanisms and tools to achieve improvement and innovations to meet the research's focus of increased profit (Clark *et al.*, 2012b). CI & I can alternatively be presented as an 8-step staircase with both focus and refocus (Clark *et al.*, 2008d). It designs and manages an approach that produces more successful outcomes that fulfills real world needs and the sequences components are integrated to form an upward spiraling process (Gray, 2013).

The key feature for CI & I is that, it is a thinking process for "focusing thinking and action for impact on performance" (Clark *et al.*, 2008d) and they are critical in achieving improvement and innovation. Current thinking is likely to maintain current performance. After all, if people ponder on similar thoughts daily, they are likely going to implement similar things and still obtain similar outcomes and, if people invest time in only thinking and take no action, they are likely to achieve nothing (Timms and Clark, 2014). Timms and Clark (2008b) reiterated that 'business as usual' approaches are less likely to produce rapid to sustainable project improvements and innovations. CI & I process is the key methodology and analytic tool in this study (Clark *et al.*, 2008b). It can also clearly depict achievements and failures and opportunities to improve the situation (Parnell, 2008). Timms and Clark (2008b) emphasized that this model transforms people from been passive information dependent into active and empowered citizens who strives for development.

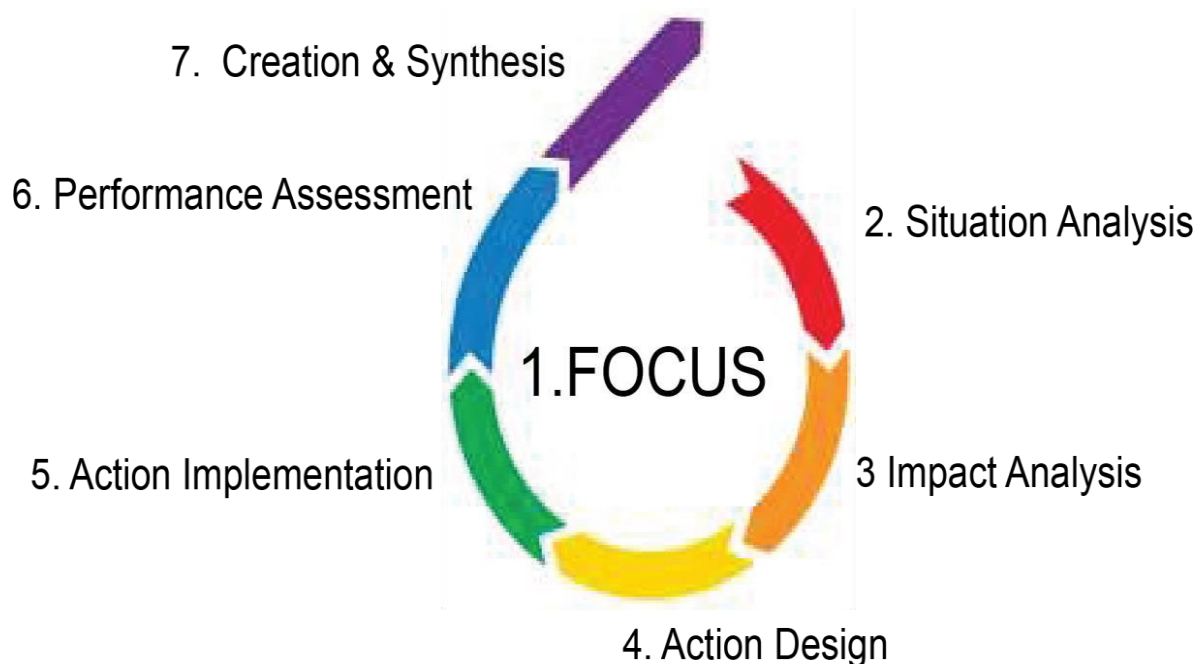


Figure 4.3. The seven key steps of CI & I designed to achieve improvement and innovation (Culled from Clark et al., 2008d)

Outcomes of each of the Continuous Improvement and Innovation (CI & I) step are displayed in Table 4.3. The development of a focus assist in having a clear SMARTT goal; situation analysis assist in creating a number of ideas and opportunities to achieve the goal; impact analysis assist in having a clear priorities for achieving the goal; action design result in a clear action that can be measured and managed; action implementation create regular and frequent thinking during implementation; performance assessment assist in clearly identifying successful action towards achieving the goal; creation and synthesis created a number of observations, questions and ideas and new opportunities; re-focus develops new SMARTT goal that feeds into the new cycle see more details in (Appendices 2.1 - 1.9).

Table 4.3: Target outcomes of each step of CI & I process (Clark *et al.*, 2001; Clark and Timms, 2014)

Step	Target outcome
1. Focus	A clear SMARTT outcome-based goals
2. Situation Analysis	A range of ideas and opportunities to achieve the goal
3. Impact Analysis	Clear priorities for how to achieve the goal
4. Action Design	A clear design for action that includes how the action will be measured and managed
5. Action Implementation	Regular and frequent thinking, feeling and action, achievement of the goal and effectiveness and efficiency
6. Performance Assessment	An assessment of the success of action, achievements of the goal and effectiveness and efficiency
7. Creation & Synthesis	Observations, questions, ideas and opportunities for further improvement or new goals
8. Re-Focus	New SMARTT outcome-based goals or continued focus on the current goal

Table 4.4, displays consequences of not completing any of the CI & I step. If step 1 - focus is missed by partners, there would be no specific goal. When step 2 - situation analysis is missed, there will be no ideas about how to achieve the goal. When step 3 - impact analysis is missed, partners will not know what makes a real difference. If action implementation is missed, then nothing happens and so forth.

Table 4.4: Symptoms experienced when steps are missed in the CI & I process

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	CI & I
Missing	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	No specific goal
STEP 1	Missing	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	No ideas about how to achieve the goal
STEP 1	STEP 2	Missing	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	Don't know what will make a real difference
STEP 1	STEP 2	STEP 3	Missing	STEP 5	STEP 6	STEP 7	STEP 8	No confident about what to do
STEP 1	STEP 2	STEP 3	STEP 4	Missing	STEP 6	STEP 7	STEP 8	Nothing happens
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	Missing	STEP 7	STEP 8	Don't know what, results were achieved, or how and why you got them
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	Missing	STEP 8	No clarity about what to focus on next

CI & I recognize that partakers undergo unique situations and require unique interventions to improve and innovate on target (Clark *et al.*, 2008d). Partners were empowered to apply CI & I tools and enhance decision making; to ensure success CI & I was applied in communities where people innovated and improved as individuals or collectively.

Timing in CI & I is significant to warrant that reasoning and performance are amended according to the changing aspects of personal, organizations and life. Feedback and monitoring sessions were timeous, results were attained with the highest level of enthusiasm and success was identified and celebrated. Change was expected to happen daily, rather than in linear fashion with prolonged outcomes.

In each Continuous Improvement and innovation (CI & I) step mechanisms and tools were selected and offered to practitioners to achieve targets. The tools presented in this study are depicted in Table 4.5. The tools are designed to achieve outcomes of each step until the overall target is achieved. For example, practitioners had to create a focus with mechanisms for this step, different mechanisms for different steps. Full descriptions of the tools purposefully selected and introduce in the study are found in and the methods followed during implementation (Appendix 2.1 - 2.9). CI & I tools assist in developing shared mental models to reach targets and improve collaboration in order to achieve rewarding results (Timms and Clark, 2008b).

Table 4.5: Tool for each part of the CI & I process

CI & I process	Thinking and action tools
Focus	SMARTT Focus
Situation Analysis	Brainstorming, profit driver tree
Impact Analysis	Eight dimension tool, Impact and influence, Eight dimension pinwheelversion
Action Design	Action Design, Action design with a calendar
Action implementation	Observation Questions Idea opportunities (OQIO) for supporting action and monitoring; Action monitoring and support
Performance Assessment	Key performance indicators (KPIs), Action implementation reporting frameworks, Achievement stacker, collaborative OQIO, personal performance checks, Stop doing, Result assessment tool
Creation and Synthesis	OQIO, Concept fan, Random entry Six thinking hats

According to, Gray (2013), and Timms and Clark (2014). CI & I is designed to achieve the following:

- 1) additional successes, improvements and innovations;
- 2) rapid successes, improvements and innovations;
- 3) evidence of success, improvements and innovations;
- 4) assurance regarding the manner in which outcomes were achieved;
- 5) knowledge and enthusiasm to keep attaining improvements and innovations both now and tomorrow;
- 6) contentment and delight from obtaining fulfilling outcomes from the system.

The study developed business owner's point of view regarding improvements and innovations in aquaculture. They moved through three cycle of CI & I to reach goals. According to Clark *et al.* (2001), the recommended number of CI & I cycles to enable people to experience the fulfillment of achieving tangible outcomes is three cycles for both individuals and groups. At each step mechanisms or tools were assessed for their ability to enhance thinking and action which is the base of improvements and innovations. The mechanism assessment tools were used as measurement instrument with seven criterias: liked; ease of use, thinking enhanced; time; cost of not doing; value and motivation. The CI & I process was used to build on the fundamentals of this research (Gray *et al.*, 2015). Parnell

et al. (2008b) supported the notion that there is no better capacity building than for people to apply CI & I in their own performances.

CHAPTER 5: Materials and Methods

5.1 Introduction

CI & I process data was gathered following the procedures of Timms and Clark 2014; Gay 2013; and Clark et al 2012b.

5.1.1. Project Location

The participants were based in five Provinces of South Africa namely Limpopo, Mpumalanga, North West, Free State and Eastern Cape (see Figure 5.1). Limpopo Province consisted of 18 projects whereby one project was located at South and another at South East of the province; and 16 were located at the North. In Mpumalanga six projects were involved in the study, located between North and East of the Province. In North West, only two projects were involved, one based in the North and the other in the East of the Province. In Free State, six projects were involved, one project was based in North West of the Province while five were based South West of the Province. In the Eastern Cape, there was only one project involved based in the West of the Province.

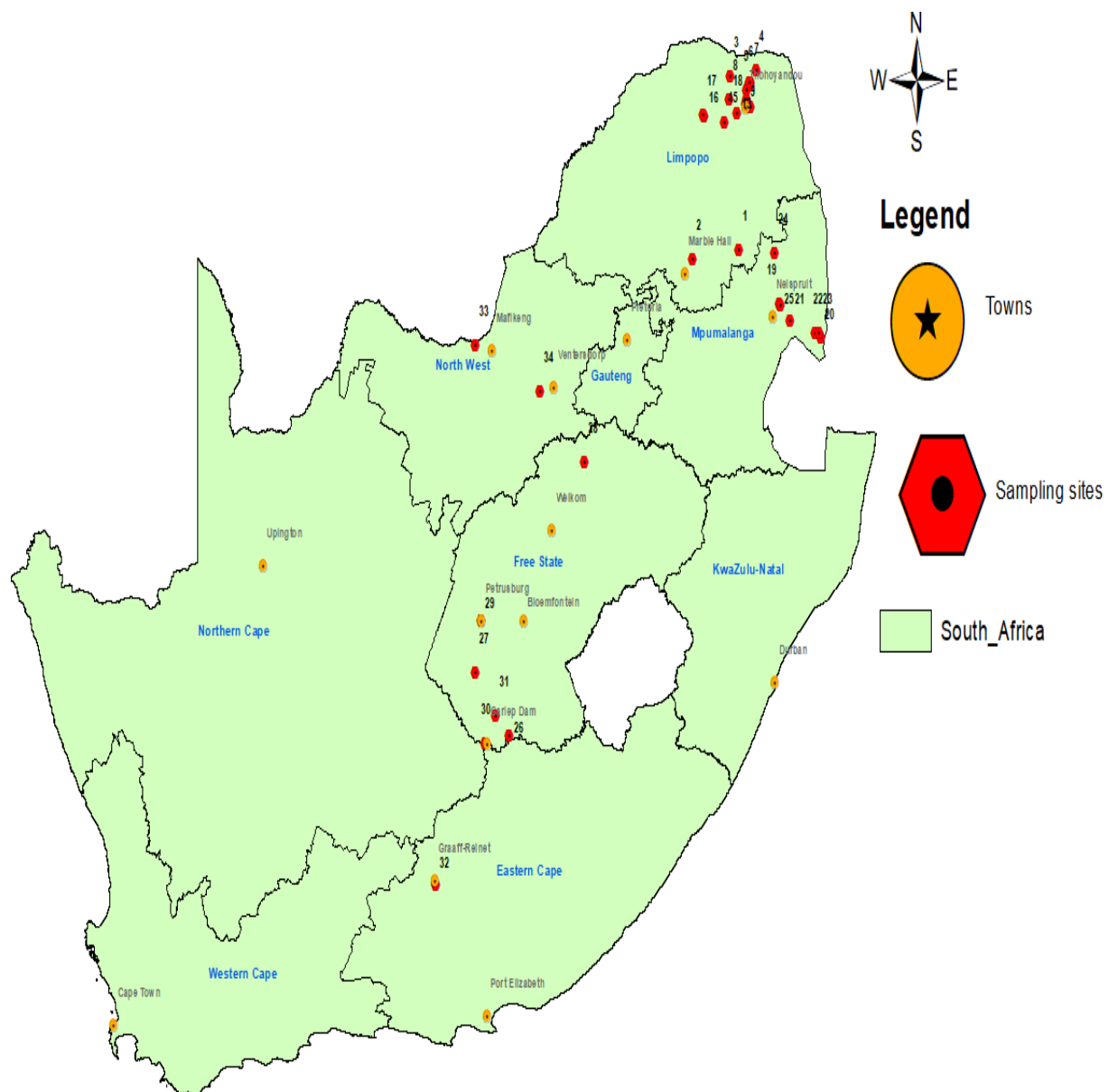


Figure 5.1. Projects or business (the red dots) geographical location according to South African Provinces involved in the study

5.1.2. Data Collection

As described earlier in this chapter, research paradigms in this study consisted of critical theory and pragmatism, methodology was action research and CI & I and core methods were case study and adaptive theory. At the moment this section describes methods of how data collected, period of data gathered and how data was evaluated.

In this study action research and CI & I steps were employed to gather qualitative and quantitative data during three cycles. The emerging data empowered the researcher to acquire a broad comprehension of the research domain and to modify consequent information gathering segments (Dick, 2000 in Gray, 2013). Partner's thoughts and perspectives were sources of data and decided their business design and what to measure.

5.1.3. Sampling Technique

Database of registered freshwater aquaculture projects was obtained from the then Department of Agriculture, Forestry and fisheries (DAFF) currently known as Department of Environment, Forestry and Fisheries (DEFF). The database consisted of 10 registered catfish projects, where only two were actively farming and the rest closed down. The sample of two projects was insufficient and was increased thorough requesting farmer database from provincial department of Agriculture. This kind of a challenge of using existing database was cautioned in the work of Edwards *et al* (2007) as being incomplete, inaccurate and outdated. The requests letter were forwarded to Head of Department (HoD) in Provincial Agriculture to gain access and only 5 out of 9 Provinces responded namely; Eastern Cape, Free State, Limpopo, Mpumalanga and North West. The support services compiled a list of farmers with catfish in their projects. A baseline session was organized where participants recruited volunteered to be part of the study. The sampling was in two-fold;

- 1) snowball sampling- is when people out of choice select to partake in the investigation instead of being designated and it is often applied when it is challenging to find participants from that preferred community;
- 2) self-selection sampling- where people identify their desire to take part in a research after the need for cases was publicized and data is collected from those who responded.

Combination of different sampling techniques is allowed but depends on the ability to gain access in organizations (Saunders *et al.*, 2016, 2019). The “decision to do CI & I or not questionnaire was self-administered in the baseline session (Appendix 1), in order to determine number of projects interested in the study. This resulted in a sample of 30 projects mostly cooperatives and few individually owned.

Data collection started in October 2017 for twelve months. The study adhered to the CI & I monthly imperative as: reasoning and performance requires to be evaluated, renewed and focused regularly (every 30, 90, 180 and 360 days). Therefore, CI & I sessions were conducted monthly to assess outcome achievement of improvement and innovation (Clark *et al.*, 2008c). The process encouraged people to apply CI & I at least on a monthly basis and the schedule of meetings for this project is displayed in Figure 5.2.

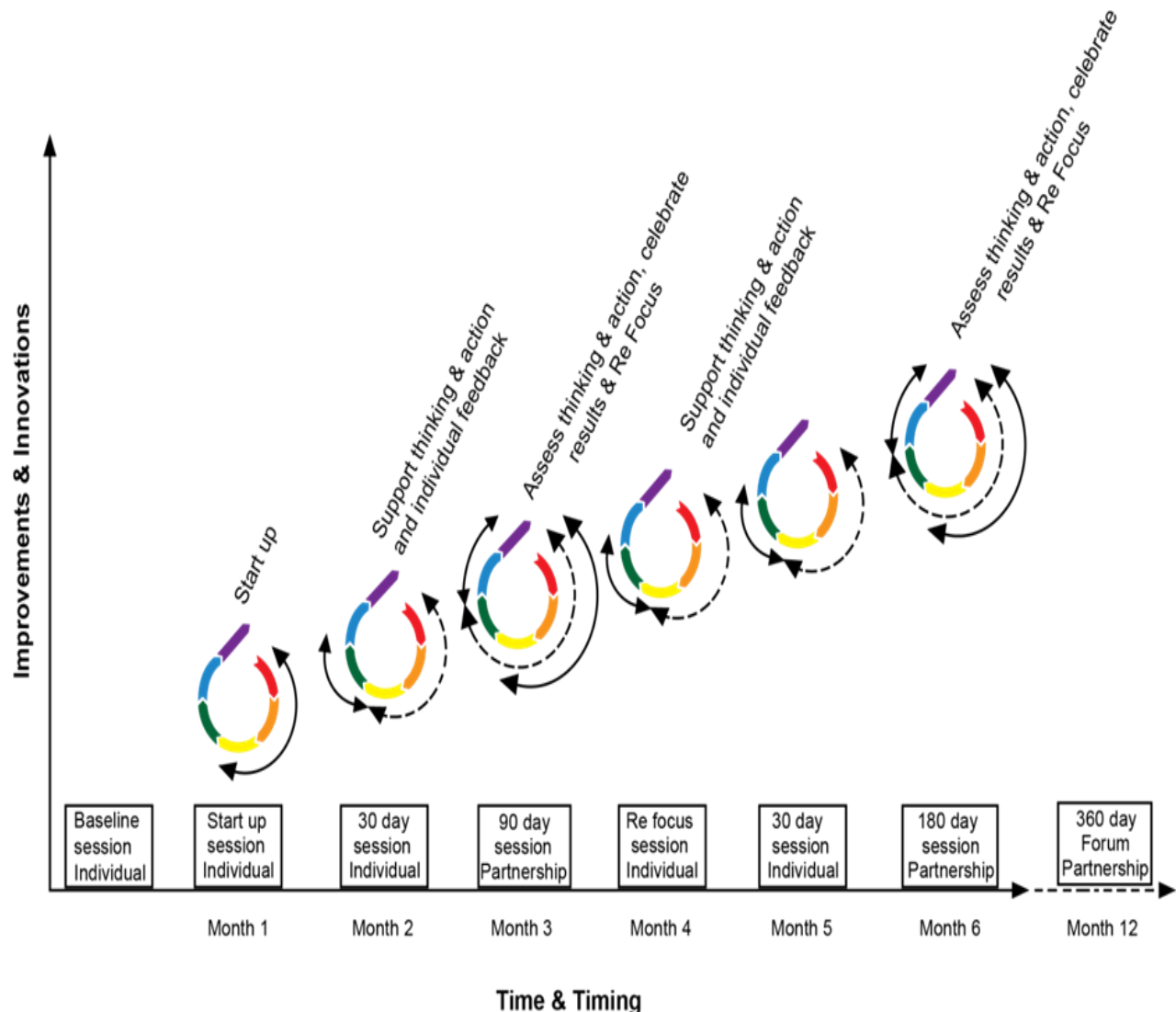


Figure 5.2. Schedule of Continuous Improvement and Innovation (CI & I) sessions adapted and modified from Gray (2013)

Different research methods were used to capture the much needed rich data. Triangulation principle was employed to reach higher validity and reliability. Triangulation was displayed in data collection from different sources, in different ways and time period (Yin, 2016; Denzin and Lincoln, 2018). Source of data were documentation, questionnaire, semi-structured interviews and focus groups.

5.1.4. Documentation

Documents such as CI & I tools worksheets, assessment tools, projects reports, verbatim transcripts and personal journal were sources of data. At the end of each CI & I step, participants were asked to assess if the tools improved their thinking and action through criteria scores.

5.1.5. Questionnaire

A baseline questionnaire was also designed and participants were requested to complete on the onset of the study. The questionnaire was structured with open-ended questions (Appendix 1).

5.1.6. Semi-Structured Interviews

Every interview requires face to face contact between the researcher and the participants (Yin, 2016). Yin (2014) emphasized that interviews are very prominent base of case study evidence. Two levels of operations are required when conducting case study interview; 1) researcher must satisfy the need of his or her type of investigation; 2) while concurrently placing out welcoming and unobjectionable enquiries in the open ended interviews. The researcher conducted prolonged case study interviews for over two hours in multiple sittings for an extended period or six hours in a day. Interviewees were treated as “key-informants” as they provided more insights, explanations and meanings related to the research. However, the researcher was not overly dependent on the key informants as other sources of evidence were corroborated into the study. The interviews were open ended and assumed in an informal fashion (Yin, 2014). The researcher also probed to gather different types of data until saturation is reached (Madzivhandila *et al.*, 2008), and this gave the participants an opportunity to expand on their original comment (Yin, 2014).

Fieldwork occurs in real-life setting involving individuals in their actual world characters and the researcher entered people space, time and social relationships. Amongst the key attributes of an investigation is that it takes place in different locations. Fieldwork research promotes going with the flow, the research was adaptive and flexible. Face-to-face dialogue allows the investigator to search for clarity when required (Yin, 2014). Structured interviews, the researcher used official survey that had questions to pose; took the position of an investigator to draw answers from the participant; researcher adopted the same consistent behavior when interviewing different participant. Qualitative interviews or unstructured interviews, questionnaire contains no specific record of enquiries to be verbalized to an interviewee. The association amongst the interviewer and interviewee is not precisely detailed on paper. Qualitative interview adhered to a “conversational mode and the interview itself will lead to social relationship” unique to every participant. It happened between a researcher and a group of participants and they may differ in directness of their words, being frank at some point but timid at others. The questions were open ended (Yin, 2016), opens

the floor with a general open main enquiry and depends on the abilities of probing, questioning and summarizing to control the target with respect to the discussion (Gray, 2013). One of key fundamentals of qualitative interview is to describe a complex social world from the perspective of participants (Yin, 2016).

Semi-structured interviews were applied in the course of the action research CI & I phases and were conducted in the real life environment of partakers to gain a better appreciation of their surroundings. These sessions were audio-recorded. Interviews involved one person and a group of people (two to three people) and also moderate size (seven to ten people). In this setting, the researcher directed attention to one person while showing respect to others and avoid making them feel less important to the research (Yin, 2014).

5.1.7. Focus Group Discussion

Focus group collects rich and detailed data from people in communities who normally do not have a voice in matters that affect them (Carey and Asbury, 2016). Focus group is the primary kind of a moderate sized team. The individuals are “focused” to gather people with similar knowledge. The researcher presumes the role of a moderator. Moderators encourages all members of the group their opinions within minimum direction. Focus groups are desired when the investigator suspect that people may willingly share information when in groups than when they are in individually. When a participant is silent in group interview, the researcher can organize a one-on-one interview after the session. Sometimes one to two people may dominate the focus group discussion. The researcher still needed to have a polite yet firm style that controls the over talkative people. A moment of silence may arise where the whole team is quiet, the researcher must find words to restart the group discussions (Yin, 2014). Not being afraid of the silence is critical because there could be questions that the participants need ample interval to reflect upon (Veal, 2005 in Gray, 2013). One member of the group may ask the researcher a question and then the researcher should be in a position to decide whether the question assist or hinder the research objectives (Yin, 2014). Focus group discussion continued until data saturation was reached, where new information ceases to come through. Saunders *et al.*, (2016; 2019) recommends that the audio- recorder be left running after the session while discussing the session and this may lead to critical information that might not be remembered clearly later (Carey and Asbury, 2016). In this study Individuals regularly met to achieve outcomes that none of them can achieve on their own (Timms and Clark, 2008c).

5.1.8. Data Analysis

Data was analyzed with CI & I approach and ATLAS.ti.8. CI & I process can be used to make improvements and innovation in participants businesses, project design and implementation, and also analyzed and reported this study step by step (Griffith *et al.*, 2008; Parnell *et al.*, 2008b). The tools in CI & I are able to arrange, breakdown a problem and process data into small pieces that are manageable. The CI & I process and tool-kit assisted participants to assess, investigate, accomplish and give feedback on improvement and innovation; it also promotes the adoptions of activities and approaches that possess the highest benefits (Timms and Clark, 2008c; Hyland and Clark, 2008). Rapid stepwise analytical potential from C & I process generates outcomes quickly with evidence regarding the efficiency of the project (Clark *et al.*, 2008b).

Performance assessment is most critical component of continuous improvement and innovation (CI & I) process. Performance assessments refer to analyzing, interpreting and assessing results attained or not relative to the main goal. This is made possible when key performance indicators (KPIs) are created at the action step established and checked throughout action implementation step. Performance assessment indicates which actions should be prioritized and enables tracking of chances in performance. Measurement of KPIs should be timeous to in order to tell if actions are having impact on the target outcomes and the results to the project wide evaluations. The key is that KPIs are discussed and supported within CI & I groups (Alford *et al.*, 2008a). CI & I enables participants to reveal attainments and receive comments that contribute to more achievement of improvements and innovations. This prevents results to only be reviewed at the end of the financial year to determine if they are having impact and loose time (Alford *et al.*, 2008b). Partners can measure where they are now and monitor changes in their businesses (Parnell *et al.*, 2008b). The study was opened to adaptation and redesigns as it continues (Gray, 2013).

ATLAS.ti.8 2016 was software used to analyses qualitative data. Analytical works involves assembly, reworking, complex layout and necessary tools to carefully analyses and search, assess, explore and question the information, to encapsulate, envision and distribute the outcomes. The analytical instrument can swift through different pamphlets, transcripts and digital archives, examining and linking such information with the research question. It allows the researcher to draw, classify and join data sections from a bulk of files. Established from the researcher's examination, the analytical instrument support and determine themes and test the proposition (Friese, 2016; 2019). Microsoft Excel Programme was also employed to analyses data in the study and also Statistical Programme for Social Science (SPSS) (Pall ant, 2013).

5.1.9. Ethics

The University of South Africa Ethics Committee approved this study according to the protocols from the university. Simple and plain language was used when to consent participants to the research especially concerning the use of audio recorded information. The names of the participants were anonymised by replacing them with code numbers. The numbers were used when verbatim quoting participants. The study followed the following principles:

Respect – valuing the dignity and worth of people and respect was given to views and opinions of others

Responsibility- participants took responsibility and avoided harm

Integrity – communication was based on an honest and fair manner

Voluntary nature of involvement- participants chose to part-take in the study openly and honestly willing to share information and new insights.

CHAPTER 6: Results

6.1. Introduction

The chapter reports on the results obtained from the initial introduction session of CI & I to interested participants in nine South African Provinces. The baseline session defines the primary discussion held with interested participants responding to the 'Decision to Do CI & I or Not' questionnaire shown in Appendix 4.1. The chapter reports the results of the current status (demographics, project information, funding, markets and employment) and decision of catfish farmers in doing CI & I. The chapter further reports on the results obtained from the action research/CI & I cycle conducted with catfish farmers over a period of 12 months. The results from the focus CI & I step where Specific, Measurable, Achievable, Targeted and Timeframe (SMARTT) goal tool was applied are reported according to the five South African provinces. This was followed by the results from situation analysis CI & I step to determine the current status and develop ideas and opportunities with the brainstorming and profit driver tools. This was followed by results from the impact analysis CI & I step to determine opportunities that will make a real difference to the situation with impact & influence, eight dimension criteria and eight dimension pinwheel version tools. This was followed by results from action design CI & I step to design specific actions by determining critical success factors, key performance indicators and key actions to achieve the focuses. This was followed by outcomes from action implementation CI & I step with action monitoring and support tool. This was followed by the outcomes from performance assessment CI & I step with achievement stacker, result assessment and observation, questions ideas and opportunities tools. This was followed by results from creation & synthesis CI & I step with six thinking hats to generate new ideas. This chapter also reports on the mechanisms applied in each CI & I step. The chapter concludes with the results from assessment of quality of experience from the application of CI & I according to participants.

6.2. Descriptive Statistics

6.2.1. Interested Businesses According to Provinces

The highest number of interested people was found in Limpopo Province (43%); 23% in both Mpumalanga and Free State; 7% North West and 3% Eastern Cape (Figure 6.1). Total number of projects interested in the study was 30.

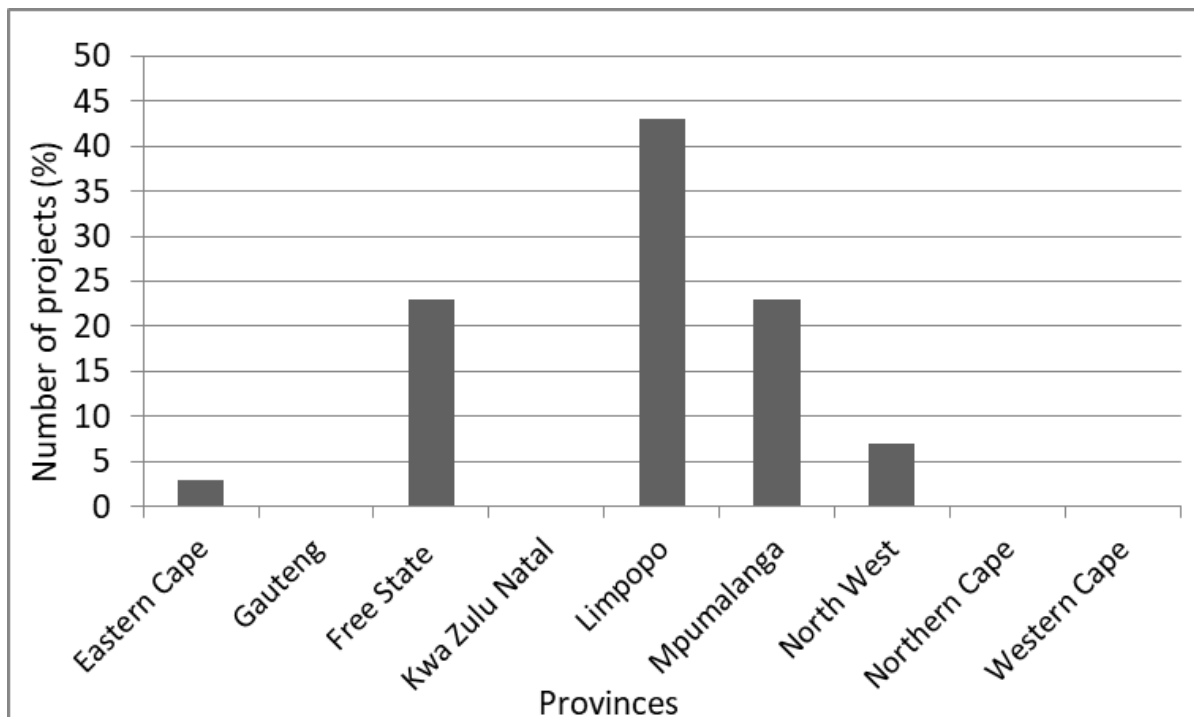


Figure 6.1. Number of interested businesses according to provinces in the study

6.2.2. Demographics of Interested People

There were 73 farmers involved in continuous improvement and innovation from the year 2018-2019. The demographics are given in Table 1. Males (58%) were higher than females (43%). Highest age-groups was 31-40 (32%) and 41-40 (22%) respectively. Majority of catfish respondents had secondary (30%) and matric (27%) as the highest education level respectively (Table 6.1).

Table 6.1: Demographics of interested individuals in the study (n=73)

		Percentage (%)
Gender	Males	58
	Females	43
Age-group	16-21	0
	22-30	8
	31-40	32
	41-50	22
	51-60	18
	Older	15
Education level	Primary	19
	Secondary	30
	Matric	27
	Tertiary	15
	None	0

6.3. Background information of interested projects

Majority of the businesses operated between 1-5 years (43%) and 5-10 years (30%). The types of projects in this study were sole traders (40%); cooperatives (30%); closed cooperation (13%); PTY Ltd (17%) and trusts (3%) respectively. The projects in this study were in operation between 1-5 years (40%) and 5-10 years (30%). Source of water used by the majority of the businesses were borehole (37%) and stream/river/dam (37%). Interested people farmed fish in earthen ponds in their majority (40%) and recirculating systems (37%) respectively (Table 6.2).

Table 6.2: Project information of farmers involved in the study (n=30)

		Percentage %
Project type	Cooperative	30
	Closed cooperation	13
	Sole trader	40
	PTY Ltd	7
	Trust	3
Years of operation (y)	<1	13
	1-5	43
	5-10	30
	11-15	0
	16-22	13
	21-25	0
	25	0
Source of water	Municipal/tap	13
	Borehole	37
	Spring	13
	Stream/river/dam	37
Production systems	Earthen ponds	40
	Recirculating systems	37
	Concrete ponds	13
	Raceways	0
	Cages	0
	Others	10

6.3.1. Type of Species

Majority of the projects were involved in polyculture between catfish/tilapia (30%); (23%) catfish only and (13%) catfish/carp/Tilapia (Figure 6.2).

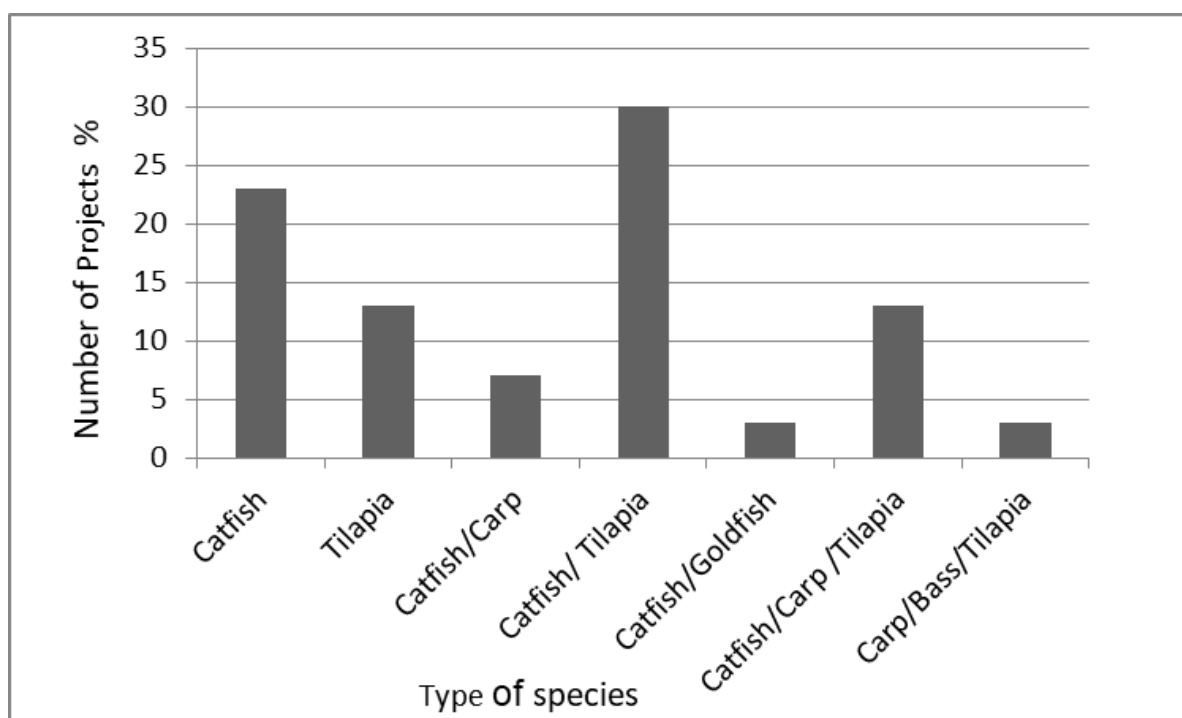


Figure 6.2. Reasons for Doing Polyculture in Eastern Cape; Free State, Limpopo, Mpumalanga and North West Provinces, South Africa

Interested people were requested to give reasons for farming with more one species and majority left the space blank (57%); 10% indicated customer preference caused them to conduct mixed farming, while 7% indicated to generate income and they were also given by government (Table 6.3).

Table 6.3: Reasons given by interested projects for embarking on a polyculture (n=30)

Reasons for Polyculture	Percentage %
Catfish found in ponds and tilapia stocked by government	7
To make money	7
Customer preference	10
Negative perception	3
Catfish is separated from carp	3
Lack of water made us to farm with twospecies	3
No reasons given	57

6.3.2. Scale of Operation of Interested Projects

The scale of operation in the projects interested in the study was at community project/cooperative (64%), followed by 33% of small-scale commercial/smallholding (<R5m per annum turnover). 3% of the projects were at commercial/ industrial production (>R5m

per annum turnover) (Figure 6.3).

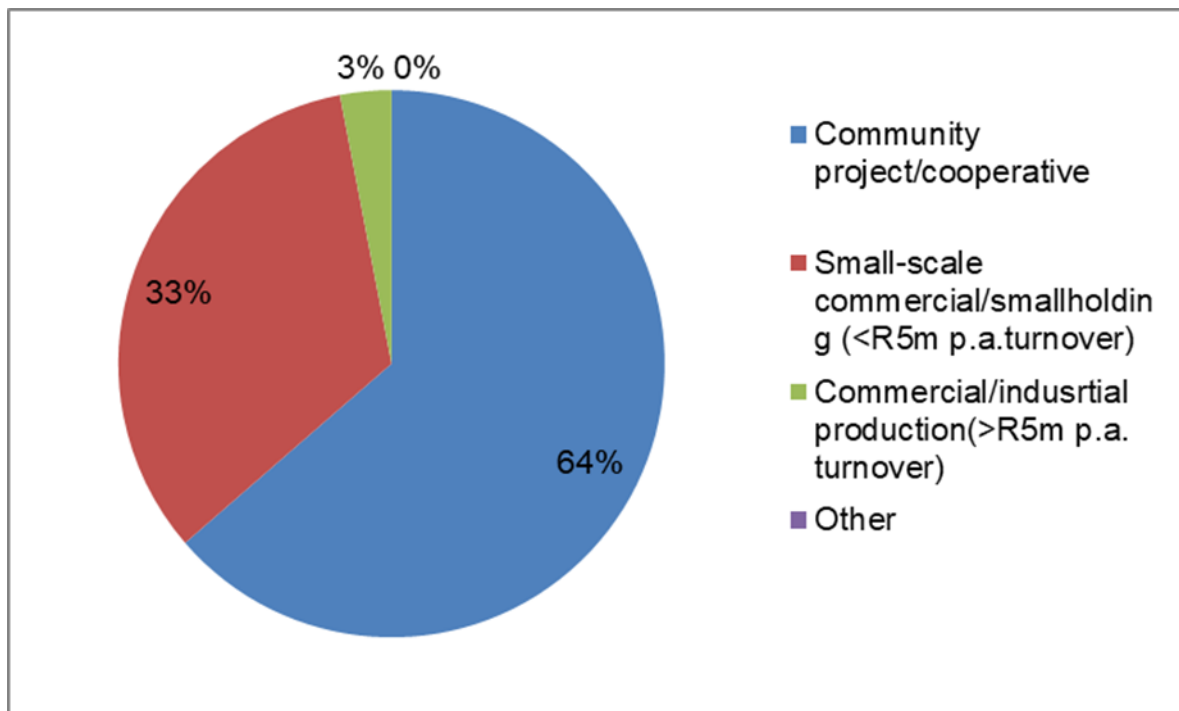


Figure 6.3. Scale of operation of interested people in the research in Eastern Cape; Free State, Limpopo, Mpumalanga and North West Provinces

6.3.4. Source of Financing

Source of financing of interested projects was private funding (53%), followed by government assistance (37%) and a few (10%) were obtaining finances from domestic investments and loans. The results further showed that majority of the projects were involved in growing the fish from fry to market size (87%). Grading was operated by 13% and spawning, fry rearing/weaning, processing, packaging, distribution were reported by 10%. Market utilized was direct to consumers (93%); 10% supermarkets and 7% wholesales and restaurants/hotels (Table 6.4). The t value for market channel used was 6.861 and p was less than 0.001, which means statistically significant at 1% level of significance.

Table 6.4: Source of financing, processing and market channels utilized by participants (n=30)

		Percentage (%)
Source of financing	Domestic investments and loans	10
	Foreign investments	0
	Foreign aid	0
	Government assistance	37
	Private capital	53
Process in operations	Spawning	10
	Fry rearing/weaning	10
	Grading	13
	Grow out	87
	Processing	10
	Packaging	10
	Distribution	10
	Others	3
Market channels used	Direct to consumers	93
	Supermarkets	10
	Wholesalers	7
	Restaurants/hotels	7

6.3.5. Capacity Utilization of Projects

Interested projects in the study were operating at 10% capacity and only a two were at 40% and one at 60% and 100% capacity.

6.3.6.. Form of product sold, price determination and type of marketing activities

Interested projects indicated that after harvest they sold their fish live whole freshly killed (87%), while 16% indicated they apply some form of processing and value adding and 10% did not apply any form of processing. The t value for type of products sold market was 9.950 and p was less than 0.001, which means statistically significant at 1% level of significance. Price was determined via producer sets price (67%) and bargain and negotiating with buyer (23%) respectively. Majority of the projects did not take any specific marketing activities (61%). Government did not play any role in linking projects to markets (70%, 12% agreed and 3% was sometimes see Table 6.5). The t value for marketing activities and government links were 13.260 and 15.456 respectively and p was less than 0.001, which means statistical significant at 1% level of significance.

Table 6.5: Form of product sold, price determination and type of marketing activities (n=30)

		Percentage %
Form of product sold	Live/ whole freshly killed	87
	Some form of processing	16
	and value adding	
	None	10
Price determination of product	Bargain & negotiate with a buyer	23
	Producer set price	67
	Other	13
	None	17
Any specific marketing activities to increase sales	Yes	33
	No	61
	Sometimes	13
Government links to market	Yes	27
	Yes	0
	No	70
	Sometimes	3

6.3.7. Description of Marketing Activities

Marketing activities were via door to door, street vending and commercial market with a frequency of 2. 1% of marketing was via value adding public gathering, local marketing and PR, new product development and distribution of pamphlets (see Figure 6.4).

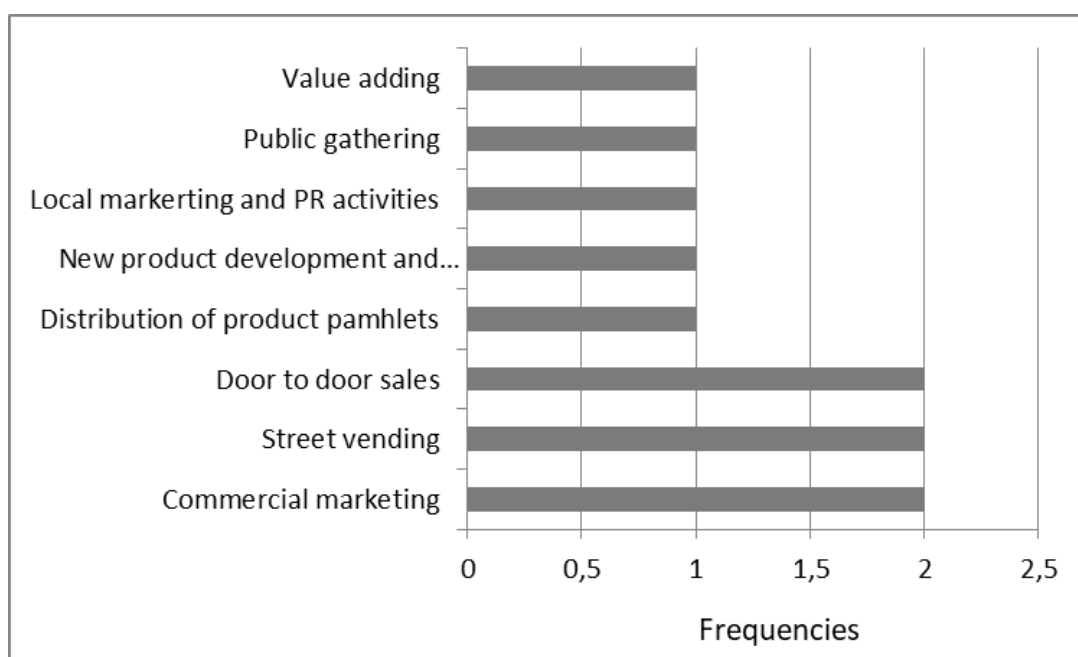


Figure 6.4. Type of marketing activities of interested people in Eastern Cape; Free State, Limpopo, Mpumalanga and North West Provinces

6.3.8. Types of Market Links by Government

Interested projects indicated that government does not play any role in linking them to markets (70%), and only 27% responded with a yes. Majority of projects indicated that government only provided them with fish pellets with a frequency of 4; others indicated government built fish processing plant for them with a frequency of 2. Other markets with a frequency of 1 were national school feeding programme, and training and workshops (see Figure 6.5).

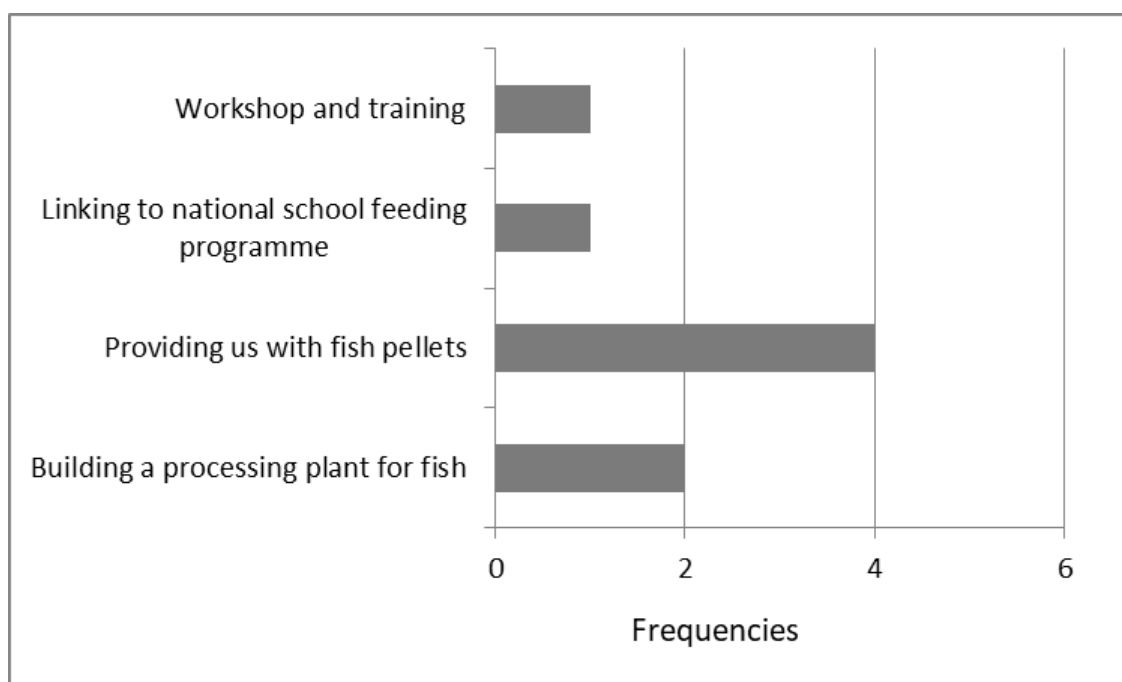


Figure 6.5. Type of activities of government took to link projects to markets

6.3.9. Trends of Permanent Employment at Eastern Cape, Free State, Limpopo, North West Provinces

High permanent employment was in the year 2016 with 13 black semi-skilled people, 5 black unskilled and 2 Black middle service and 4 middle service colored. The year 2014 had 4 Black semi-skilled and 7 unskilled and 1 Indian unskilled. The year 2013 had 12 total employments with 4 semi-skilled and 7 unskilled Black people and 1 white person. In 2015 total number of employment were 10 with 4 semi-skilled and 5 unskilled and 1 Indian unskilled (see Table 6.6).

Table 6.6: Permanent employment trend levels of interested projects in the study

Employment category	2016				2015				2014				2013			
	B	C	I	W	B	C	I	W	B	C	I	W	B	C	I	W
Professional				3												
Skilled																
Middle service	4	4														
Semi-skilled	1	9			4				4				4			
Unskilled	5			1	5		1		7			1	7			1
Total	37				10				12				12			

6.3.10. Trends of Temporary Employment at Eastern Cape, Free State, Limpopo, North West Provinces

High temporary employment was in the year 2015 with 20 black semi-skilled people, 25 black unskilled. Followed by year 2016 with 9 black semi-skilled people, 31 black unskilled and 1 Indian semi-skilled. The year 2013 had 20 black semi-skilled and 12. The year 2014 had 20 semi-skilled and 9 unskilled black (see Table 6.7)

Table 6.7: Temporary employment trend levels of interested projects in the study

Employment category	2016				2015				2014				2013			
	B	C	I	W	B	C	I	W	B	C	I	W	B	C	I	W
Professional Skilled																
Middle service																
Semi-skilled	9		1		20				20				20			
Unskilled	31				25				9				12			
Total	41				45				29				32			

6.4. Baseline Session Questions

6.4.1. Decision to do Continuous Improvement and Innovation (CI &I) or not

Interested people responded yes (100%) to the question of wanting to continually improve and innovate their project performance; working in a high performance team and meeting every 30, 60, 90, 180 and 360 to take action and report.

Participants were asked if they had an interest in collaborating in a project that improves and innovates in their business and their interest in this project was very high (100%). The participants were happy with the given definitions of improvement and innovation.

When participants were asked how they achieved improvement and innovation, they indicated "farming with vegetables, pigs or poultry and selling". Others indicated processing of fish products and being involved in inland fisheries, '*Apply value adding to fish and sell, we also do fisheries from the dam (Disaneng DS01)*'. Other participants with commercial background achieved improvement and innovation via, '*Plan, do and review cycle (Karoo Catch KC41)*', and '*Assess outcomes constantly and adapt if required (KC42)*'. Studying entrepreneurship and constant engagements with experts were also reported as a manner of attaining innovation.

Majority of the projects achieved number of improvements yearly 30%; weekly 20%; monthly 20% and none 13% respectively and others indicated that it was achieved on a continuous basis; '*This is a continuous focus for us (KC41)*'. The time dedicated to improvement and innovation was daily (37%); weekly (23%), monthly yearly and none were 17%. All projects responded yes to what the project had to offer.

Participants responded no to being offered a mechanism for achieving improvement and innovation before in their lives before, however, there were two who responded yes, one

indicated it was already being applied “in-house” and the other was offered this mechanism at an “entrepreneur workshop environment”.

All participants responded yes to being okay with the role of a researcher being a coach and a referee in the study. Participants were given an opportunity to play a CI & I game and found fun in learning the sequence of its steps. All participants responded yes to CI & I being logical and one appreciated the sequenced steps and emphasize its essence to the new members, *‘I like it like that, it will help the ladies in the cooperative a lot because they are young and new (One Vision OV60)’*.

All participants found value in having a clear process. The value was acquiring business management skills including; *‘How to run business, advantage and disadvantages of how to deal with them (50)’*. Others indicated the process will assist them to manage correctly and generate income, *‘it will help us move towards farming in a professional and profitable manner (05)’*, and *‘great benefit in all areas of business (Karoo Catch KC41)’*. Others indicated being able to diagnose problem and provide resolutions; *‘It lets you identify problems and solutions (KC42)’*, and, *‘a practical problem solving technique (Jubelly JB49)’*. Clear process improves business output while it provides guidance to identify problems and make profit; *‘Improve production, clear direction; save time, discuss problems, help to develop the growth of fish and be profitable (Disaneng DS03)’*.

The opportunity of being involved in this specific study was seen as improvement of skills, production and sales, built focus to run sustainable businesses and improve livelihoods. It was also indicated that the study would give a better roadmap to fit business opportunities; *‘It will give me a better view of where to fit into South African (SA) aquaculture (Karoo Catch KC42)’*.

The opportunity of being involved in the study was given a score of 9 or above by 99% of interested people as shown in Figure 6.6. Therefore, they scored the opportunity of being part of this study very high. They mentioned the process has a lot to teach and guide, *‘the method has lot of things to learn from your project, gain more experience, and reach our goal that we have set (Lephoi LP51)’*, and it’s a new method, *‘it is still new to us (Gotswametsing project GMP63)’*.

All projects responded with a yes to be involved in a study and showed a lot of hope; *‘because we have been in the dark for seven years and now there is light (Mudau MA39)’*.

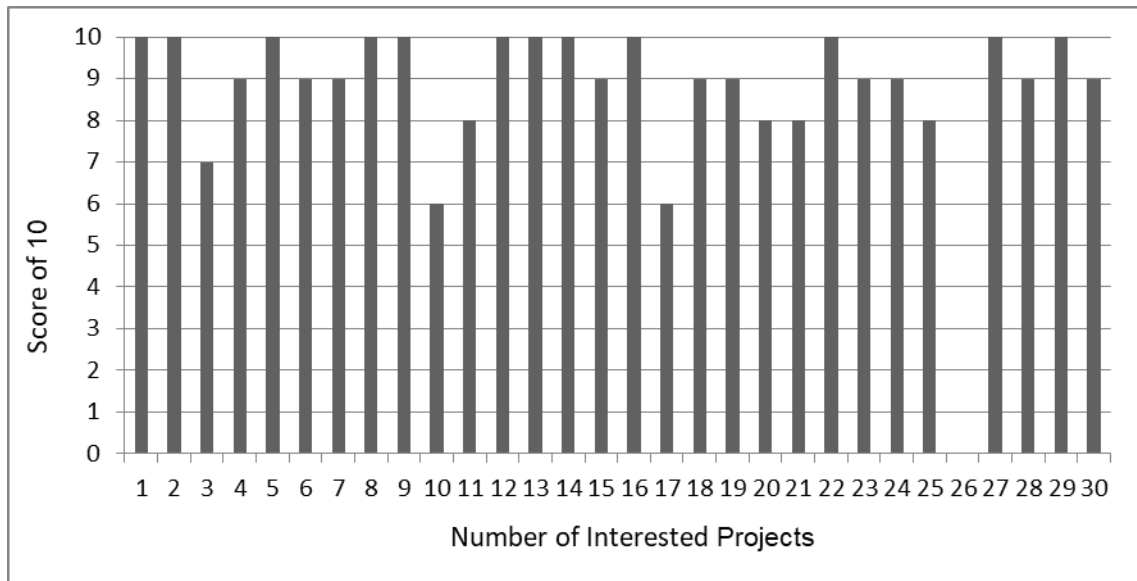


Figure 6.6. Scores of the opportunity to be involved in the study

6.5. Research Partners for CI &I Cycle 1

The research views participants as partners and partnership is defined as “interdependent, business like relationship between people for a specific purpose involving clear rights, roles and responsibilities (Gray 2013).” Partners were given codes to indemnify their identity. Partners involved in the study did aquaculture as an additional income generating business and only three were solely farming with catfish only. Majority of the businesses were involved in mixed species farming on a small scale and only two were commercial (see Table 6.8).

Table 6.8: Project description of interested people for CI & I cycle 1

Project	Research partner ID	Business description
1	Disaneng DS 01, 02, 03 & 04	Breeding, growing and processing catfish in a Recirculating Aquaculture system
2	Tladinga TD 05, 06, 07, 08 & 09	Farming crops & selling to Spar. Stocked catfish and tilapia in the earthen ponds
3	Masibambane MB 10, 11, 12, 13, 14, 15, 16, 17 & 18	Farming with crops and Poultry & selling to community. They stocked tilapia & catfish in earthen ponds
4	Gilmo GM 19, 20 & 21	Farming with poultry & horticulture. Farm with tilapia & carp in earthen ponds & sells to the community
5	Master Denzel MD 22	Farming catfish, carp & tilapia in earthen ponds
6	Mthaiza MT 23, 24 & 25	Commercial Sugar cane farming. Stocked catfish, tilapia & Carp in irrigation dams fitted with water canal

(Full version Appendix 3)

CHAPTER 7: Empirical Results based on the Application of CI & I model

7.1. Introduction

In this step research partners were asked to build a focus by employing Specific, Measurable, Achievable, Realistic, Targeted and Time - framed (SMARTT) goal tool.

7.2. Eastern Cape Province

7.2.1. Focus Step

Karoo Catch KC Project

The SMARTT goal tool requested partners to cite their initial/draft goal and partners indicated that they wanted 'to develop the Karoo Catch KC business from pilot phase into a commercial phase'. In specific, partners were requested to be clear about what they wanted to achieve, and they mentioned that the focus was to make a replicable and sustainable business; *'I think we need to focus on making this business, making this viable so that we can copy and paste it after that (Karoo Catch KC69)'*. For measurable, partners were requested to indicate how they would assess whether the goal had been achieved, and the response was 'positive net profit'. Achievable, partners checked if the goal was realistic even though it may be challenging, and the response was that the financial model of the business forecasted this. *'The goal is reasonable as per the financial model predictions (KC41)'*. Relevant, partners were asked if the goal was related to a need, problem or opportunity and the response was if business is not sustainable then there will no development, *'Well, if we're not viable we're going nowhere, so it's essential. Otherwise we're going to be in the recession forever (KC69)'*. Targeted, is the level of performance partners were aiming for and the response was 5%. Time - framed is when will the goal be achieved by and partners indicated 17 months. The SMARTT goal was to develop the KC farming and processing initiative from a pilot to a commercially viable and sustainable business which achieves a net profit of 5% per annum by February 2019 in our province (see Table 7.1).

Table 7.1: Outcome of draft and SMARTT goal developed by KC business partners

Research Partner	Draft Goal	SMARTT Goal
KC41, 42 & 73	To develop KC from a pilot project phase into a commercially viable and sustainable business	To develop the KC farming and processing initiative from a pilot to a commercially viable and sustainable business, which achieves a net profit of 5% per annum by February 2019 in our province

7.2.2. Situation Analysis Step

In this step, situation analysis partners were asked to think about their current situation in the business in terms of challenges and constraints regarding fish farming with brainstorming tool. The word cost has been used the most (15) times in KC business (Figure 7.1). One partner articulated that cost of product delivery to the market has to be kept low in order to keep their prices affordable and realizing profit:

'Although distribution is not our expense per say, it's got to be cost effective in order for our product to be cost effective (Karoo Catch KC69), and the distribution needs to be cost effective so that the product doesn't become too expensive (KC41).'

Cost was followed by the word product indicated 12 times and it was defined in the context of developing good relations to secure market. *'Furthermore, price at which the market takes their fish per kilogram is good. However, sometimes external factors such as increase of fuel can easily affect the delivery cost though the price of the product remains the same (KC41).'*

Product was also mentioned in terms of the business having an accredited facility to process the product. *'Market liaison to fit product into markets (KC41). And then from the market perspective we've got off-takes for every kilogram of fish we produce at the right price (KC69). What I am getting at is, if the petrol price suddenly goes through the roof, we've got a serious problem because our clients can't afford our product, even though our price hasn't changed (KC69).'*

Product was followed by the word supply which frequently appeared 10 times. The partners mentioned that for their business to succeed they have to ensure adequate supply of water for their fish that is of high standards and was tested regularly. Additionally, the manufactured pellets have to be affordable and of high quality to meet nutritional requirements of the fish.

'Sufficient quality and quantity of water supply is essential. You know the quality of the borehole water does not change over time which is why we are monitoring it so carefully, speaking of which we need to send another sample off and reliable and cost effective feed supply (KC69).'

Other words reported 2 times were management, finances and genetics; however, the partners expressed their significant value in achieving the goal. Partners mentioned that they have to have an experienced team on board, lack of finances has the potential of shutting down operations if ignored, the genetics of their species had to be constantly improved and quality system managed effectively.

'To interview qualified and experienced management team to plan effectively (KC41)

'Access to reliable finances because it could close the business down if you could miss something like that, so access to reliable finances, maintain and improve genetics of our stock, and quality management systems (KC69).'



Figure 7.1. Situation analysis for CI & I step 2 in Karoo Catch (KC) business adapted from ATLAS.ti8

7.2.3. Impact Analysis Step

In the previous step situation analysis, partners developed a number of opportunities that would improve their situation. In this step, partners used the impact and Influence tool to assess and priorities opportunities generated to determine which ones will have the most impact in relation to the goal on a scale of 1-10 (1=low; 10=high).

7.2.3.1. Impact and Influence Outcomes

Karoo Catch (KC) Project

The results of this business showed that the impact and influence of opportunities were reported as presented in Figure 7.2. The impact of the opportunity secures off-take for all products at required price (1.1) were scored 10 because partners felt that successful implementation of this opportunity is entirely dependent on them as a business. Since it had a lot to do with product acceptance to the market, and the influence score was 8.

'Secure off-take for all products, so this is to what degree does it affect our smart goal, 10 (Karoo Catch KC41), influence of 8: I mean it's up to us, if we don't do it, nobody else is going to do it (Karoo Catch KC69). It's also product acceptance, Umh...so that's why I'm not going for ten (KC69).'

Partners indicated that they have the influence and ability to implement this opportunity, *'If you look at funding as an example, it's incredibly important, but we've actually got very little control over it, so that would be an example of like a 10 and a 2, something like that. Whereas when you look at this, 8 is right because there is an element to which we can't control (Karoo Catch*

KC69)'.

Partners also indicated that their end products should be suitable for market acceptance (1.2), impact 10 and influence 8. *'So we have to, our products have to fit a market, which is what we've been trying to do, but we're doing it stop start because we do not have a dedicated person for it, uhm...but how receptive the market is also a factor so that's why I'm saying it's a 10 (KC41).'*

Establish accredited facilities to process products (1.3), partners indicated that they are limited to selling frozen products due to lack of accreditation and they will obtain approvals with newly built processing plant. *'We can only sell unfrozen stuff and that's the difficulty we sit with now, because our facility is not an RCS (Loan and Financial Service Provider) accredited or approved, so now we can only sell fresh products out there, we can freeze and sell, so now we're completely limited to what you can produce in a day or two. And that is our bottleneck now with processing. There is a big factory that we are building, uhm...we will have the approvals in place and so you can freeze and sell and then your shelf life is longer and your distribution network is wider. We can sell to somebody next door and they can freeze no problem, we're not allowed to freeze (KC41).'*

Researcher asked if partners felt their influence was low, this was articulated better in the following; *'Well I would say uhm... it's probably a 9 the impact because we can sell a little bit without the accredited. Our influence when we've designed this factory to get the approval, so it's probably a 9. The 1% is there, is always a difficult person on the other end that's uncooperative, I would say it's a 9 (KC41).'*

Develop and implement quality management systems (1.4), partners gave a score of 8 for impact and 9 influence. *'The impact is huge (KC41) yes, 9 or 10 (KC69).'* Lack of quality management system was described as mistakenly having hazardous items in the food that could close down operations and also affect export. *'If we don't have a quality management system in the factory, there will be a stapler in something and we will shut down (KC41).'* or a button from somebody's jacket will go into something and it'll be a huge risk.

'Somebody chokes and then you're screwed. So I would say not having a quality management system is not even an option, we also can't export if we don't have a quality management system in the factory (Karoo catch KC41).'

There were other secured markets that could accept products without quality management system made influence score high. *'Yes, but there are other markets we can supply even without either of those because we could sell fresh fillet for instance, you know (KC69). So maybe your impact is 8 because of that tiny little market (Karoo Catch KC41). We can influence that perhaps 9 (KC69).'*

So the impact of not having the right team was scored highest score of 10, *'our influence is probably 8. When we interview, we have practicals, we do our best to choose the right person but somebody can always mess you around during an interview (KC41). And changes happen*

as well, I mean people can regress and various things can happen beyond anyone's control (Karoo Catch KC69)'.

The impact of implementing Continuous Performance Development (CPD) for all staff (1.6) was scored 6, *'impact of not doing it, I mean they can plod along, It's probably a 6, I would say'*, and influence was 8, *'Our control over it's probably an 8 (KC41)'*.

Access reliable finances timeously (1.7) had an impact of 9 and influence of 4. *'I would say 9 because that's what we've seen thus far is the finance hasn't been there, we hopped along very expensively (KC69), others disagreed, ok impact 9 and influence 2 (KC41). I would say it's higher than 2, I mean, we got to find the right places to apply, we got to apply, etc. but at the end of the day maybe a four (KC69)'*.

Partners further elaborated their disagreement with score of 5 for influence because funders would still be begged to release funds. *'No, no... If you take applications into consideration, it probably is higher, I'm just thinking in terms of, once they sign now, you got to beg them to release the money (KC41). Yes, that's an element, but I think there's more to it, yes, so maybe hmm... 5 (KC69)'*.

Ensure sufficient water quantity and quality (1.8) had 10 impact, *'impact of no water, 10 (KC41). Yes, its 10, it is, no doubt (KC69)'*. Influence was 9 of ensuring water availability, *'control over it, I would say 9 (KC41). We can control that very largely but there will always be an element that we can't (KC69)'*. However partners reported that uncontrolled circumstances like drought could also occur. *'What if there's like a massive drought for ten years (KC41). Well that, we can't control that, but how likely is that (KC69). Yes, should we say 8 maybe (KC41)'*. Installation of water repair system would be installed to save water. *'So we busy with hmm... we are working on a waste water repair system with United States Agency for International Development (USAID) so that we can pilot it now and then hopefully it works and it gets implemented for all the system so that the only water we lose is to evaporation (KC41)'*.

Identify cost effective product distribution options, *'And product, you know if you're selling three hundred tons of products per month, that's three hundred cubes of water, almost, because most of what you're selling is actually water. Certainly most of what we're harvesting is mostly water (KC69). Do you mean in terms of the water (KC41), every catfish we take to the factory is seven hundred and something grams of water for every catfish, that's water we've lost (Karoo Catch KC69)'*.

Researcher asked partners how would water be extracted from the fish and the response was that the business has limited water supply and water re-use options were looked into. *'What I'm saying is we've got a certain amount of water out of the borehole and we need more than that to run the farm, so the waste water when we're cleaning filters and stuff off, we can't just dump that water, we need to retreat that water and so that we can use that for the fish again (KC69)'*.

The impact of identifying cost effective product distribution options (1.9) was given a score of

8, *'the impact is probably 8 and the control over it is probably also about an 8 (KC41)'*. Another partner indicated to rather score influence 7 due to petrol price hikes and unplanned strikes could affect the cost effectiveness. *'Yes, I would say so also 7, cause the thing like petrol price and so forth, strikes, there are things that will be out of our control (KC69)'*.

Ensure cost effective and reliable feed supply (1.10) scored an *'impact 10 (Karoo Catch KC41)'*. Some felt the impact was more than a score of 10, *'absolutely 10 and a half (Karoo Catch KC69)'*. Partners have contracted an animal feed manufacturing company and they have good working relations. *'We are working with Montego, the animal feed company at the moment and we have a good working relationship but if that goes pear shaped then we have a problem (KC41)'*. Furthermore, the company was also producing the catfish recipe, *'we've developed a recipe that they producing for us. We just have to work on that relationship continuously (KC41)'*.

Maintain and improve genetics of our stock (1.11) partners indicated that, *'impact I would say would probably be a 7 or so, we can porter along like we offer a long time, influence out of that is 10 though, I mean it's up to us to do it (KC41)'*.

Partners plotted the scores on impact and influence electronic spread-sheet as displayed in Figure 4.25 to select the best option. Partners indicated they selected to continue with all the opportunities to the next step as they are all essential and on-going. *'We are taking everything in that block, it's all stuff that we are working on, so I'm happy to include them all, I mean the only one that we are not actively doing there is genetics (KC41)'*. Partners were not active on the genetics due to lack of budget due to, *'it's a budgetary constraint (KC69)'*.

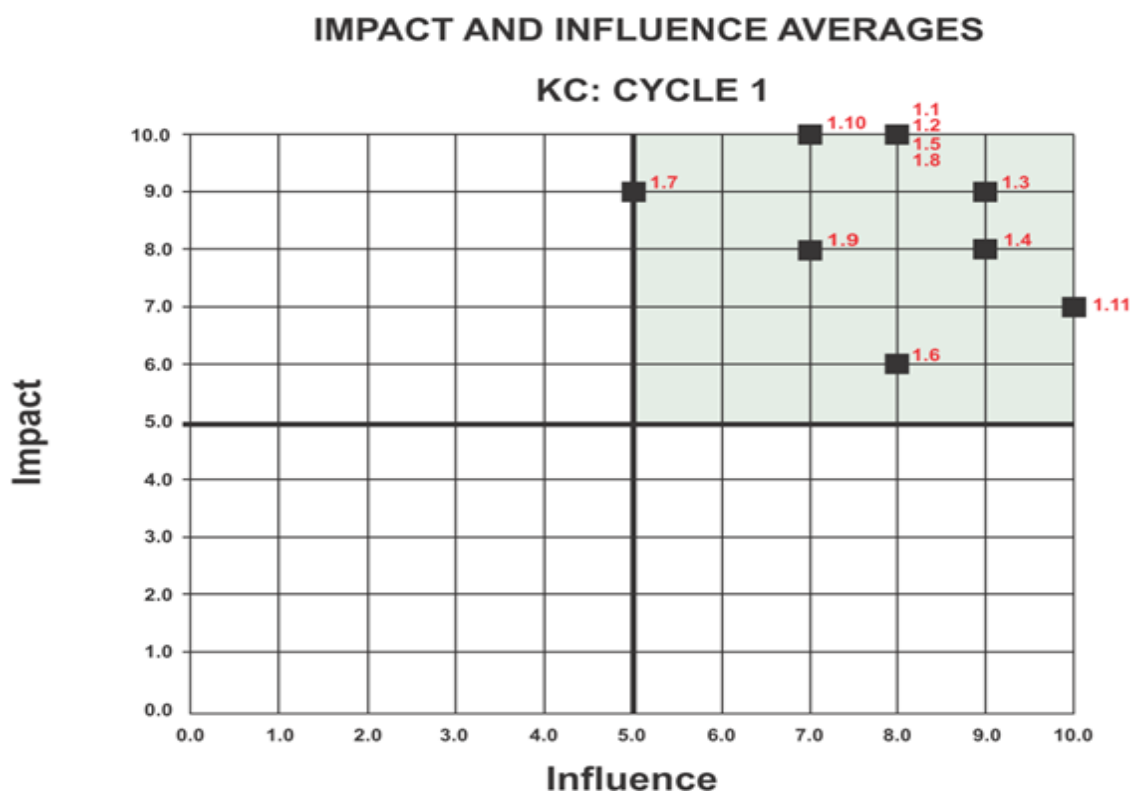


Figure 7.2. The impact and influence tool to assess opportunities in Karoo Catch KC business

7.3.2.2. Eight Dimensions Bar Graph

Partners applied eight dimension criteria tool to assess and compare opportunities individually for achieving the goal. The eight dimensions criterias were: benefit; cost of not doing; ease; motivation; cost; risk; time and term were scored from 1-10 (1=low; 10=high) (Appendix 4.1).

Opportunity 1.1: Securing off-takes

The results showed that benefit and cost of not doing were very high with a score of 10 (Table 7.2). Partners reported the significance of this opportunity in order to have progress in their business.

'Okay, so the benefit of securing an off take for all products is 10 and cost of not doing is 10 (KC41), certainly very high (KC69)'. 'If we don't secure an off-take we are going nowhere (KC41)'.

Ease was scored very low, 3 and partners articulated the difficulty in securing off-takes. *'Ease of doing it, 3 (KC41), yes, it's not that easy (KC69)'*. Researcher probed by asking partners to elaborate on the difficulty and the response was that people promises only and fail to fit product into market.

'A lot of people talk but it's getting to the finishing line for the specific products that we have developed, and yes, I would say it is not easy, 3, when foundation has been laid there are letters of intent, now they have to be converted to off-takes (KC41)'.

Motivation was scored high, 10 and partners reported that they had to be very enthusiastic to secure off-takes. *'Motivation is our enthusiasm, how we feel now or the person or the company needs to be like 10 enthusiastic to do it, ok so its 33 total (KC41)'.*

The cost was moderate, 5, yet very critical such as traveling costs. *'Money to travel (KC41). It's not a massive cost I mean it's imperative but it is not a massive costs, 5 (KC69)'.*

Researcher asked partner to score risk or likelihood of undesirable consequences as a result of implementing the opportunity. Partners mentioned the chance of been denied by clients, and the fish being listed as a red fish by World Wildlife Fund - Southern African Sustainable Seafood Institute (WFF - SASSI). *'So in other words somebody says no (KC41). Unintended consequences, hmm SASSI list it as a red fish or something like that, I think the risk is very low I would hope (K69)'.*

Partners were asked to indicate the time needed to implement the opportunity and they mentioned short time with a score of 4. *'If you put in months, we might be talking three months so that's not a huge time either, 4, that work is largely being done already (KC69)'.*

Term was very short between implementing and seeing the benefits because the business has fish. *'It's quick, we've got fish in the system, so, 2 (KC69)'.*

The total positive dimension was 33/40 and total negative dimension was 13/40 indicating secure off-takes would bring higher positive results and low negative results when implemented.

Opportunity 1.2: Active market liaison to fit product to market

The benefit of obtaining active market liaison to fit product to market was high, 10. *'The benefit is 10 (KC41)'*. Partners questioned if this opportunity was not similar to the previous one of secure off-takes, *'isn't that the same as the first one, it's a subset of the first one (KC69)'*. The response was that off - take was now and liaison does not happen now.

'It is but I think that hmm, it is in a way but securing the off-take is a now thing whereas liaison with them is not necessarily to securing the off-take now, it could be, lets develop polony for when we have the big factory, is not necessarily what people make now in the little factory (KC41)'.

'You could get some off-takes and not all, the thing is, the off-takes is for what we have available now, while the liaison is not necessarily for immediate off-takes, it could be for the longer terms afterwards but it's working towards longer product off-takes (KC41)'.

Cost of not doing was given second highest score, 8 because it relied on customer preference. *'It's tweaking I think also in terms of like do you want it in a pouch, do you want the fish boerewors in a pouch or do you want it in a tray, do you want it with this label, do you want it with that sticker, do you want this flavor, so it's those type of things also not actually the actual product, so if we don't give it to the customer according to how they want it, they are going to send it back, that's why I think 8. It's not extremely difficult to do some of it; it's a tick in a block exercise (KC41). So it's probably seven (KC69)'*.

'It takes effort, it's not just a walk in the park and you need to be enthusiastic, so that's also probably an 8; 29 I think it's the total (KC41)'.

Researcher asked partners how much would be the score of cost on a scale from 1-10 and the response was 6 because some of the activities might come at an expense while some might not. *'Six, some things are going to be simple and some are not (KC41) and it's going to be few trips to Cape Town, that type of a thing (KC69)'*.

Researcher asked partners to score the risk, the likelihood of negative consequences as a result of implementing the opportunity. Partners articulated that they had a specific product line and changes from client preferences would come at a cost.

'I think that is fairly significant because my concern with this is that we've got a product line that we're selling, we're talking to them about something else, they saying right now we want that, we don't want this anymore. We have been doing much accommodating of these wants from clients (KC69. See with that type of the product it's more about measure the moisture and that's what we should've headed to but because he's a trader, he doesn't measure the moisture, he just wants to feel it, whereas with your formal market it's going to be more specific and that's where the quality management system comes in, so that you can have this as the specification for this product and there's the line in the sand if you don't like that then it's a different specification product and we don't have that with a dried whole fish (Karoo

Catch KC41)'.

Time, what was the length of time needed to implement the opportunity and partners indicated a longer time depending on the type of activity you are doing. *'Some things are quick if it's a label, if it's a product development thing then it could be longer, 6, I would say (Karoo Catch KC41)'*.

Term was the length of time between implementing and seeing the benefit and partners mentioned it was fairly long. *'It's fairly long and it could be months (Karoo Catch KC69). Term will depend again if it's a label and if it's a label, its tomorrow (Karoo Catch KC41)'*.

The total positive dimension was 29/40 and total negative dimension was 21/40 indicating that active market liaison to fit product to market would bring high positive results, however cautioned that the negative results would also be slightly high.

Table 7.2: Scores for securing off-takes and market liaison opportunities on Eight Dimension Criteria for Karoo Catch KC project cycle 1

Criteria	Opportunity	Opportunity
	1.1: Securing Off-Takes	1.2: Active Market Liaison
Benefit	10	8
Cost of not doing	10	8
Ease	3	5
Motivation	10	8
Positive Total	33	29
Cost	5	6
Risk	2	4
Time	4	6
Term	2	5
Negative Total	13	21

Opportunity 1.3: Establish accredited facilities to process products

The results showed that the benefit of establishing accredited facilities to process products was high, 10 (Table 7.3). Partners articulated that in their business it was a must to establish accredited facilities for processing, *'Hmm (thinking sound), the benefit of doing it is 10 surely (KC69), and yes well, we have to have them (Karoo Catch KC41)'*.

Cost of not doing the facility accreditation for processing fish products was high, 10, however at the moment the business could manage with difficulty on what they had. *'The cost of not doing it will also be ten or close to it, nine (KC69), and nine, we can hobble along (KC41)'*.

Ease was very low, 2. Partners indicated that the opportunity would be difficult to do and it

required high capital. *'It is quite difficult, yes (Karoo Catch KC69) and it requires a hell of a lot of money, and that's the other thing (KC41).'* It was further elaborated that unknown expenses would be carried by the business.

'And it's all unexpected, I mean who would've budgeted an extra two and a half million rands in the factory just because the municipal road that's too much high, so now we have to compensate for that, you know, who budgets for that. Uhm...so in terms of ease, it's not easy, so 2 (Karoo Catch KC69).'

Motivation to implement was given the first highest score, 10. Partners emphasized that motivation is highly desired to establish accredited facilities. *'Motivation, Jeez you got to be motivated because it's got to be done, ten (Karoo Catch KC69).'* The risk obtained first highest score, 9. *'The risk of unintended consequences is also very high, nine (Karoo Catch KC69). Yes, cause it's your neighbour jumping up and down, not wanting a fish factory next to them (Karoo Catch KC41).'* Time obtained first highest score, 9 and partners articulated that to establish accredited facility takes a long time. *'Time required to implement it is slow as well (KC69) very slow, nine (KC41).'*

Term also obtained first highest score of 9 and partners reported that to establish accredited facility is a long process. *'Term, also fairly slow because it is a long term process (Karoo Catch KC69), building now and we will only be operating in June (Karoo Catch KC41).'*

The total positive dimension obtained 31/40 while negative dimension obtained 37/40, indicating that this opportunity would give back undesired results.

Opportunity 1.4: Develop and implement quality management systems

The benefit of developing and implementing quality management systems received first highest score, 9. The cost of not doing obtained first highest score 9. Ease of doing quality management system obtained fourth lowest score 4. Partners articulated that to implement quality management system was not easy, they outsourced expertise and still action was difficult. *'No it's not easy (KC69). Yes, 4. I mean we've got somebody to guide us but it's the doing, it's a hell of a job (KC41). I've had it on my desk for twenty-three months (KC69).'*

Motivation obtained second highest score 8. Partners required a lot of motivation, inspiration and the right attitude. *'Heaven's alive we need some motivation, inspiration (KC69). Yes, you need a lot of motivation to do it, so 8 (KC41). Yes, but you also need the right attitude to do it (KC69).'*

Cost obtained the fourth lowest score 4. Partners reported that the cost were not as massive as compared to factory construction. *'The cost of doing it is reasonably high (KC69). It's not massive, it's probably a four, I mean if you compared it to like a cost of a factory or it's paying whoever to put the systems in place for us, so I'd say four (KC41).'*

Risk obtained fourth highest score of 6. Partners articulated that to implement quality management system was costly due to changes that may occur, *'Yes there are a lot of risks*

because it means I mean by the very nature of it, it's going to require expenses and issues (KC69). Your process is not right you need to change this (KC41), sorry your tanks are too deep (KC69), 6 (KC41)'. Other partners a posed question of increasing the score of risk to one another. 'You don't think it's higher than that (KC69). I don't think so because a lot of it we've thought through hey. You know, our factory is designed based on what we do in the small factory (KC41)'.

Time needed to implement received third highest score of 7. Partners articulated that audits occurred after six months of record keeping. *'Time required to do it you need six months of records before you can even have an audit so it takes quite a long time(KC41) its slow (KC69), seven (KC41)'.*

Term obtained fourth lowest score 4. According to partners implementation of quality management system was short, *'it's long term (KC69) But the length of time between implementing and seeing the benefit is quite quick, so I'd say that it's a four (KC41). Can you sell the stuff before the first audit, that's quite low then (KC69). Because the price that we desire would be higher than the price that we must have as a minimum (KC69)'.*

Total positive dimension for quality management system obtained 30/40 while negative dimension obtained 21/40. Although the opportunity would bring positive results, there would be negative consequences also.

Table 7.3: Scores for accredited facilities and quality management system opportunities on Eight Dimension Criteria for Karoo Catch KC project cycle 1

Criteria	Opportunity 1.3: Accredited facilities	Opportunity 1.4: Quality management system
Benefit	10	9
Cost of not doing	9	9
Ease	2	4
Motivation	10	8
Positive Total	31	30
Cost	10	4
Risk	9	6
Time	9	7
Term	9	4
Negative Total	37	21

Opportunity 1.5: Appoint a qualified and experienced management team

The benefit of doing this opportunity was scored first highest score10 (Table 7.4). The cost of

not doing obtained first highest score 9. The ease of doing obtained third lowest score 3. Motivation obtained second highest score 8. Partners articulated that appointing qualified and management team was a long process and required high motivation. *'It's quite a process hey and you need a high level of motivation, so 8 (KC41)'*. Cost to implement obtained third lowest score 3 because they were low.

'Because it's adverts (KC41) Yes because It's not that expensive (KC69), we had to pay agency fees which actually hasn't worked out to be that much either (KC41). If you think about the cost associated with all the background stuff that goes into preparing for all the job descriptions and adverts (KC41), but you said not including labor, you're not including people's time, man power (KC69)'.

Risk or likelihood of undesirable consequences obtained the first lowest score 1. Partners reported that sometimes required reasons why they were not appointed. *'Like the one woman, who said why I didn't get that position. It's small; it's not a big risk (KC41)'*.

Time and term obtained third highest score 3 because to prepare paperwork took a long time and the impact was quicker. *'It's taken a long time to put the paperwork together and, so three I would say, but you should see an impact quite quickly (KC41), soon after arrival yes (KC69). So maybe that's also three (KC41)'*.

Total positive dimension for appointing qualified team obtained 30/40 while negative dimension obtained 10/40. This opportunity would bring positive results and the negative consequences would be low.

Opportunity 1.6: Plan Continuous Professional Development (CPD) for all staff

The benefit of planning Continuous Professional Development (CPD) for all staff was given the third highest scores 7. Cost of not doing was scored fourth highest score 6. Ease of doing was given fourth lowest score 4 and partners showed mixed responses between ease and difficulty. *'It's not that difficult (KC41) but it's not that easy either because you need to have the right people to implement it. If you have the wrong person it's not going to go anywhere either, four (KC69)'*. Motivation was given second highest score of 8, *'you definitely need, 8 (KC41)'*. Cost to implement was scored fourth lowest score 4 and this relied on what required being outsourced. *'Depending on what's out sourced, it's probably a four. Some is in house; some is out sourced (KC41)'*. Risk obtained second lowest score 2. *Risk is very low in this instance, maybe a two (KC69)'*.

Time obtained third highest score 7 and partners indicated that planning and course attendance required a lot of time. *'Time that it takes, you think of the planning (KC41). It's also you know, you put the person in the course; they got to know how to do the course. It could take weeks, it could take a year (KC69) or you have to develop the material for the course (KC41). Yes or if, I mean I'm thinking in terms of a new production manager going on the Stellenbosch course that's a year (KC69), six (KC41)'*.

Term obtained the third lowest score of 3 and partners indicated it should be quick. *'It should be pretty quick (KC41) should be quick, low, two (KC69), three maybe, because they need the bit of scaffolding afterwards (KC41).'*

Planning continuous development programme had total positive dimension score of 24/40 and 15/40 for total negative dimension. The opportunity would bring back higher positive results than negative results and it is ongoing. *'That's what we're in the process of doing now, finding the people that know how to do what needs to be done (KC41).'*

Table 7.4: Scores for appointment of qualified team and planning Continuous Professional Programme (CPD) opportunities on Eight Dimension Criteria in Karoo Catch KC project cycle 1

Criteria	Opportunity 1.5: Appoint qualified team	Opportunity 1.6: Plan CPD for all staff
Benefit	10	7
Cost of not doing	9	5
Ease	3	4
Motivation	8	8
Positive Total	30	24
Cost	3	4
Risk	1	2
Time	3	6
Term	3	3
Negative Total	10	15

Opportunity 1.7: Access to reliable finance timeously

Benefit was scored second highest score 9 (see Table 7.5). Cost of not doing was scored first highest score 9. Ease was scored first lowest score 1 and it was out of partners control. *'Access reliable finance is timeously and it's outside of our control that's the challenge (Karoo Catch KC69).'*

Motivation had the highest score 10 and cost obtained second highest score 8. This was supported by the high costs incurred by partners during travelling to submit application forms. *'The cost of doing it is fairly highly, I mean I had to drive to Port Elizabeth to sign two forms (Karoo catch KC69). So the cost is high, 8 (KC41).'* Furthermore, partners explained that the service was supposed to be speedily rendered by extension services, *'which is crazy because we've got state development agencies that should be falling over themselves to help (KC69)' and they are non-functional (Karoo Catch KC41).'* Partners concluded cost with score of 8 due

to exorbitant amount of money spent on communication which was curbed by establishing a social media chat group. *'Listen, it's very, I mean the amount of money it just cost us in phone calls, that's just ridiculous. We have a chat group called 'Do or Die', and we want these things to get done (KC41).'*

Risk obtained lowest score of 2 and time obtained second highest score 8. Term to see the benefit was scored the second lowest 2 and partners indicated that if funders paid on time, it would be very quick.

'Term associated, I mean you'll see the benefit instantly (KC69), and you see the benefit quickly when they actually pay (KC41).'

Total score for positive dimension was 29/40 and negative dimension was 20/40, indicating that access to reliable finance timeously would bring higher positive results than negative results during implementation.

Opportunity 1.8: Ensure sufficient water quality and quantity

The benefit of ensuring sufficient water quality and quantity was scored the first highest score 10. Cost of not doing was scored first highest score 10 and partners indicated that fish required water to survive, *'fish can't survive without water (KC41).'* Ease of doing was given third highest score of 7 and partners indicated they hired water experts because they couldn't do it themselves.

'It's not simple and it's not inexpensive (KC69). We needed to bring in experts to do it, we couldn't do it ourselves, seven (KC41).'

Motivation obtained second highest score 8 and partners articulated that they had to persevere until the opportunity was accomplished. *'I'm extremely motivated, eight (KC69), How many times did you have to phone in begging, that's our biggest problem, if we hadn't pushed on it, it wouldn't have happened (KC41).'*

The cost obtained the second highest score of 8 and risk received fourth highest score 5, time obtained third highest score 7, *'It's also fairly, fairly timeous, maybe a seven (KC69).'* Term obtained second lowest score 2 because the benefits were instant. *'You should see the benefit instantly; it would be short (KC41).'*

Total score for positive dimension was 35/40 and negative dimension was 21/40, indicating that access to reliable finance timeously would bring higher positive results than negative results during implementation.

Table 7.5: Scores for reliable finance and sufficient water opportunities on Eight Dimension Criteria for Karoo Catch KC project cycle 1

Criteria	Opportunity 1.7: Reliable finance	Opportunity 1.8: Sufficient water quantity
Benefit	9	10
Cost of not doing	9	10
Ease	1	7
Motivation	10	8
Positive Total	29	35
Cost	8	8
Risk	2	4
Time	8	7
Term	2	2
Negative Total	20	21

Opportunity 1.9: Identify cost effective product distribution options

Benefit was scored second highest score 8 (Table 7.6). Partners articulated that finding a more cost effective way of transportation can reduce the price of product.

'Distribution options, the benefit of doing it could even be higher. I mean if we can find a more cost effective way of transporting, it means the end user pays less for the product so the product should sell better (KC69) and yes except that some customers have their own networks, eight (Karoo Catch KC41).'

Cost of not doing obtained the second highest score 8. Ease of doing was scored fifth highest score 5 because the opportunity required networking. *'It's also not extremely difficult, It requires a networker, 5 (Karoo Catch KC41).'* Motivation was given the fifth highest score of 5, partners articulating that it would not be difficult to do. *'Motivation is five it's not that difficult a thing to do (KC41).'* Cost obtained first lowest score 1 because it would only be telecommunication and searching for quotation. Risk obtained second lowest score 2. Time obtained second lowest score of 2 and term also obtained lowest score 2.

Total score for positive dimension was 26/40 and negative score was 8/40, meaning that identifying cost effective product distribution options would bring high positive results that negative results.

Opportunity 1.10: Ensure cost effective and reliable feed supply

Benefit and cost of not doing were given first highest score 10. Partners indicated that if the opportunity was not implemented things could go extremely wrong for the business. *'As we are now but should things go pear shaped (KC41) it's our biggest risk, it's bigger than finance (KC69)'*. Ease of doing and motivation obtained the fourth lowest score 4.

Cost of implementation obtained the fourth lowest score of 4 and partners indicated established a solid relationship with animal feed company to manufacture catfish pellets. *'The relationship with animal feed company was still solid, unlike the with the other fish species. It's also low at the moment (KC41). But I think for a moment, we haven't all fall down with Montego and staff in this industry as that done to the trout and the tilapia guys even the tilapia guys have been told to take a hike, hmm our next best option is to probably to put up a feed mill here (KC69)'*. Researcher probed partners if they were feeding with tilapia or trout pellets and the response was no, they developed their own recipe and the company pelleted for them.

'No catfish diet. It's our own recipe (KC69); it's our own recipe that Montego makes the food for us (KC41). They make a very good pellet, It's very good feed (KC69)'.

Risk was scored second lowest score 2. Time needed to implement obtained second lowest score 2 and the term obtained first lowest score of 1.

Total score for positive dimension was 28/40 and negative dimension was 7/40, indicating that ensuring cost effective and reliable feed supply would bring higher positive results than negative results.

Opportunity 1.11: Maintain and improve genetics of stock

Benefit of maintaining and improving genetics of stock obtained third highest score 7 because it would improve production, *'It's going to improve growth, improve yield and so forth (KC69)'*.

Cost of not doing was given fourth highest score 6. Ease of doing was given fourth highest score 6 and partners indicated that it will require infrastructure, land and time.

'It would require infrastructure, it will require space, it will require time which we got on the other side um...also maybe a six (KC69). It will have to be imported maybe (KC41) and the genetic improvement programme requires time, require skills (KC69)'.

Cost obtained third lowest score 4; risk obtained first lowest score 1; time and term obtained second lowest score 3.

Total score for positive dimension was 24/40 and negative dimension was 13/40. The opportunity of improving genetics of stock would bring positive results to the business.

Table 7.6: Scores for effective distribution, feed supply and improve genetics opportunities on Eight Dimension Criteria for Karoo Catch (KC) project cycle 1

Criteria	Opportunity 1.9: Effective distribution options	Opportunit y 1.10: Effective feed supply	Oppor tunity 1.11: Impro ve geneti cs
Benefit	8	10	7
Cost of not doing	8	10	6
Ease	5	4	6
Motivation	5	4	5
Positive Total	26	28	24
Cost	1	2	3
Risk	2	2	1
Time	3	2	3
Term	2	1	3
Negative Total	8	7	13

Eight Dimensions Pinwheel Version: *Karoo Catch (KC)*

Researcher asked partners to plot the scores from eight dimension criteria on the pinwheel to select the best opportunities to implement. According to the results, the opportunity that had highest positives and lowest negatives was 1.8: Ensure sufficient water quantity and quality with a higher bell shape on the right and lower on the left hand side (Figure 7.3). Followed by all opportunities with second highest score on benefit, cost of not doing and motivation. However, ease of doing was given a low score in almost all the opportunities.

The second best option was opportunity 1.3: Establish accredited facilities to process products, however this opportunity would not be easy, highly costly, and risky and it would take a long time to implement and see the benefits. The third best option was opportunity 1.7: Access to reliable finance and it was better explained by partner as:

'It is probably the biggest challenge that we've faced to date, is to get people to say we'll give you this grant or we'll give you this loan, either case, and then you have a contract with them and the contract says that on that day we going to give you so much money and it says a hundred rand on that day. They give it to you late and they don't give you hundred rand they give you twenty rand and then they expect you to start. You can't start until you've got the

money, you know, cause there we've got other people that are lined up, there's equipment, and all sorts of stuff that's lined up ready to go. It costs money to do. Just tell the people to wait, there's no appreciation of that though at all (KC69)'.

This group has selected to take all the opportunities forward to the next step because they were ongoing.

EIGHT DIMENSIONS PINWHEEL VERSION

KC: CYCLE 1

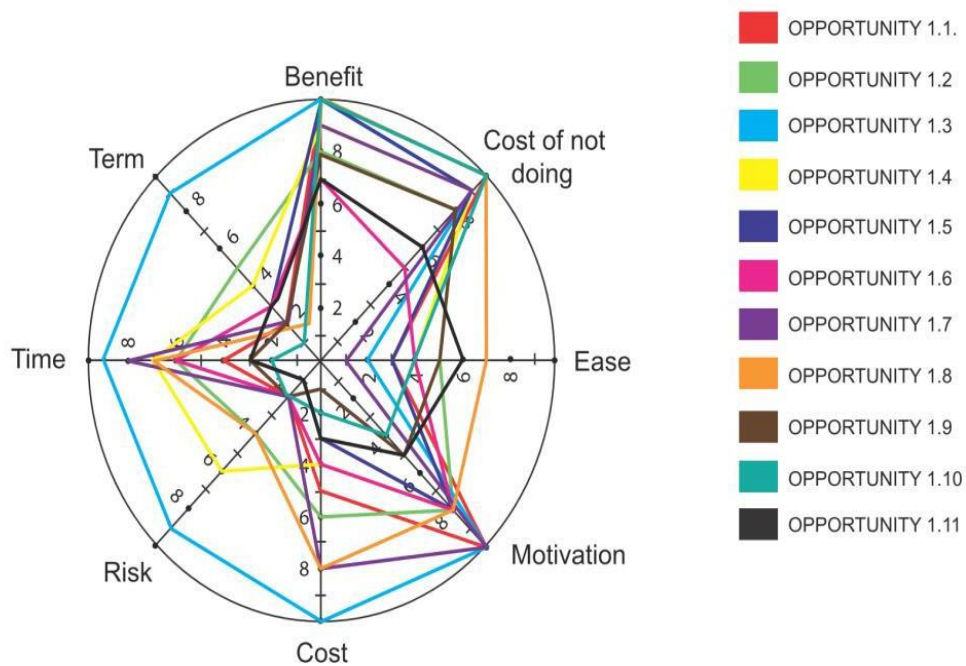


Figure 7.3. Scores for all opportunities plotted on eight- dimension pinwheel version

7.2.4. Action Design Step

In action design step partners applied action design tool to come up with Critical Success Factors (CSFS), Key Performance Indicators (KPIs) and the Key Action (KA).

Karoo Catch (KC) Project

Partners in *Karoo Catch (KC) project* would take action of identifying customers for their catfish, providing them with a product sample, obtaining guidelines of accrediting processing facility, advertise and hire personnel and identify training needs for their staff and resources such as capital would be required to successfully implement (Table 7.7).

Partners also attested that the project was already embarking on a similar process like action design named 'wildly important goals' where they present their progress weekly and consolidate results.

'What we have monthly is something called wildly important goal, so the presentation that we went to basically said we live in this or we work in this whirl wind that happens around us all of the time. In order to move forward you have to keep setting goals like this and then, and then every single Thursday we sit around this table and each person. Each person uhm...presents their progress in terms of their goals. See, so these are your goals that's how you have done for each of them, so if you go green, it's done if you are yellow, it's still in progress and if it's red you haven't started so your goal is to get 85% green every month. So this will feed nicely into that and then once a month we consolidate and see how we've scored (Karoo Catch KC41).'

The researcher asked the level of confidence required to implement. Partners responded by emphasizing the importance of implementation was mostly driven by the risk that they took of putting their properties as surety for obtaining loans and sometimes when things were handed out to people without any educational background, responsibility and agency of wanting to see things happens becomes minimal.

'But surely that means that they don't understand the personal benefit of implementing. I mean we mention the word under-educated background, you don't, you don't understand stuff like that because they've never been exposed to it (Karoo Catch KC69). And also it's been given, I mean we've taken a loan where we've signed our houses away (Karoo Catch KC41). Yes that's true they've been given food and given this, so there's no accountability there's no sense of responsibility, agency, so whether it happens or not we will still be okay (Karoo Catch KC69).'

Table 7.7: The Critical Success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Karoo Catch (KC) project.

Critical Success Factors (CSFs)	Key Performance Indicators (KPIs)	Key Actions (KAs)
Secure off-takes for all products at required price	Signed order	Identify potential customers, provide samples and prices, secure orders
Active market liaison to fit product to market	Signed order	Provide samples, obtain inputs, product adjustments, acceptance for products
Accredited facilities	National Regulator for Compulsory Specification (NRCS) certificate	Contact Human Resource Centre (HRC), obtain guidelines, inspections, obtain accreditation
Management team	Signed contracts of employment	Advertise,
Continuous Professional Development (CPD)	Implement training plan,	Training need analysis, design training programme, source funds, implement

7.2.5. Performance Assessment Step

In the previous step partners tracked the results of their action. In this step Performance Assessment, partners assessed the results of their action after additional 30 days of implementation.

7.2.5.1. Results Assessment Outcomes

Karoo Catch (KC) Project

In the previous session partners implemented their action and were now giving a report of what transpired during action taking. Partners reported that signed orders for potential customers were secured and they needed support to secure further off - takes at Department of Education. Signed orders were also obtained for active market liaison to fit product to market and further funding support was required to develop the product. The activity of accreditation from Human Rights Council (HRC) was achieved and the partner still needed to get approval from national Department of Agriculture to use the name *Clarias* on their products. Partners also managed to conduct interviews and recruit new staff. The training programme for staff was also conducted and it was on-going throughout the year (Table 7.8).

Table 7.8: Performance Assessment results for Karoo Catch project cycle 1

Critical Success Factors (CSFs)	Key Performance Indicators (KPIs)	Key Actions (KAs)	Results	Support needed
Secure off - takes for all products	Signed order	Identify potential customers, provide samples prices,	Singed orders	Department
Active market liaison to fit product to market	Signed order	Provide	Signed orders	R & D funding for
Accredited facilities	NRCS certificate	Contact	Achieved	Confirmation from
Management team	Signed contracts of employment	Advertise, wrote job descriptions, conducted interviews, appointed	Achieved	None
Continuous Professional Development (CPD)	Implement training plan, attendance register	Training analysis,	Achieved and on-going	Funds

Partners mentioned that aquaculture and Agriculture farming have lot of similarities because the possibilities of sitting with stock for long periods of time are high besides the fact that it required capital is too high.

'If we compare ourselves straight from aquaculture, Agriculture side we are very similar, and have different types of inputs but actually the consequences is the same, so we sit and we sit with stocks for 6-8 months, we've invested heavily capital into the tunnel (Karoo Catch KC72).

The activity of conducting Continuous Professional (CP) training was completed but it was highlighted as on-going and new training needs analysis should be done.

'Continuous Professional Development (CPD) achieved and on-going, so we completed the plan that carry outputs together, it's done, hmm... but it is an on-going thing, so now she needs to do new training needs analysis (Karoo Catch KC41).'

Partners have advertised, conducted interviews and appointed new staff members to the

project. *'So we advertised, job description, shortlisting, we did interviews and appointed, so much has happened (Karoo Catch KC41).'*

Signed orders for active market liaison were acquired and market was happy with their product. *'No because they were happy with the packaging and all that (KC41).'*

NRCS (i.e. certificate for accredited facility) was achieved as indicated by partners; however, they also wanted support from Department of Agriculture, Forestry and Fisheries (DAFF) to use the name *Clarias* on their products. *'I think what we do need with National Regulator for Compulsory Specifications (NRCS) but it's not an ideally a research thing, but is DAFF's thing is that confirmation we can use the Clarias (KC41).'*

On the activity of identifying potential customers the support required was to secure off-takes at Department of Education. *'So the step is identifying potential customers, divide the support into price list. Support required hmm... department of education, so sort of access to the thing in market so Department of Education's off-takes (KC41).'*

'Research and Development funding was identified under support needed by partners from their activities. I would say R & D funding would be a nice thing, so like product development funding and that could be human consumptions, skills, anything. All the staff we discussed yesterday (KC41).'

7.2.5.2. Observations, Questions, Ideas, Opportunities (OQIO) Outcomes

The partners observed that their Specific, Measurable, Achievable, Relevant, Targeted, Time-framed (SMARTT) focus was too broad and they needed to narrow it down. For questions partners mentioned the more appropriate to focus on a single tunnel than 5% profitability of agro-processing. The idea of focusing on a single production unit will be more viable and the opportunity was to develop a standard for a single unit for fish production (Table 4.38). The business can focus on a single unit of production from one tunnel and it might give more results unlike focusing on the whole business.

'We might want to ring-fence something in the business right down to a single production unit; let's say a tunnel, so that it's sensible (Karoo Catch KC 73). I think the single units will be more useful because it's more comparable and it might give you more units versus one business and I do believe that will help out-growers (Karoo Catch KC41).'

Another partner supported this idea by saying that someone who was just appointed and joined the research conscientise about that our first Specific, Measurable, Achievable, Relevant, Targeted, Time-framed (SMARTT) goal being too broad.

'But I think is of value, what we saying is step one we came in like this. Now the feedback is coming from KC69 as an outsider, came on you are looking too broad you can't actually handle this as a single Doctor of Philosophy (PhD), so now we've done the first quotes, now we come back and start the second one now we say hang on that was too broad, the second one was to be far more focused (KC69).'

7.2.6. Creation and Synthesis Step

In the previous step partners assessed the results of their action and had an opportunity to new knowledge and thinking guided by the tailored questions. The six thinking hat was applied to unscramble thinking so that partners can apply one thinking mode at a time instead of wasting time in arguments or drifting discussions (Figure 4.49).

7.2.6.1. Observations, Questions, Ideas and Opportunities (OQIO) Outcomes

Partners applied Observations, Questions, Ideas and Opportunities (OQIO) tool to generate new ideas that were fed into the next cycle. Partners observed that the initial SMARTT goal was too wide and needed to be narrowed down. *'Ok this is the point where we say, the first one was broad we need to narrow it down to new strategy for phase two, Ok observation one, too broad (Karoo Catch KC69).'*

Another partner suggested relooking into the 5% profit that the projects wanted to achieve in this cycle and make it more focused. Then the question would be focused on the relevance of comparing the entire business to one production tunnel and also changing the time frame. *'I think the other thing is that hmm... the measure of output hmm needs to be more focused. You can't have 5% profitability at Karoo Catch (KC) as an enterprise with Agro-processing and all other things involved. Is it relevant to compare the whole enterprise to tunnel farming and is the timing relevant (Karoo Catch KC69).* The other partner agreed by mentioning that the time framed was been increased by twelve months again. *'Because now it's been pushed up by twelve months again (Karoo Catch KC41).'*

The partners agreed that the ideas were single tunnel value adding development and growth potential. *'So the idea is the relevance of a single tunnel to growth adding value to the research on small farmer (KC69). Single production unit (KC41).'*

The opportunity of refocusing on a single production unit was to be able to duplicate the design to improve small scale farming. *'The opportunity is to develop a standard for a single unit of production. So that it can be hmm duplicated on a large scale to address small farming, only government programme for that matter, it could be Phakisa, it could be small farmer development (Karoo Catch KC69).'*

7.3. Limpopo Province

7.3.1. Focus Step

Tladinga TD Project

In this session draft goal was to make more money, construct more ponds and have more fish and make business out of fish. This was better explained by one partner as thus;

'When I am saying to make a business out of fish, before you can make money you have to know what to do because before you can make any business obviously you have to have the tools to make a business before you can start making money, I don't know, making money is the ultimate goal but before you can say I want to make money, how can you make money out of something you don't know (Tladinga TD05).'

The goal was specified as improving technical knowledge of catfish. *'We want to know about how to breed catfish from small until to the market size, we want to know more about it from fingerling up to the end (TD05).'*

The number of fingerlings from fry stage to market size could be measured and the issue of working in an aquaculture value chain was also indicated. *'It is like when I am producing fish eggs, I give them to this one this number to grow them, then after sells at the size of selling, then we will be able to see where the loss of fish has happened (TD06).'* Other partners indicated income generation and capacity buildings as things that could be measured in this goal.

Partners found it challenging to articulate achievable of SMARTT goal due to not being actively selling with catfish at the moment, *'If I want to see an increase or improvement it means I am doing something already, and now we are not doing anything with catfish (TD05).'*, and others understood it from perspective of inflation, *'It will go according to inflation if money increases, we see it by going up and down, so how will we know that because we are still starting, now we will say we want this and it is money (TD07).'*

The goal was relevant because there was a need to make a sustainable business from fish farming according to partners. *'You can produce fish and the community don't buy them, so this are needs and you must be sure the community needs them (TD06).'* Time-framed was

12 months. Partners improved the draft goal to SMARTT goal by developing a catfish business via increasing capacity or technical skills and generate income in 12 months (Table 4.17).

Phetwane PT Project

The draft goal was to make a profit making business; *'we want to ensure that there is a profitable and sustainable business that is able to pay its workers (PT47, 44 & 46).'* Job creation and improve livelihoods, *'to grow to an extent that we create more employment for our community to develop (PT49 & 48).'* Job creation, income and sustainability were

measurable and the scale of improvement was reasonable and achievable.

The goal was relevant because there was a need to farm with fish in the community. Partners' targeted 2% profit and 2 created employment in their business within a time-frame of 12 months. The developed SMARTT goal was solely to create a sustainable project that generated income and created 2 employments within 12 months (see Table 7.9).

Table 7.9: Outcome of draft and SMARTT goal developed by Tladinga (TD) and Phetwane (PT) projects

Research Partner	Draft Goal	SMARTT Goal
TD 05, 06, 07,08 & 09	Make more money, to make business out of fish, more ponds and more fish	To make a business of catfishfarming in TD project by increasing the capacity of cooperative members and improve profit by 2% within 12 months
PT 44, 45, 46, 46, 48 & 49	To be sustainable and make profit; We want to ensure that there is a profitable business and sustainable, To grow to an extent that we create more employment for our community; we want to see project have money to payworkers; job creation and community development	To create a profitable and sustainable business that achieves 2 jobs in PT catfish project within twelve months

Makhado and Mutale Projects

Partners in this group indicated that the draft goal was creating employment and feeding their community with fish. Partners specified that they wanted to improve technical skills in order to make their business a success and contribute to job creation and eradicate poverty. Profit and technical skills were measurable of whether the goal was achieved according to partners. Partners mentioned that the goal of improving technical skills in aquaculture was achievable. The goal of developing fish farming in their communities was a very relevant opportunity due to its nutritional benefits. Partners aimed at achieving 2% profit. This goal would be achieved within 12 months according to partners. The developed SMARTT goal was to create employment and make profit to improve livelihoods within a year (Table 7.10).

The draft goal was to make money from fish farming business. Partners specified that they needed to contribute to job creation at the end of the year and achieve 2% profit in relation to the study's objective. The Specific, Measurable, Achievable, Relevant, Targeted, Time-framed (SMARTT) goal was to make their business generate income to create employment and improve livelihoods within 12 months.

Table 7.10: Outcome of draft and Specific, Measurable, Achievable, Relevant, Targeted, Time - framed (SMARTT) goal developed Makhado and Mutale projects

Research Partner	Draft Goal	SMARTT Goal
CF 32, FF 36, 72 & 77, AN 35 & RB 38	To create employment and produce fish for the community	We want to create employment and make profit in my business To improve lives of our community within 12 months
TT 30, MK 31, MA 39, TRL 34, NT 33 & UR 38	To make money from our projects	To make money from fish farming business, create employment for our community within 12 months

Chikudini CF, Funyufnyu FF, Alianapo AN, Ramabaga RB, Nemutamba NM, TshaundiTshelwala (TT), Makhura (MK), MA, TshitakholeRL (TRL), Nemutamba (NT) & UR

7.3.2. Situation Analysis Step

Tladinga (TD) Project

Water was mention 14 times in this business and it involved various aspects such as not having waders during harvesting (see Figure 7.4). *'Clothes to go into the water (Tladinga TD08)'*. Another participant wondered whether alternative borehole with salty water could be suitable to raise catfish. *'Can I ask, we are utilizing water from the canal, we put catfish inside the ponds and when there is no water and again we made a borehole, can catfish live inside water that is salty and from borehole (TD07)'*.

Researcher probed partners by asking where the water in their ponds came from the river or from the borehole. *No, our water comes from the river (Tladinga TD07)*. However other partners mentioned that they did experienced drought the previous year. *Water can dry out and all our fish die, like last year (TD06)*. And another partner disputed and gave more details on this issue by articulating that, *'It is not lack of water, is water in terms of like there is lot of water there but when there is drought like last year there was no rain, so the rivers were dry, so water is there but during drought nothing (TD05)'*.

Water was followed by the word market and it appeared 6 times. The partners expressed by their situation or challenges in the following manner; *'Marketing (Tladinga TD06; 07) and Market (TD08)'*. The researcher probed partners by asking what exactly they are referring to by marketing. *'Market is there, it is our local community but we have not tested outside of our local community (TD05)'*.

Electricity appeared 6 times followed by market and the researcher asked the partners in this focus group to elaborate further their need of electricity. *'We are farming in a bushveld, so at night we can't see; we need electricity (Tladinga TD07)'*.

PT46); Lack of management not good (PT45)'.

Security also appeared 2 times and it was expressed as lack of security personnel on farms. 'Security guard (PT36); Lack of safety of our workers (PT47)'.

Nets also appeared 2 times and partners indicated that they don't have nets. 'No nets (PT44); Nets (PT47)'.



Figure 7.5. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Phetwane (PT) project adapted from Atlas.ti 8

Tshaundi Tshelwala TT, Makhura MK, Mudau MA, TshitakholeRL TRL, Nemutamba NT, Ukhadzilito UK37 Businesses (Mutale Group)

The word water appeared 5 times in this business (Figure 7.6). Partners indicated shortage of water as their major constraint to achieve their goal. It was expressed as follows:

'Lack of water (Tshaundi Tshelwala TT30); Lack of good water (Ukhadzilito UK37); No water (Makhura MK31); shortage of water during drought time (Nemutamba NT23) lack of enough water (TshitakholeRL TRL34)'.

The word birds were discussed 4 times in this group and partners expressed it as follows:

'Birds (fish eagles) predatory land animals) (Mudau MA39); problem of birds eating fish (UK37); predation by birds (MK29); animals and birds who eat my fish (NT33)'.

The word market was discussed 4 times in this group as the businesses do not have any specific market to sell their products. Partners said the following; *Lack of market (TT30, MK29, TRL24)*, *problem of marketing (UK37)*, *market (NT33)*.

Security had the lowest frequency of two in this group and partners expressed it as theft of their fish. *Security (NT33) and lack of security like fences because people are busy stealing my fish (RTL34).*



Figure 7.6. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Mutale projects adapted from ATLAS.ti8

ChikhudiniF CF, Alianapo AN, Funyufunyu FF, Fharanani FR (Makhado Group)

In Makhado group water was mostly discussed with a frequency of 4 (see Figure 7.7). Partners indicated this as lack of water in their business. *'Water source is very far from the dam (ChikhudiniF CF32); lack of water (Funyufunyu FF36), how to get water (Alianapo AN35), no borehole water (UR38)'*.

Water was followed by market mentioned two times. *'Lack of market (CF32); vultures those are problems affecting my farm and market (AN35)'*.

Fingerlings and storage were also mentioned two times and partners mentioned *'lack of fingerling (FF36)'*.



Figure 7.7. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Makhado projects adapted from ATLAS.ti8

Impact and Influence Outcomes

Tladinga (TD) Project

The opportunities from the previous step were assessed on a scale of 1-10 for the level of impact and influence towards achieving the goal. Opportunity 1.1. Lack of electricity was given impact score 7 and influence score 5 (See Figure 7.8). Partners felt that the reasons for wanting electricity were that business was operating in a dark shrub, *'we are farming in a bush-veld and at night we can't see so we need electricity (Tladinga TD07)'*.

In opportunity 1.2, the impact of having additional fish ponds was given second highest score of 8 and influence 4. Lack of quality fish feeds (1.3) was scored impact of 8 and influence of 4. Lack of backup water (1.4) had an impact of 8 and influence of 4. Researcher probed and asked partners what was their source of water. The response was better encapsulated in the following quote:

'Water comes from the river (Tladinga TD07). Water can dry out and all our fish die, like last year (Tladinga TD06). It's not lack of water, is water in terms of like there is lot of water there but when there is drought like last year there was no rain so the rivers were dry, so water is there but it runs out during drought (Tladinga TD05)'.

The challenge of predation by birds and other land animals (1.5) was given an impact score 9 and influence 3, *'we have a problem of another animal that looks like a crocodile that eats our fish (Tladinga TD06)'*.

The score for impact of shortage of labor (1.6) was in the middle 5 and the influence was also in the middle 5. Partners felt that aquaculture was labor intensive business, *'labor like hmm... fish farming is labor intensive a bit, we have to keep the project clean and all of that, there is a lot of things that we need to do so we don't get to do anything so shortage of labor (TD05)'*.

Lack of finances (1.7) was given third highest score of 7 and influence was in the middle 5.

Lack of financial information in fish farming (1.8) obtained the fourth highest score of 6 on both impact and influence. Partners indicated that there was no available information on cost of fish production in order to stay informed.

'Another one, I don't know how to put it, you know like financial information for fish farming, like as to know how much can you expect, how much is it, hmm... the basic financial information you can use for the project, you see (Tladinga TD05).'

The opportunity of improving record keeping skills (1.9) was having an impact 8 and influence 4. The opportunity of lack of aquaculture expertise (1.10) was scored 8 impact and

5 influence. The impact of not having equipments (1.11) was scored 5 impact and the influence was scored 5. Partners referred equipments as to harvesting equipments.

'No, even that thing to hold catfish with, you can't just hold it with your hands and put it in a bag, you get scared sometimes (Tladinga TD07).'

The impact of not having market access (1.12) was scored 5 and influence was also scored. Partners indicated that they sell their catfish to the local community, the market is available.

'Market is there, it's our local community but we haven't tested outside the local community (Tladinga TD05).'

'But if we don't sell, problem, can you imagine preparing all fish thinking Spar store will buy them. I mean just taking them to Spar store for example, it needs the period we know that we have fish every month and they will take them (Tladinga TD07).' *'Yes, they were buying catfish one by one, and they will be finished, they will be finished (Tladinga TD07).'*

Lack of processing house (1.13) was scored 7 impact and 3 influence. Lack of training (1.14) was scored 9 impact and 5 influence. The impact of lack of fencing (1.15) had an impact score 8 and influence 3.

Other partners reported lack of security as a constraint inhibiting them from profit making.

'The things that prevent us from making money from fish farming is that the farm is open, there is no fencing (TD06).'

The opportunities taken forward in this group were 1.10 Lack of expertise and 1.14 Lack of training to the next step.

IMPACT AND INFLUENCE AVERAGES

TD: CYCLE 1

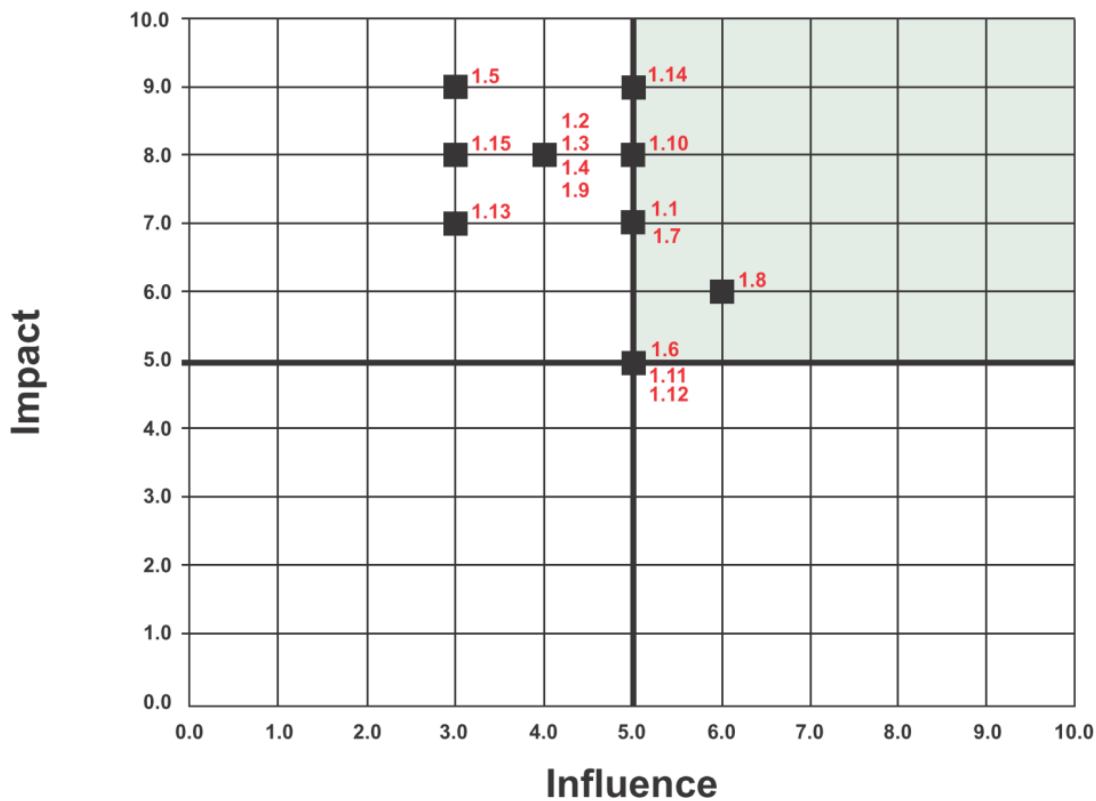


Figure 7.8. The impact and influence tool to assess opportunities in Tladinga TD business

Eight Dimension Criteria: Tladinga (TD) Project

Opportunity 1.10 Lack of expertise and opportunity 1.14 Lack of training were assessed on Eight Dimension Criteria from 1-10 (1=low; 10=high). Benefit of sourcing expertise obtained first highest score 9. The cost of not sourcing expertise was given first highest score 9. Partners felt that there would be no progress without expert advice, *‘we rated it high because if we can’t get expert advice we will not be able to move forward, if we don’t get training we will not succeed (Tladinga TD05)’*.

Ease of sourcing expertise obtained second lowest score 3. Motivation of partners to implement obtained third highest score 7. The total score for positive dimension was 28/40 for this opportunity. Cost of sourcing expertise obtained first lowest score 2 and the likelihood of negative consequences as a result of implementation/ risk was scored 3, *‘they won’t be anything wrong during implementation (TD05)’*. The length of time it would take to implement obtained fourth highest score 6 and term was scored 4, *‘we have to go by the schedule of the trainer (TD06)’*. The total score for negative dimension was 15/40 as presented in Table 7.11.

Table 7.11: Scores for lack of expertise and training opportunities on Eight Dimension Criteria for Tladinga TD project cycle 1

Criteria	Opportunity 1.10: Lack of expertise	Opportunity 1.14: Lack of training
Benefit	9	10
Cost of not doing	9	8
Ease	3	7
Motivation	7	9
Positive Total	28	35
Cost	2	4
Risk	3	1
Time	6	3
Term	4	4
Negative Total	15	13

Eight Dimensions Pinwheel Version: *Tladinga (TD) Project*

The scores from Eight Dimensions table were further plotted on the pinwheel version to select the best option. The results showed that the curve shape of opportunity 1.4 was further away from the middle line, meaning that the positives were high. The curve shape was close to the middle line on the left hand side, indicating that the negatives were the lowest compared to opportunity 1.10: Lack of expertise (see Figure 7.9).

The understanding of this session on impact analysis was articulated in the following manner by partners:

'This is also going to specify that we have lot of challenges in farming but now we choose a problem that if we can solve, it will at least bring progress, we do need fish food for fish to grow but if we don't even know how to raise catfish, I can give you fish feeds, we can construct additional ponds or maybe obtain funding to dig more ponds but you don't know how to raise catfish, so it will not help. You can get funds maybe for electricity and say put in electricity we need it for fish, we will have electricity but you don't know, meaning all the problems we are talking about. We really think everything is important but now extension officers will come here and ask us what can we do, and then you say, fence, put fence because we have predators, and they will put in fence for you with money and they will comeback later and say you are not productive (Tladinga TD05).'

EIGHT DIMENSIONS PINWHEEL VERSION

TD: CYCLE 1

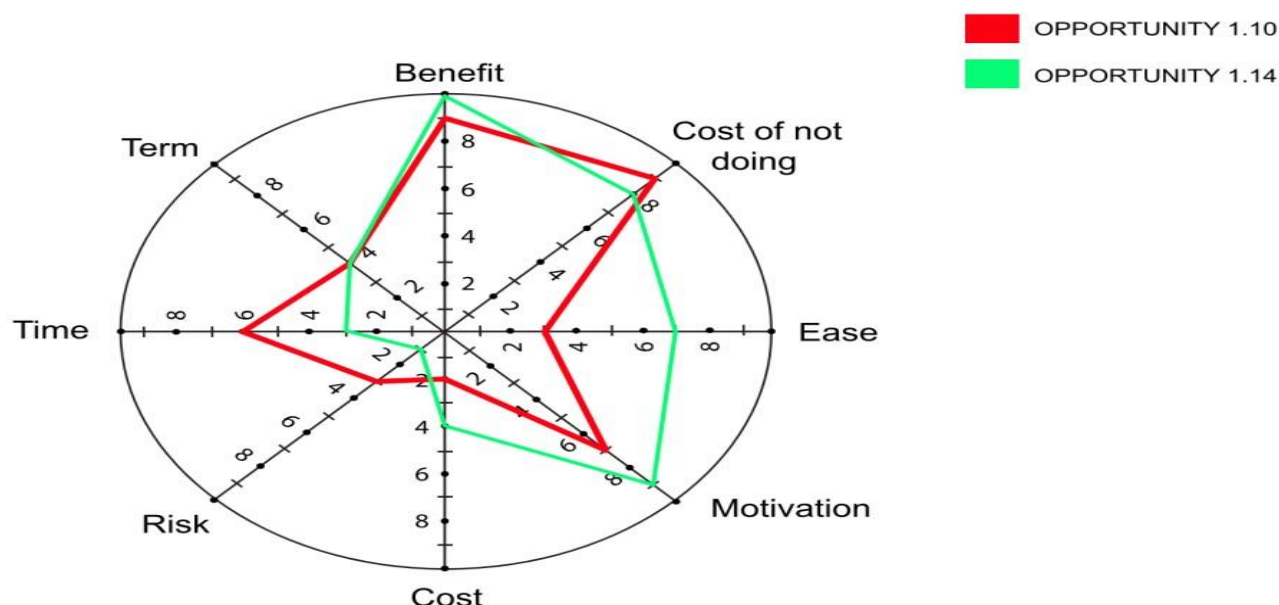


Figure 7.9. Scores for all opportunities plotted on eight-dimension pinwheel version

Impact and Influence: Phetwane (PT) Project

The opportunity increase market access (1.1) obtained highest impact score 10 and influence obtained third highest score 7 (see Figure 7.10). Partners articulated market access as a constraint, 'lack of market for our fish (tilapia, catfish, carp) (Phetwane PT49). Market (Phetwane PT44) lack of market (PT45)'.

Opportunity of preventing predation (1.2) obtained first highest impact score 9 and third highest influence score 7. Partners articulated increased need for secured ponds. 'Securing ponds (Phetwane PT47), lack of protection on our dam (Phetwane PT48), predation (Phetwane PT45)'.

Opportunity 1.3 fixing inlet and outlet pipes obtained second highest impact score 8 and fourth highest influence score 6. The opportunity of purchasing protective clothing (1.4) received first highest impact score 9 and fourth highest influence score 6.

The impact of obtaining equipments (1.5) obtained first highest score 9, while influence obtained fourth highest score 6. The opportunity of improving technical skills (1.6) had the highest impact score of 10 and fourth highest influence score 6.

Improve communication skills (1.7) obtained second highest impact score 8 and first highest influence score lack of good 9. Partners articulated communication within the cooperative committee. *'Lack of communication with fish farming committee (Phetwane PT46)'*.

Improve security (1.8) obtained the first highest impact score 9 and third highest influence score 7. Water exchange opportunity (1.9) obtained first highest impact score 9 and third highest influence score 7. Water quality equipments (1.10) had an impact of 8 and influence of 7. Constructing processing house (1.11) had an impact score 8 and influence 6. Constructing cold room (1.12) had impact score 9 and influence of 6. Construct a RAS (1.13) had an impact score 8 and influence 6. Obtain screen wire (1.14) had an impact 9 and influence 6. The opportunity of improving technical skills (1.15) had impact of 9 and influence of 6.

Opportunities that obtained the highest impact and influence scores were market access (1.1) and prevent predation (1.2) and they were taken to the next step.

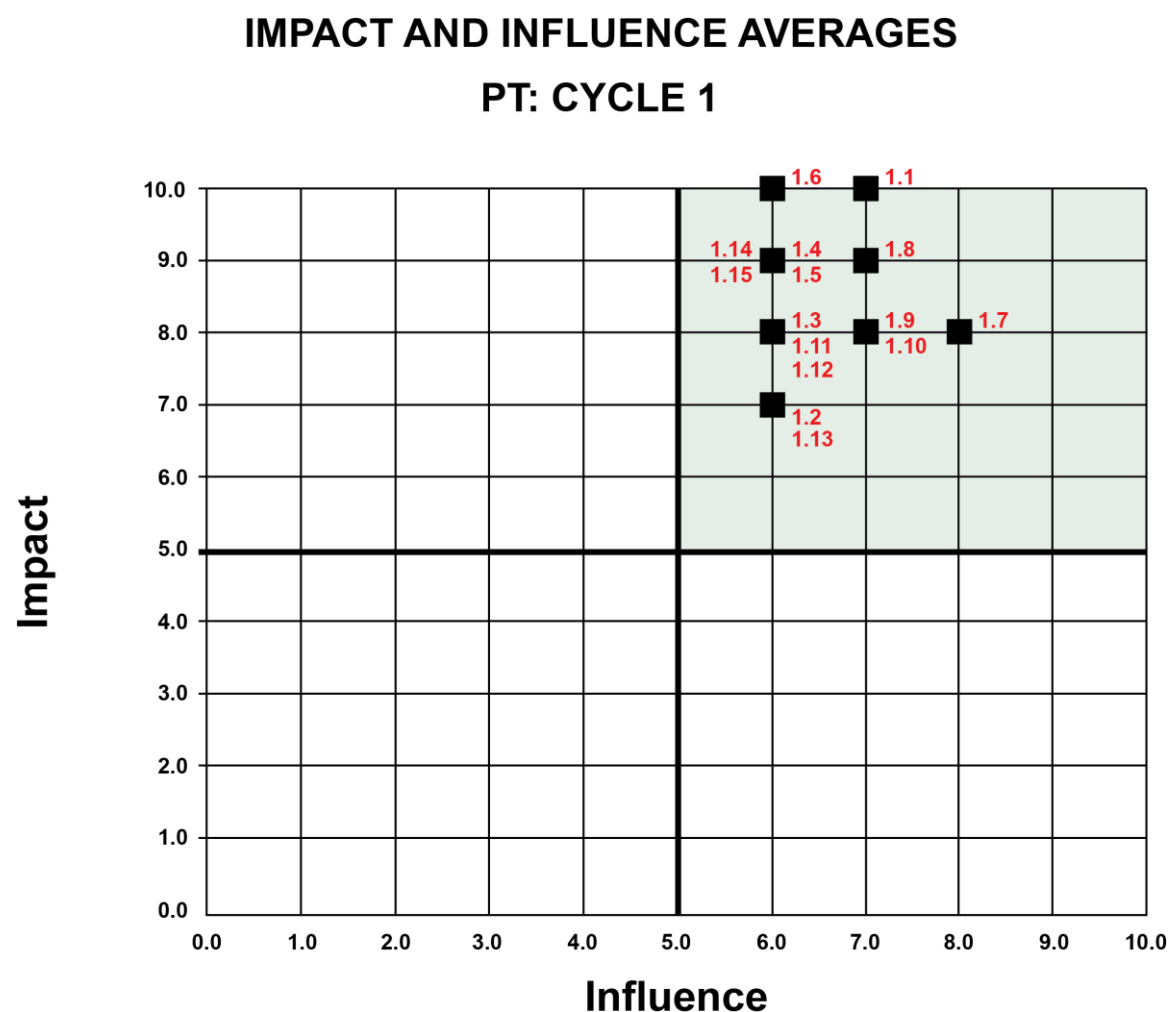


Figure 7.10. The scores of impact and influence tool employed to assess opportunities in Phetwane PT business

Eight Dimension Criteria: *Phetwane (PT) Project*

The opportunities were assessed on a scale of 1-10 on the eight dimension criteria. The highest scored opportunities on benefit were market access, communication skills and water exchange. The first highest benefit score was found in inlet and outlet pipes opportunity and second highest was in security, followed by predation and water quality equipments (See Table 7.12).

Cost of not doing obtained first highest score 9 in water exchange (1.6), followed by water quality equipments (1.9) with the second highest score 8 and market access (1.1) with the third highest score 7. Predation (1.2) and inlet/outlet pipes (1.3) both obtained fifth highest score 5 and the communication skills (1.7) obtained lowest score of 1.

Ease was highest in water quality equipments with a score of 10, the medium score was found in the rest of the opportunities with an exception of security (1.4) which obtained lowest score 1.

Motivation obtained first highest score 9 in inlet/outlet pipe (1.3) and second highest score 8 in market access (1.1), predation (1.2) and water exchange (1.6). Communication skills (1.7) obtained fourth highest score 6 and security (1.4) was given lowest score 1.

The cost of implementation was high in predation (1.2) and communication skills (1.7) with the first highest score 9. Followed by a second highest score 8 in water exchange (1.9), third highest score 7 in market access (1.1) and fourth highest score 6 for inlet/outlet pipes (1.3). The fifth highest score 5 was obtained in security (1.4) and water quality equipments (1.9).

Risk obtained second highest score of 8 in security (1.4), fourth highest score 6 in inlet/outlet pipes (1.2); fifth highest score 5 in water exchange (1.6) and water quality equipments (1.5). The third lowest score 4 was found in rest of the opportunities.

Time was longer in water exchange (1.6) with the third highest score 7; followed by water quality equipments (1.9) with the fourth highest score of 6 and fifth highest score 5 in the remaining opportunities.

Term between implementing and seeing the benefits obtained the highest score 10 in security (1.4) and fourth highest score 6 in the remaining opportunities with the exception of communication (1.7) and water quality equipments (1.9).

The total positive dimension score was high 34/40 in water quality equipments (1.9); followed by 32/40 in water exchange (1.6); 31/40 in market access (1.1); 28/40 in communication skills (1.7); 26/40 in predation (1.2); 22/40 in inlet/outlet pipes (1.3) and lower in security (1.4) 18/40.

The total negative score was high 26/40 in predation (1.2) and 1.4 (security); followed by 23/40 in communication skills (1.7) and water exchange (1.6); 21/40 in market access (1.1); 20/40 in inlet/outlet pipes and least negatives were found in water quality equipments (1.9) with 18/40.

Table 7.12: Scores for selected opportunities from Eight Dimension Criteria for Phetwane PT project cycle 1

Criteria	1.1: Market access	1.2: Predation	1.3 Inlet and outlet pipes	1.7 Communication skills	1.4 Security	1.6 Water exchange	1.9 Water quality equipments
Benefit	10	7	9	10	8	10	7
Cost of not doing	7	6	5	1	4	9	8
Ease	6	5	5	5	1	5	10
Motivation	8	8	9	6	5	8	8
Positive Total	31	26	22	28	18	32	34
Cost	7	9	6	9	5	8	5
Risk	4	6	4	4	8	5	5
Time	4	5	4	5	4	7	6
Term	6	6	6	2	10	5	3
Negative Total	21	26	20	23	26	23	18

Eight Dimensions Pinwheel Version: *Phetwane (PT) Project*

The scores from eight dimensions table were further plotted on the Pinwheel Version. The opportunity that had the highest curve shape situated further away from the middle line was water exchange (1.9) on the right hand side (Figure 4.19.2). Followed technical skills (1.6) and being cognizant that it would not be easy to implement. Market access (1.1) was the second best bell shape on the right hand side; followed by prevent predation (1.2). The shortest bell shape on the right hand side was found in protective clothing (1.4). On the left hand side of the pinwheel the bigger bell shape was found in protective clothing (1.4) and the shortest bell shape was in communication skills (1.7) (see Figure 7.11).

In this group market access (1.1) and water quality equipments (1.9) were the best options and were taken further to the next step.

EIGHT DIMENSIONS PINWHEEL VERSION

PT: CYCLE 1

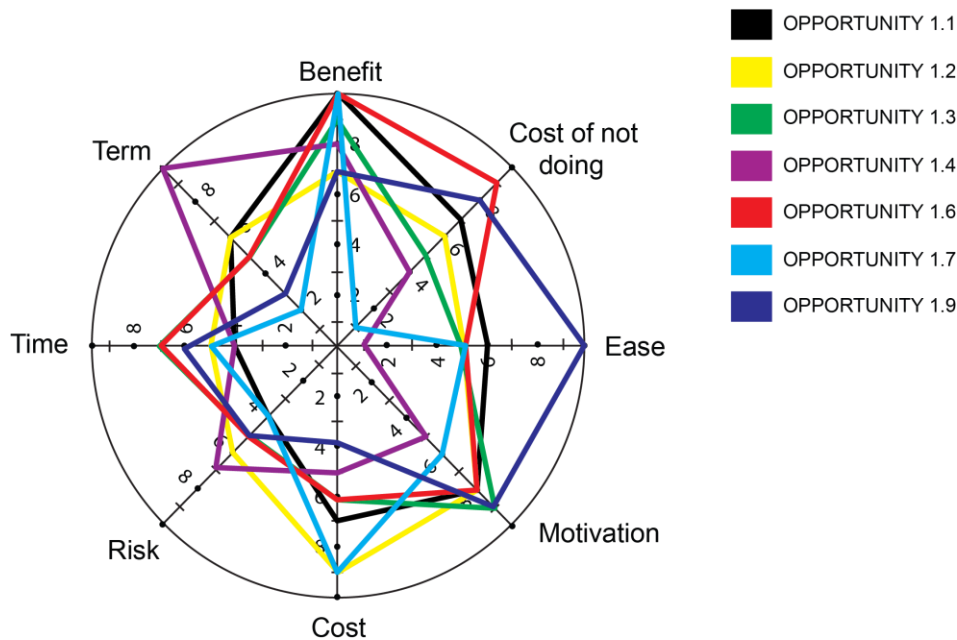


Figure 7.11. Scores for all opportunities plotted on Eight Dimension Pinwheel Version PT project

Makhado Group

Impact and Influence: *Alianapo (AN) Project*

Impact for increasing fish food (1.1) obtained third highest score 7 and obtained second highest score 8. The impact and influence of increasing water (1.2) obtained first highest score 9. Use of natural things (1.3) obtained fourth impact and influence score 6. Increase farming space (1.4) had impact 7 and influence 8. Increase number of catfish (1.5) had an impact score 5 and influence 7. Increase equipments (1.6) had an impact score 5 and influence 5. Predation by birds (1.7) had an impact 4 and influence of 5. Increase of market (1.8) scored impact of 3 and influence of 6. Increase number of ponds (1.9) had an impact 5 and influence 6. The scores were plotted on the Impact and Influence electronic spreadsheet (Figure 7.12). Partners selected to continue with opportunity 1.1 increase fish food and opportunity 1.2 increase water.

IMPACT AND INFLUENCE AVERAGES

AN: CYCLE 1

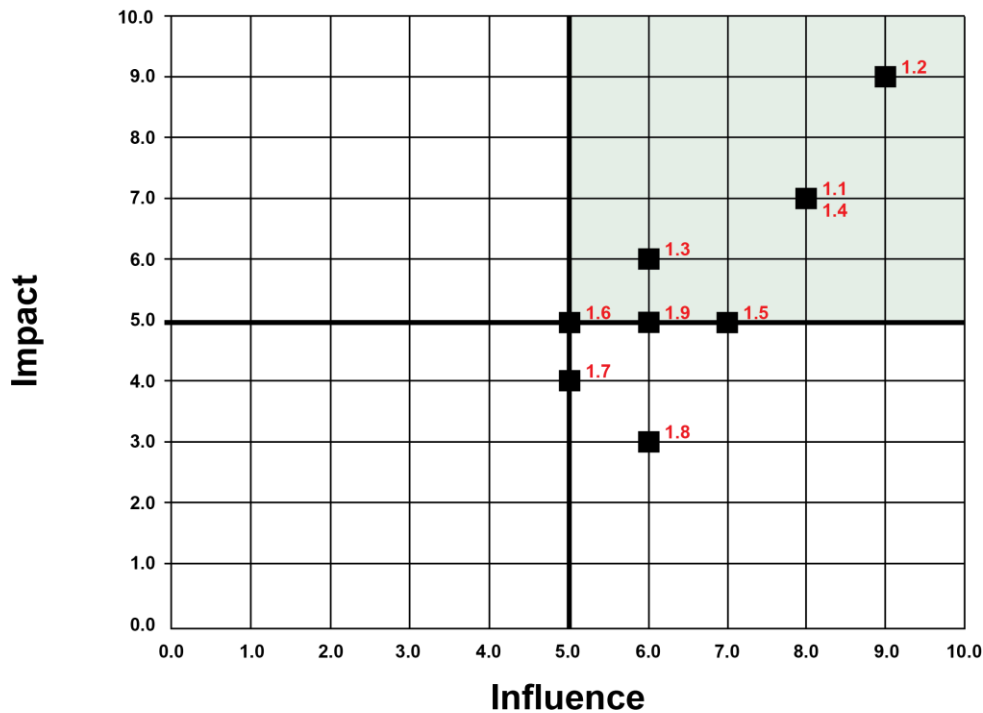


Figure 7.12. The scores of impact and influence tool employed to assess opportunities in Alianapo AN business

7.3.3. Impact Analysis Step

Eight Dimension Criteria: *Alianapo (AN) Project*

The benefit of increasing fish food was scored third highest score 7 and cost of not doing was given fifth highest score 5. Ease of implementing fish food obtained second lowest score 3 and the motivation of partners to implement obtained fourth highest score 6. The cost of implementation obtained first highest score 9 and risk obtained third highest score 7. Time to implement obtained fourth highest score 6 and term obtained fifth highest score 5 (Table 7.13).

The benefit of increasing water was scored second highest score 8. Cost of not doing was scored third highest, 7. Ease of increasing water was scored 6 and the cost was high, 9. Risk was also high, 9, time was in the middle and term was 6.

Table 7.13: Scores of selected opportunities from Eight Dimension Criteria for *Alianapo* AN project cycle 1

Criteria	Opportunity 1.1:	Opportunity 1.2:
	Increase fish food	Increase water
Benefit	7	8
Cost of not doing	5	7
Ease	3	6
Motivation	6	5
Positive Total	21	26
Cost	9	9
Risk	7	9
Time	6	5
Term	5	6
Negative Total	27	27

Eight Dimension Pinwheel Version: *Alianapo* (AN) Project

Increase water (1.2) had the curve further away from the middle line of the pinwheel on the right hand side than in increase fish food (1.1). On the left hand side the curve was higher in increasing water (1.2), although the opportunity would be costly with high risks and it would take long time to see the benefits (Figure 7.14). Partner selected to take both opportunities to the next step.

EIGHT DIMENSIONS PINWHEEL VERSION

AN: CYCLE 1

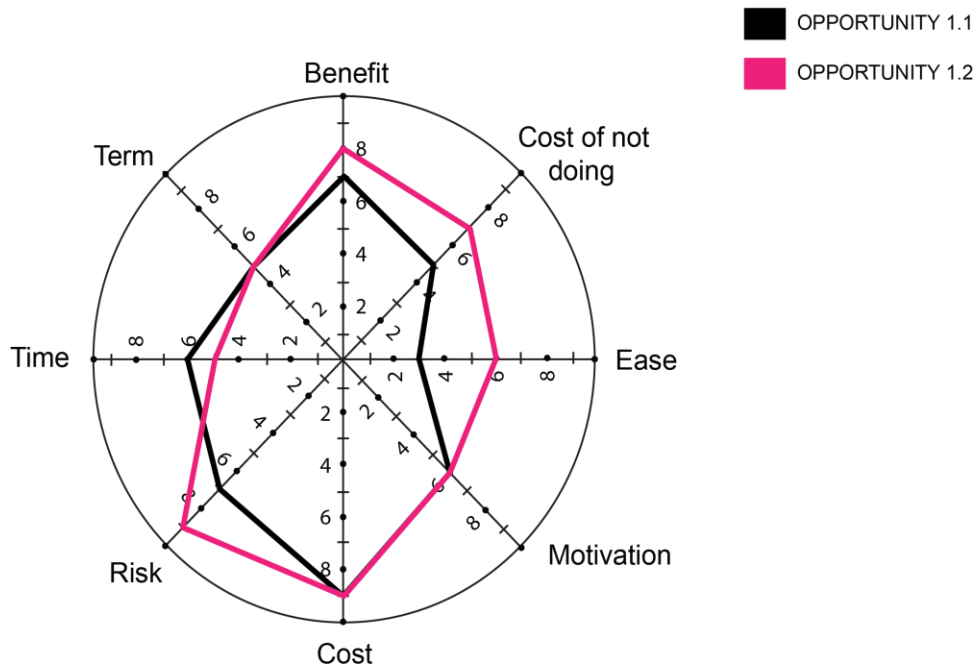


Figure 7.14. Scores for food and water on Eight Dimension Pinwheel Version of Alianapo AN project

Impact and Influence: ChikhudiniF (CF) Project

The impact of the opportunity of removing frogs (1.1) obtained fifth highest score 5 and influence obtained second highest score 8. The impact of increasing water (1.2) obtained third lowest score 4 and the influence obtained lowest score 1. The opportunity of increasing number of equipments (1.3) was having fourth highest impact 6 and third highest influence 7. The opportunity of increasing market access (1.4) obtained the first highest impact 9 and the highest influence score 10 (Figure 7.15).

IMPACT AND INFLUENCE AVERAGES

CF: CYCLE 1

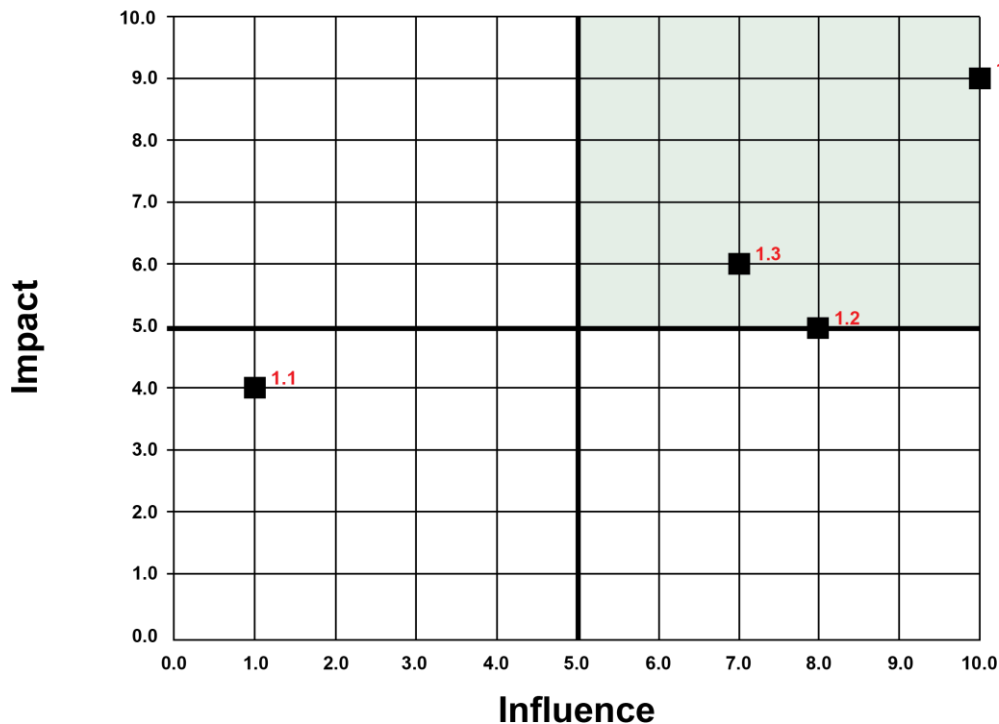


Figure 7.15. The scores of impact and influence tool employed to assess opportunities in ChikhudiniF CF project

Eight dimension Criteria: ChikhudiniF (CF) Project

Benefit obtained highest score 10 in the opportunity of increasing equipments (1.3) and second highest score 8 in obtaining market access (1.4) (see Table 7.14). The cost of not doing obtained fifth highest score 5 in both the opportunities. Ease of doing obtained fifth highest score 5 in increasing equipments and the lowest score 1 in market access. Motivation obtained highest score 10 in market access and first highest score 9 in obtaining equipments.

Cost was very high 10 in increasing equipments and 7 in market access. Risk was high 9 in increasing equipments and 5 in obtaining market. Time would be longer 10 for increasing equipments and in the middle 5 for obtaining market access. Term was longer 10 in increasing equipments and 6 in obtaining market.

The total positive score was 25/40 and negative dimension was 39/40 in increasing equipments (1.3); while in obtaining market (1.4) positive and negative dimension were 24/40.

Table 7.14: Scores of selected opportunities from Eight Dimension Criteria for *ChikhudiniF* CF project cycle 1

Criteria	Opportunity 1.3: Increase equipments	Opportunity 1.4: Market access
Benefit	10	8
Cost of not doing	5	5
Ease	5	1
Motivation	9	10
Positive Total	25	24
Cost	10	7
Risk	9	5
Time	10	6
Term	10	6
Negative Total	39	24

Eight Dimension Pinwheel Version: *ChikhudiniF* (CF) Project

In the opportunity of increasing number of equipments (1.3), the bell shape on the pinwheel was far away from the middle line on the left hand side than the right side indicating the negatives were higher than the positives. In the opportunity of market access (1.4) the bell shape was also further away from the middle line on the left hand side than the right hand side indicating higher negatives (Figure 7.16). Partner selected to take both opportunities further to the next step regardless of the higher negatives expected.

EIGHT DIMENSIONS PINWHEEL VERSION

CF: CYCLE 1

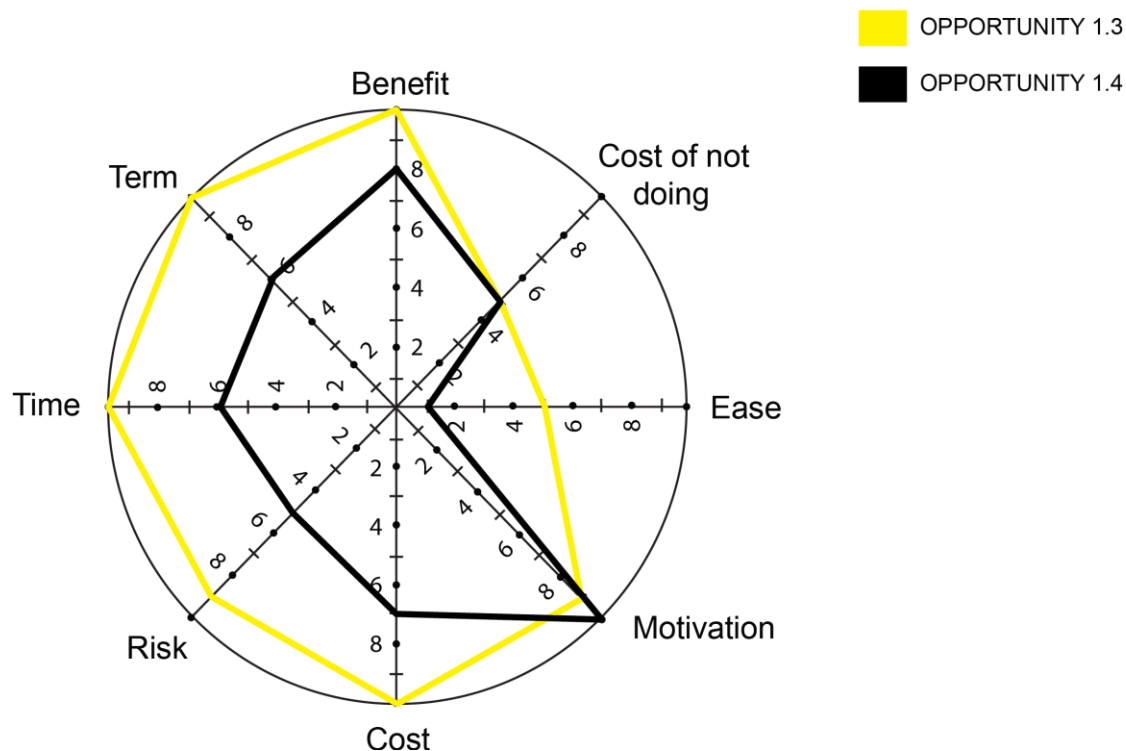


Figure 7.16. Scores for equipment and market on Eight Dimension Pinwheel Version for ChikhudiniF CF project

Impact and Influence: Funyufunyu (FF) Project

The opportunity of increasing fish food (1.1) obtained second highest impact and influence score 8. The impact of opportunity of increasing fingerlings (1.2) obtained fourth highest score 6 and third highest influence score 7. Decreasing variable costs (1.3) was given a third lowest impact score 4 and fourth highest influence score 6. The opportunity of increasing water (1.4) obtained third highest impact score 7 and second highest influence score 8. The opportunity of increasing equipments (1.5) obtained third highest in score 7 for both impact and influence. The impact 1.6 receiving knowledge had impact of 8 and influence of 3 (see Figure 7.17). Partners selected opportunity increase fish food (1.1) and opportunity to increase water (1.4) forward to the next step.

IMPACT AND INFLUENCE AVERAGES

FF: CYCLE 1

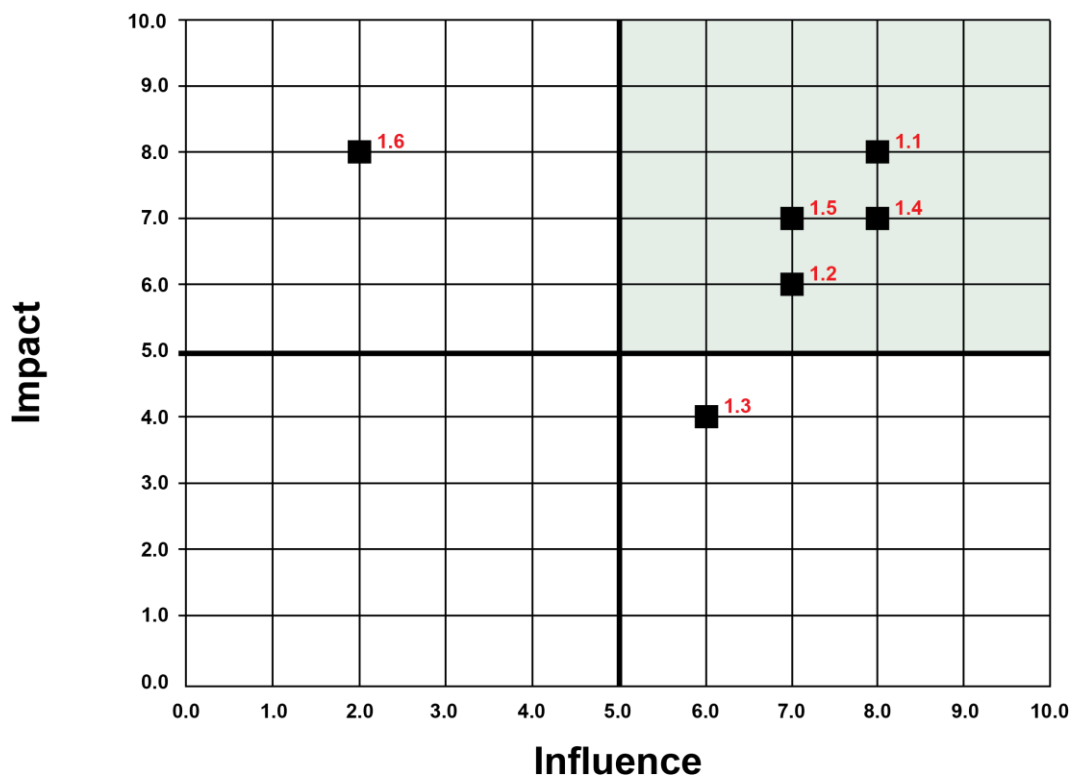


Figure 7.17. The scores of impact and influence tool employed to assess opportunities in Funyufunyu FF project

Eight Dimension Criteria: Funyufunyu (FF) Project

The benefit of implementing was given the second highest score 8 in both increasing food (1.1) and increasing water (1.4) (Table 7.15). Cost of not doing was scored third highest score 7 in increasing fish food and fourth highest score 6 in increasing water. Ease was scored second lowest score of 3 in increasing food and third lowest score 4 in increasing water. Motivation obtained first highest score 9 in increasing food and second highest score 8 in increasing water. Cost to implement was scored second highest score 8 in increasing fish food and third highest score 7 in increasing water. Risk obtained lowest score 1 in both opportunities. Time was fairly long in both opportunities with the third highest score 7. Term was in the middle in both opportunities with the fifth highest score of 5. Total positive score was 27/40 for fish food (1.1) and 26 in increasing water (1.2); while total negative dimension was 21/40 and 20/40 respectively.

Table 7.15: Scores of selected opportunities from Eight Dimension Criteria for FF project cycle 1

Criteria	Opportunity 1.1: Fish food	Opportunity 1.4: increase water
Benefit	8	8
Cost of not doing	7	6
Ease	3	4
Motivation	9	8
Positive Total	27	26
Cost	8	7
Risk	1	1
Time	7	7
Term	5	5
Negative Total	21	20

Eight Dimension Pinwheel Version: *Funyufunyu (FF) Project*

The scores from eight dimensions criteria table were further plotted on the eight dimension pinwheel version (Figure 7.18). The bell shape on the right hand side was similar in both increasing fish food (1.1) and increasing water (1.4), indicating that the positives were equal. On the left hand side of the pinwheel bell shape was equal in both opportunities, indicating the negatives were also the same. Partner selected to take both opportunities further to the next step.

EIGHT DIMENSIONS PINWHEEL VERSION FF: CYCLE 1

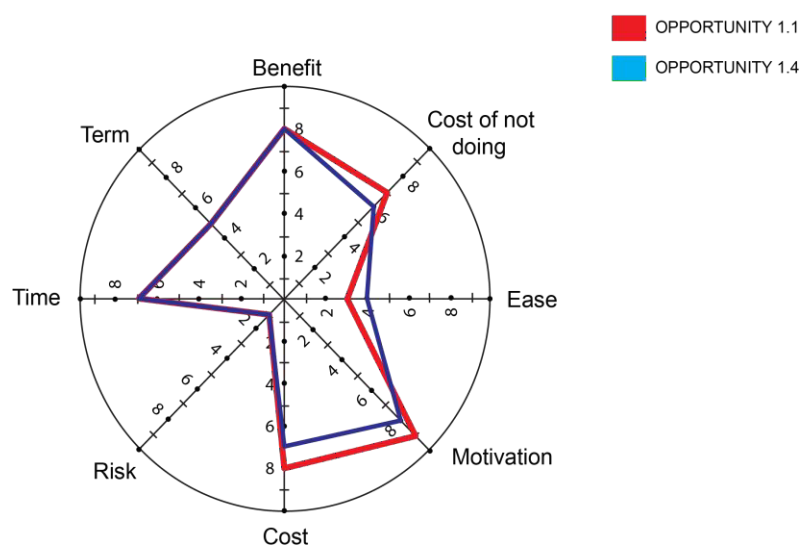


Figure 7.18. Scores for equipment and market on Eight Dimension Pinwheel Version for Funyufunyu FF project

Impact and Influence: *Fharanani FR Project*

Lack of food (1.1) had the highest impact and influence score 10; followed by lack of water (1.4) with the fourth highest impact score 6 and first highest influence score 9. Opportunity of no fencing (1.2) had fourth highest impact score 6 and second highest influence score 8 while the opportunity of predation (1.3) had fourth highest impact score 6 and second highest influence score 8 (Figure 7.19).

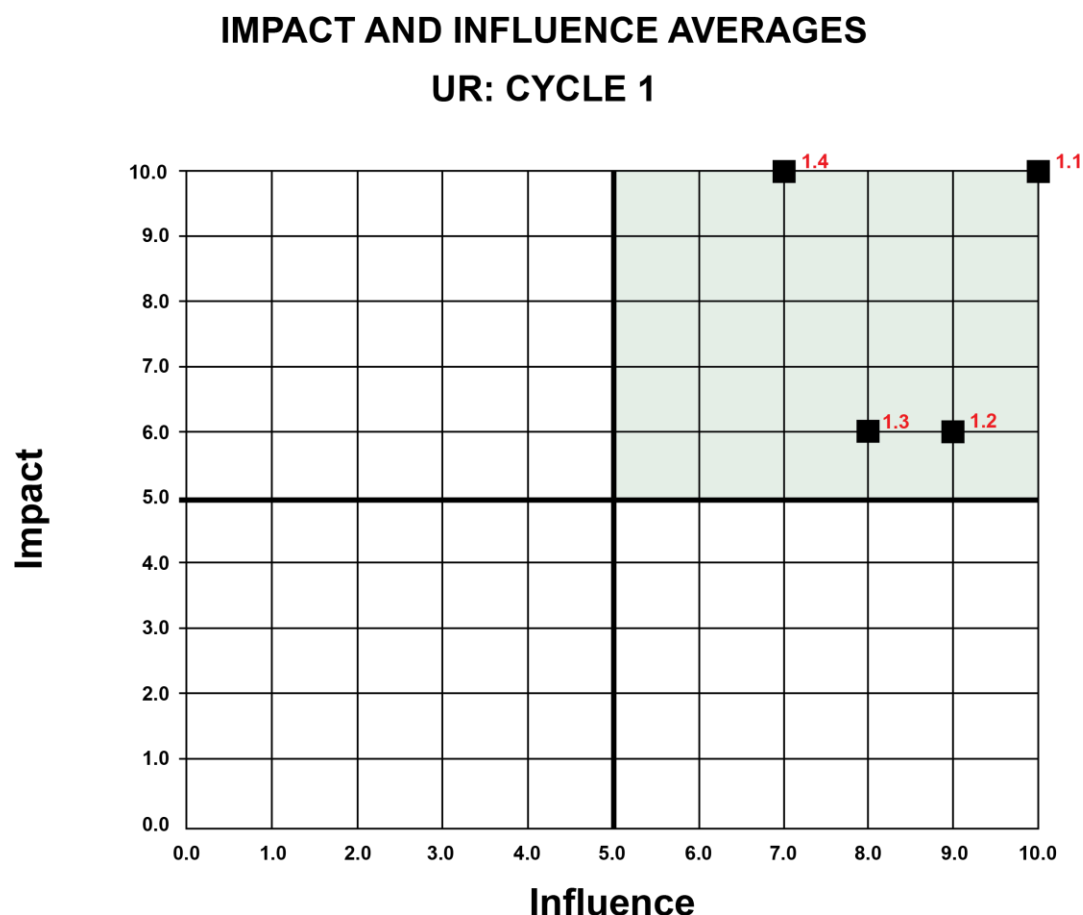


Figure 7.19. The scores of impact and influence tool employed to assess opportunities in *Fharanani FR project*

Eight Dimension Criteria: *Fharanani FR Project*

Benefit was high with the second highest score 8 for increasing fish food (1.1) and fifth highest score 5 for predation (1.4). Cost of not doing obtained second highest score 8 in fish food and third highest score 7 for predation. It would be easy to implement fish food with a fourth highest score of 6 than predation with a fifth highest score of 5. Motivation was more in implementing fish food with the second highest score 8 than implementing predation with the fourth highest score of 6. Cost of implementation obtained fourth highest score 6 in both opportunities. Risk was high in predation with the third highest score 7 than fish food with the fourth highest score of 6. Time to implement would be slightly long in preventing predation

with the fourth highest score 6 than in increasing fish food with the fifth highest score of 5 (see Table 7.16).

The total score for positive dimension was 29/40 in fish food (1.1) and 23/40 in predation (1.4). The total score for negative dimension was 25/40 in predation and 22/40 in increasing fish food.

Table 7.16: Scores of selected opportunities from Eight Dimension Criteria for Fharanani FR project cycle 1

Criteria	Opportunity 1.1: Fish food	Opportunity 1.4: Predation
Benefit	8	5
Cost of not doing	8	7
Ease	6	5
Motivation	8	6
Positive Total	29	23
Cost	6	6
Risk	6	7
Time	5	6
Term	5	6
Negative Total	22	25

Eight Dimension Pinwheel Version: *Fharanani FR Project*

The eight dimension criteria table scores were plotted on the eight dimension pinwheel version. Opportunity of increasing fish food (1.1) had bigger bell shape on the right hand side of the pinwheel and smaller bell shape on the left hand side, indicating that positives were higher than negatives. Increase of water (1.2) had smaller bell shape both on the left and the right hand side of the pinwheel, indicating that negatives were higher than positive. The best option to continue implementing was increasing fish food (see Figure 7.20)

EIGHT DIMENSIONS PINWHEEL VERSION

UR: CYCLE 1

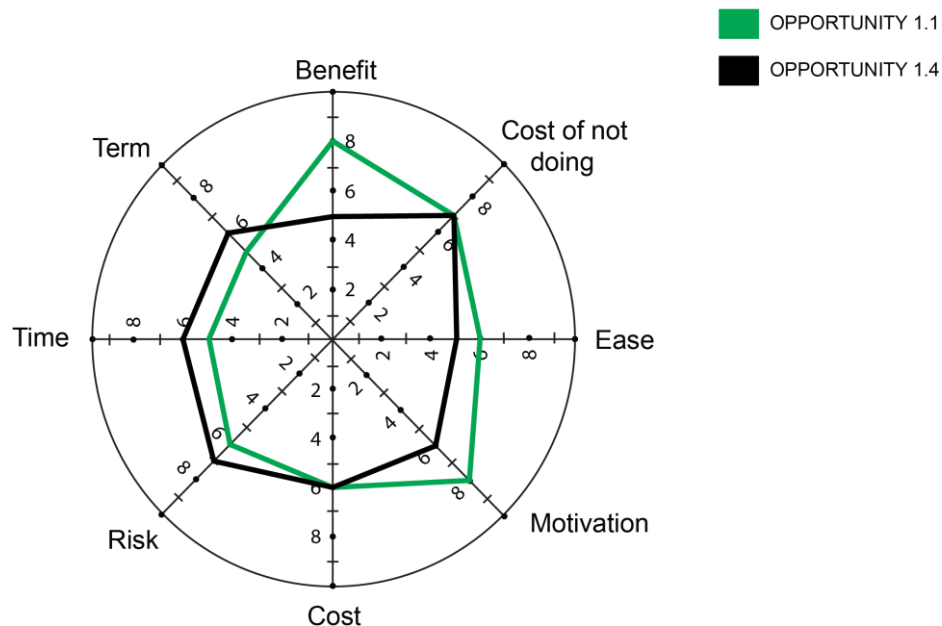


Figure 7.20. Scores for equipment and market on Eight Dimension Pinwheel Version for Fharanani FR project

Mutale Group

Impact and Influence: Tshaundi Tshelwala (TT) Project

Opportunity of removing frogs (1.1) had second highest impact score 8 and highest influence score 10. Increasing water (1.2) had highest impact 10 and third highest influence score 7. Increasing ponds (1.3) scored second highest impact 8 and third highest influence 7. Increasing number of equipments (1.4) had third highest impact 7 and fifth highest influence score 5. The impact and influence of obtaining fish nets (1.5) were in the middle with the fifth highest score 5. The opportunity of increasing food (1.6) had second highest impact score 8 and first highest influence score 9. The opportunity of obtaining market access (1.7) had third highest impact score 7 and second highest influence score 8. The scores were plotted on the impact and influence electronic spreadsheet and the results showed that increasing water (1.2); increasing ponds (1.3) and obtaining market access (1.7) had high impact and influence over implementation (Figure 7.21).

IMPACT AND INFLUENCE AVERAGES

TT: CYCLE 1

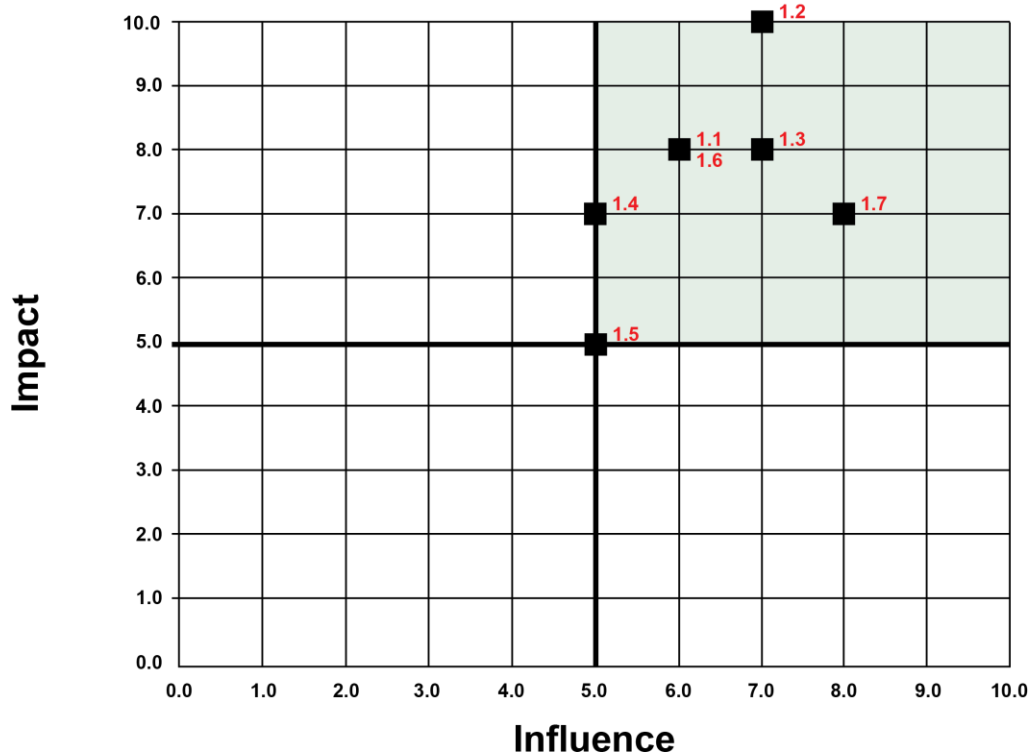


Figure 7.21. The scores of impact and influence tool employed to assess opportunities in Tshaundi Tshelwala TT project

Eight Dimension Criteria: Tshaundi Tshelwala (TT) project

Opportunity of increasing water (1.2) and increasing ponds (1.3) were assessed on eight dimension criteria tool on a scale of 1-10 (1=low; 10=high). The results showed that benefit was high with second highest score of 8 in water access (1.1) and fifth highest score 5 in increasing ponds (1.3). The cost of not doing obtained second highest score 8 in water access and third highest score 7 in increasing ponds. Ease obtained fourth highest score of 6 in water access and fifth highest score of 5 in pond construction. Motivation obtained second highest score of 8 in water access and fourth highest score 6 in pond construction. Total score for positive dimension was 30/40 in water access and 23/40 in increasing ponds.

Cost obtained fourth highest score 6 in both water access (1.2) and increasing ponds (1.3). Risk obtained third highest score 7 in pond construction and fourth highest score 6 in water access. Time to implement and term were slightly longer in both pond construction with fourth highest score 6 and fifth highest score 5 in water access. Total score for negative dimension was 25/40 in increasing ponds and 22/40 in water access (see Table 7.17).

Table 7.17: Scores of selected opportunities from Eight Dimension Criteria for Tshaundi Tshelwala TT project cycle 1

Criteria	Opportunity 1.2: Water access	Opportunity 1.3: Pond construction
Benefit	8	5
Cost of not doing	8	7
Ease	6	5
Motivation	8	6
Positive Total	30	23
Cost	6	6
Risk	6	7
Time	5	6
Term	5	6
Negative Total	22	25

Eight Dimension Pinwheel Version: *Tshaundi Tshelwala (TT) Project*

The scores from eight dimension criteria were plotted on eight dimension pinwheel version. The pinwheel showed that water access (1.2) had bigger bell shape on the right and left hand side indicating high positives and negatives. Increasing ponds (1.3) had smaller bell shape on the right indicating low positives and bigger bell shape on the left indicating high negatives. The best option to be taken further was opportunity water access (1.1), however, partners selected to continue with both the opportunities to action step (Figure 7.22).

EIGHT DIMENSIONS PINWHEEL VERSION

TT: CYCLE 1

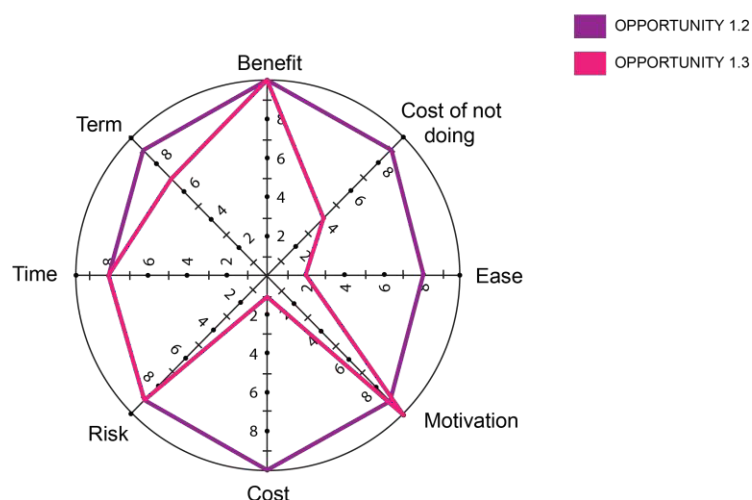


Figure 7.22. Scores for equipment and market on Eight Dimension Pinwheel Version for Tshaundi Tshelwala TT project

Impact and Influence: *Makhura (MK) Project*

The opportunity of removing frogs (1.1) had first highest impact score 9 and fifth highest influence score 5. The opportunity of increasing water (1.2) had third lowest impact score 4 and first lowest influence score 2. Opportunity of increasing food (1.3) scored second highest impact score 8 and second lowest influence score 2. Opportunity of increasing number of equipments (1.4) had third lowest impact score 4 and second highest influence score 8. The impact of market access (1.5) was in the middle with fifth highest score 5 and fourth highest influence score 6. The opportunity of preventing theft (1.6) had first highest impact score 9 and third highest influence score 7. Opportunity predation (1.7) was given both first highest impact and influence score 9. The scores were plotted on the impact and influence electronic spreadsheet see (Figure 7.23). Opportunity of preventing theft (1.6) and preventing predation (1.7) were taken further to the next step due to high scores on impact and influence.

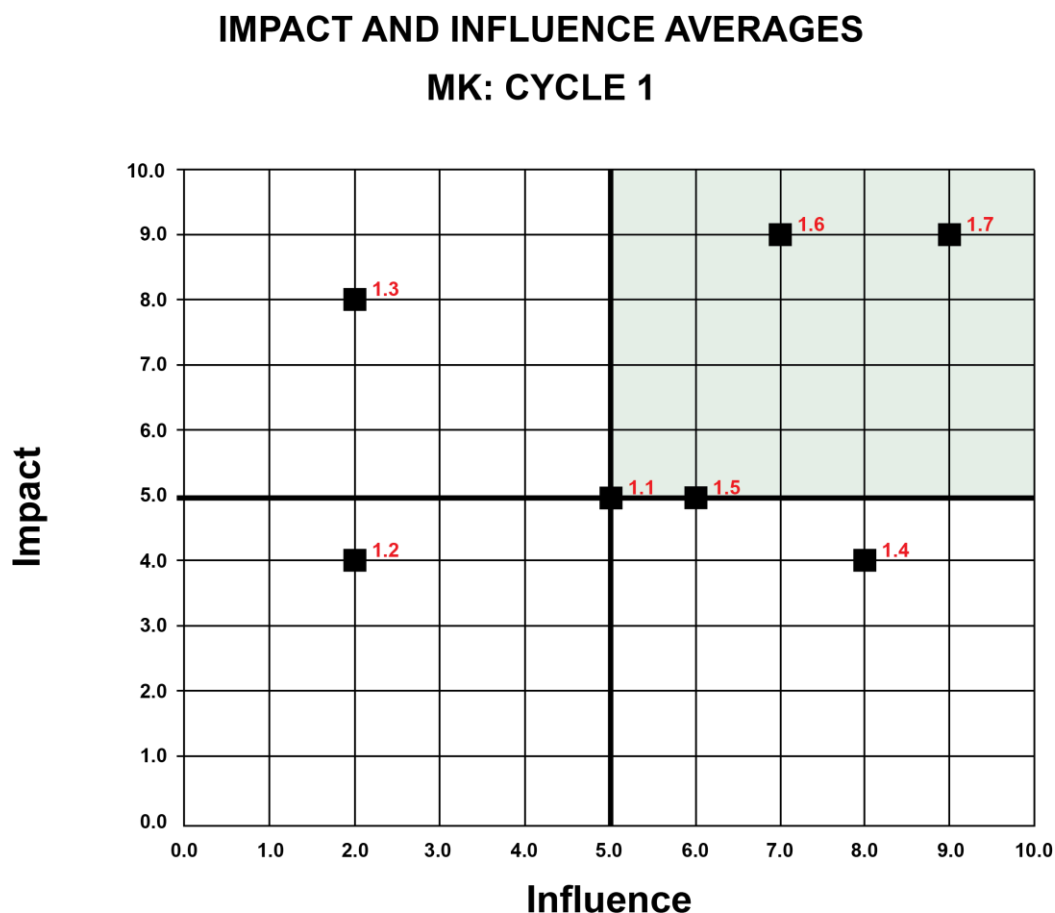


Figure 7.23. The scores of impact and influence tool employed to assess opportunities in Makhura MK project

Eight Dimension Criteria: *Makhura (MK) Project*

Preventing theft (1.6) and preventing predation (1.7) were assessed on eight dimension criteria on a scale from 1-10 (1=low; 10=high). Benefit obtained highest score 10 for preventing theft (1.6) and preventing predation (1.7). The cost of not doing was high in preventing theft with the second highest score 8 and fourth highest score 6 in preventing predation. Ease obtained first highest score 9 in preventing theft and second lowest score 3 in preventing predation. Motivation obtained first highest score of 9 in preventing theft and third highest score 7 in preventing predation. Total score for positive dimension 36/40 for preventing theft and 27/40 for preventing predation.

Cost obtained highest score 10 for both preventing theft (1.6) and preventing predation (1.7). Risk obtained third highest score 7 in theft and second highest score 8 in predation. Time to implement was longer in theft with the first highest score 9 and second highest score 8 in predation. Term obtained first highest score 9 for theft and third highest score 7 for predation. Total score for negative dimension was 33/40 for theft and 25/40 for predation (see Table 7.18).

Table 7.18: Scores of selected opportunities from Eight Dimension Criteria for *Makhura MK project cycle 1*

Criteria	Opportunity 1.6: Theft	Opportunity 1.7: Predation
Benefit	10	10
Cost of not doing	8	6
Ease	9	3
Motivation	9	7
Positive Total	36	27
Cost	10	2
Risk	7	8
Time	9	8
Term	9	7
Negative Total	33	25

Eight Dimension Pinwheel Version: *Makhura (MK) Project*

The eight dimension scores from the previous table were plotted on eight dimension pinwheel version. Opportunity of preventing theft (1.6) had a bigger bell on the right and left hand side of the pinwheel indicating high positives and high negatives. Opportunity of

preventing predation (1.7) had a smaller bell shape on the right and bigger bell shape on the left hand side of the pinwheel indicating high negatives during implementation. According to pinwheel, the best option to be taken further was preventing predation (1.7), however, partners selected to continue with both the opportunities to action step (Figure 7.24).

EIGHT DIMENSIONS PINWHEEL VERSION

MK: CYCLE 1

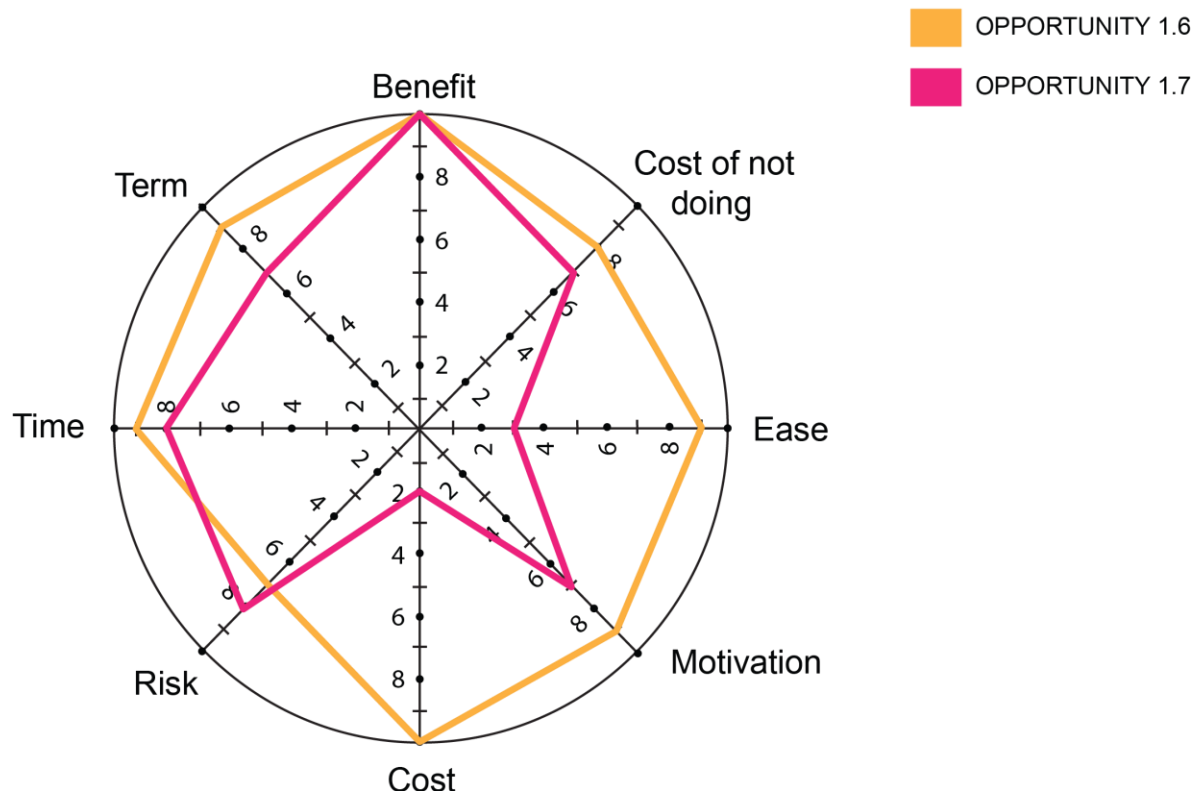


Figure 7.24. Scores for theft and predation on Eight Dimension Pinwheel Version for Makhura MK project

Impact and Influence: Mudau (MA) Project

The impact and influence of increasing fish food (1.1) both obtained first highest score 9. The impact and influence of creating storage facility (1.2) both obtained second highest score 8. Opportunity of improving catfish skills (1.3) obtained first highest score 9 on both impact and influence. Opportunity of obtaining finance (1.4) obtained fourth highest score of 6 for both impact and influence. The opportunities with high impact and influence were increasing fish food (1.1) and breeding skills (1.3) (Figure 7.25).

IMPACT AND INFLUENCE AVERAGES

MA: CYCLE 1

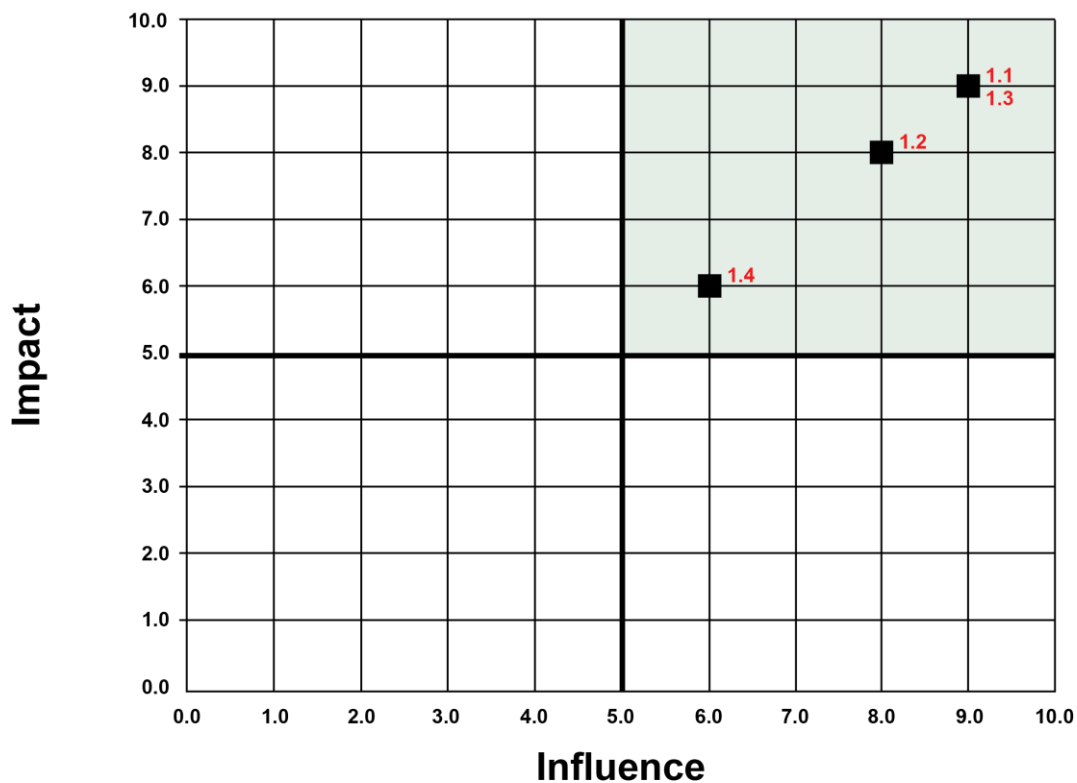


Figure 7.25. The scores of impact and influence tool employed to assess opportunities in Mudau MA project

Eight Dimension Criteria: Mudau (MA) Project

Increasing fish food (1.1) and breeding skills (1.3) were assessed on eight dimension criteria from 1-10 (1=low; 10=high). Benefit obtained highest score of 10 in the opportunity of increasing fish food and opportunity of breeding skills. Cost of not doing obtained second highest score 8 in increasing fish food and fourth highest score of 6 in breeding skills. Ease obtained first highest score of 9 in increasing fish food and second lowest score 3 in breeding skills. Motivation obtained first highest score 9 in increasing fish food and a score of 7 in breeding skills. Total score for positive dimension was 36/40 in fish food and 27/40 in breeding skills.

It would be very costly to implement the opportunity of increasing fish food with the highest score of 10 and not so costly to improve breeding skills with the first lowest score 2. Risk obtained third highest scored 7 in fish food and second highest score 8 in breeding skills. Time was longer in fish food with the first highest score 9 and second highest score 8 for breeding skills. Term was high with first highest score 9 in fish food and third highest score 7

in breeding skills. Total score for negative dimension was 33/40 for fish food and 23/40 for breeding skills (Table 7.19).

Table 7.19: Scores of selected opportunities from Eight Dimension Criteria for Mudau MA project cycle 1

Criteria	Opportunity 1.1: Fish food	Opportunity 1.3: Breeding skills
Benefit	10	10
Cost of not doing	8	6
Ease	9	3
Motivation	9	7
Positive Total	36	27
Cost	10	2
Risk	7	8
Time	9	8
Term	9	7
Negative Total	33	25

Eight Dimension Pinwheel Version: *Mudau (MA) Project*

The scores from the eight dimensions criteria table were plotted on the eight dimension pinwheel version. On the right hand side of the pinwheel, the bell shape of increasing fish food (1.1) was bigger than the bell shape of improving breeding skills (1.3). On the left side of the pinwheel, the bell shape was bigger on increasing food than in breeding skills. Both of the opportunities were taken further to the next step (Figure 7.26).

**EIGHT DIMENSIONS PINWHEEL VERSION
MA: CYCLE 1**

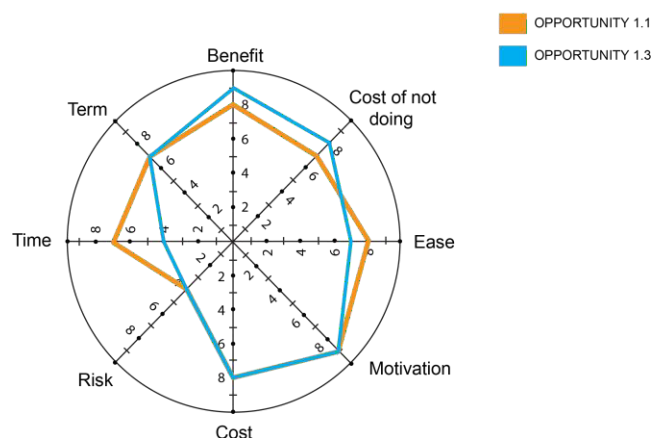


Figure 7.26. Scores for theft and predation on Eight Dimension Pinwheel Version for MA project

Impact and Influence: *Nemutamba (NT) Project*

Partners assessed the level of impact and influence on a scale from 1-10 (1=low; 10=high) towards achieving the goal. Opportunity of increase fish food (1.1) obtained highest impact and influence 10. Opportunity of strengthening pond wall (1.2) obtained highest impact and influence 10. The impact of preventing theft (1.3) scored highest impact and influence 10. Opportunity of installing fence (1.4) around the business scored second highest impact 8 and first highest influence 9. Opportunity of improving security (1.5) around the ponds obtained second highest impact 8 first highest influence 9. Impact of covering ponds (1.6) with a net obtained highest score 10 and second highest influence score 8. Opportunity of hiring a security guard (1.7) had third highest impact 7 and fifth highest influence score 5. Opportunity of improving market access (1.8) scored highest impact and influence 10. Increasing fish food (1.1); strengthening pond wall (1.2) and hiring a security guard (1.7) had the highest impact and influence according to the electronic spread sheet (Figure 7.27).

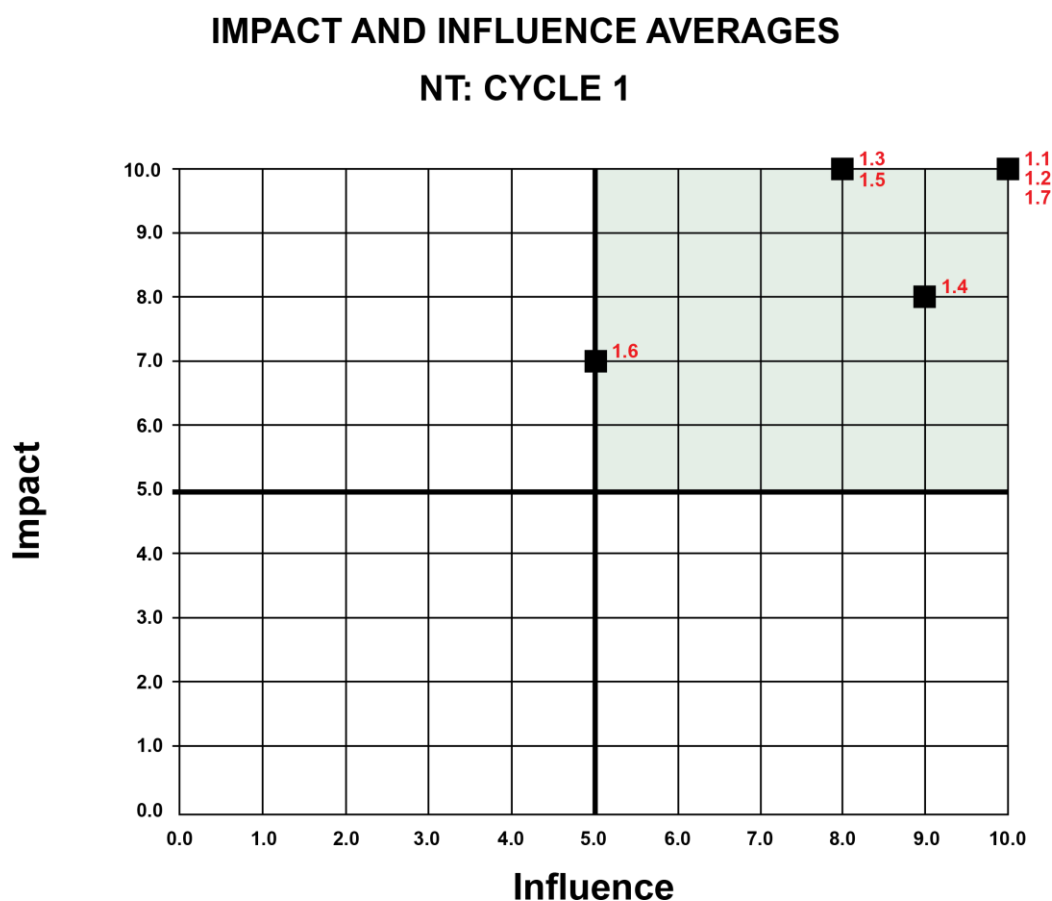


Figure 7.27. The scores of impact and influence tool employed to assess opportunities in *Nemutamba NT project*

Eight Dimension Criteria: *Nemutamba (NT) Project*

The benefit of accessing fish food (1.1) obtained third highest score 7 and preventing theft (1.3) obtained second highest score 8. Cost of not doing scored first highest score 9 on fish food and second highest score 8 on preventing theft. Ease obtained second lowest score 3 in fish food and fifth highest score 5 in preventing theft. Motivation of implementing both fish food and preventing theft obtained second highest score 8. Total score for positive dimension was 27/40 in fish food and 31/40 in preventing theft.

Cost obtained first highest score 9 in fish food and second highest score 8 in preventing theft. Risk was scored first lowest score 2 in fish food and second highest score 8 in preventing theft. Time was long in fish food with the second highest score 8 and fourth highest score 6 in preventing theft. Term was in the middle in both opportunities with the fifth highest score 5. Total score for negative dimension was 24/40 in fish food and 28/40 in preventing theft (Table 7.20).

Table 7.20: Scores of selected opportunities from Eight Dimension Criteria for Nemutamba NT project cycle 1

Criteria	Opportunity 1.1: Fish food	Opportunity 1.3: Prevent theft
Benefit	7	8
Cost of not doing	9	8
Ease	3	5
Motivation	8	8
Positive Total	27	31
Cost	9	8
Risk	2	8
Time	8	6
Term	5	5
Negative Total	24	28

Eight Dimension Pinwheel Version: *Nemutamba (NT) Project*

The scores from eight dimension criteria table were further plotted on pinwheel version (Figure 7.28). Opportunity of increasing fish food (1.1) had bigger bell shape on the right and left side of the pinwheel indicating high positives and negatives. Opportunity of improving theft (1.3) had a bigger bell shape on the right and left side indicating high positives and negatives. The opportunities were taken further to action step.

EIGHT DIMENSIONS PINWHEEL VERSION

NT: CYCLE 1

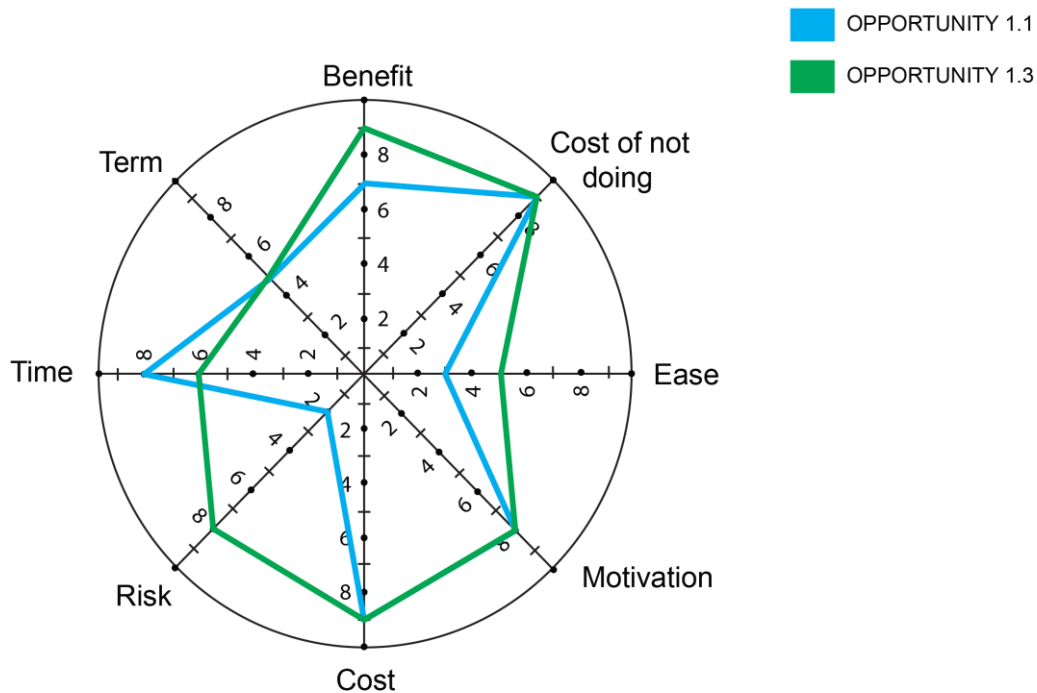


Figure 7.28. Scores for theft and predation on Eight Dimension Pinwheel Version for Nemutamba NT project

Impact and Influence: Ukhadzilito (UK) Project

The impact of increasing fish food (1.1) was given highest score 9 and influence was given second highest score 8. The impact and influence of improving ponds (1.2) were given third highest score 7. Access to water (1.3) achieved an impact with fourth highest score 6 and second highest influence score 8. The opportunity of preventing predation from birds (1.4) was scored third highest impact score 7 and first highest influence score 9. Market access (1.5) achieved third highest impact score of 7 and first highest influence score 9. The impact of netting fish (1.6) obtained fourth highest score 6 and second highest influence score 8. The opportunity of removing frogs (1.7) achieved second highest impact score 8 and first highest influence score 9. The opportunities were plotted on the electronic spreadsheet and increase fish food (1.1) and market access (1.5) had the highest impact and influence (see Figure 7.29).

IMPACT AND INFLUENCE AVERAGES

UK: CYCLE 1

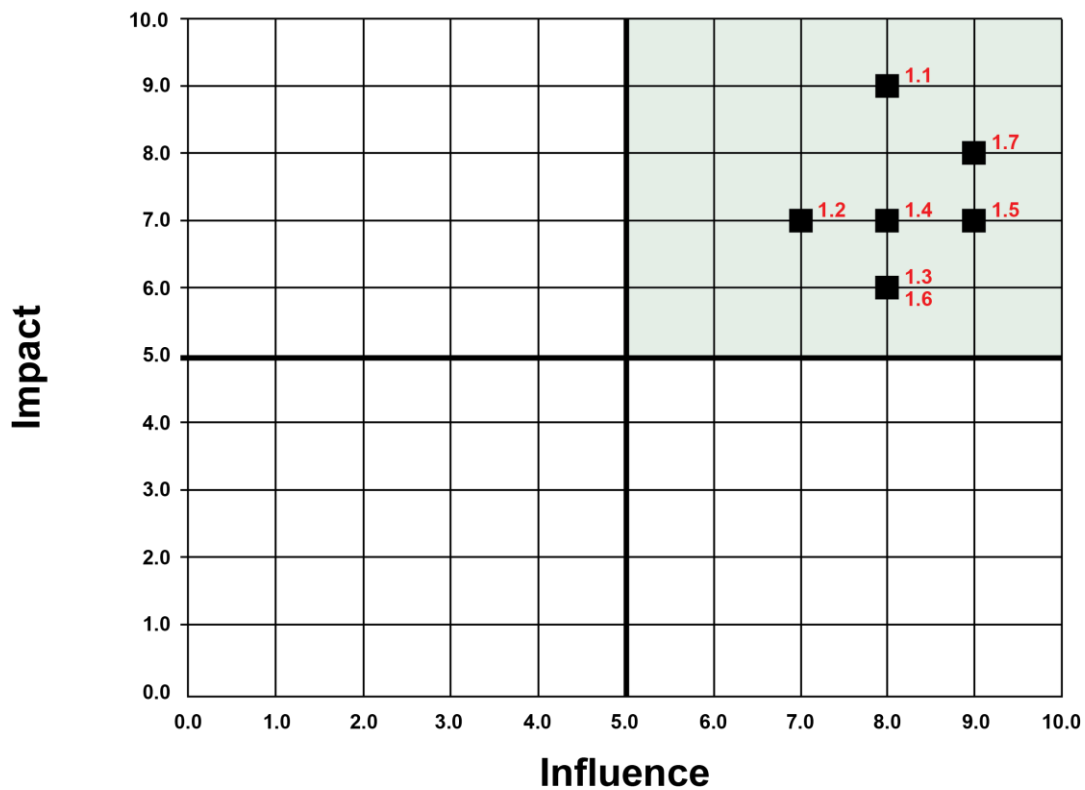


Figure 7.29. The scores of impact and influence tool employed to assess opportunities in Ukhadzilito UK project

Eight Dimension Criteria: Ukhadzilito (UK) Project

The selected opportunities were assessed on a scale from 1-10 on eight dimensions criteria. Benefit of market access (1.1) obtained third highest score 7 and lowest score 1 in fish food. Cost of not doing achieved second highest score 8 for both increasing fish food and market access. Ease was scored fifth highest score 5 for increasing fish food and fourth highest score 6 for market access. Motivation was given first highest score 9 in fish food and highest score 10 in market access. Total score for positive dimension was 23/40 for increasing fish food and 31/40 for market access.

Cost to implement was scored highest score 10 in market access and second highest score 8 in fish food. Risk obtained third highest score 7 in increasing fish food and second highest score 8 in market access. Time was scored fourth highest score 6 in market access and third lowest score 4 in increasing fish food. Term to see the benefits from implementation was given first highest score of 9 in market access and fourth highest score of 6 in increasing fish food. The total score for negative dimension was 25/40 in fish food and 33/40 in market access (see Table 7.21).

Table 7.21: Scores of selected opportunities from Eight Dimension Criteria for Ukhadzilito UK project cycle 1

Criteria	Opportunity 1.1: Fish food	Opportunity 1.5: Market access
Benefit	1	7
Cost of not doing	8	8
Ease	5	6
Motivation	9	10
Positive Total	23	31
Cost	8	10
Risk	7	8
Time	4	6
Term	6	9
Negative Total	25	33

Eight Dimension Pinwheel Version: *Ukhadzilito (UK) Project*

Eight dimension criteria scores were plotted on the eight dimension pinwheel version. The pinwheel showed that opportunity of market (1.5) had a bigger bell shape on the right and left hand side indicating high positives and negatives. Opportunity of increasing fish food (1.1), the bell shape was smaller on both the right and left hand side indicating low positives and negatives. Increasing fish food (1.1) was taken further to the next step (See Figure 7.30).

EIGHT DIMENSIONS PINWHEEL VERSION

UK: CYCLE 1

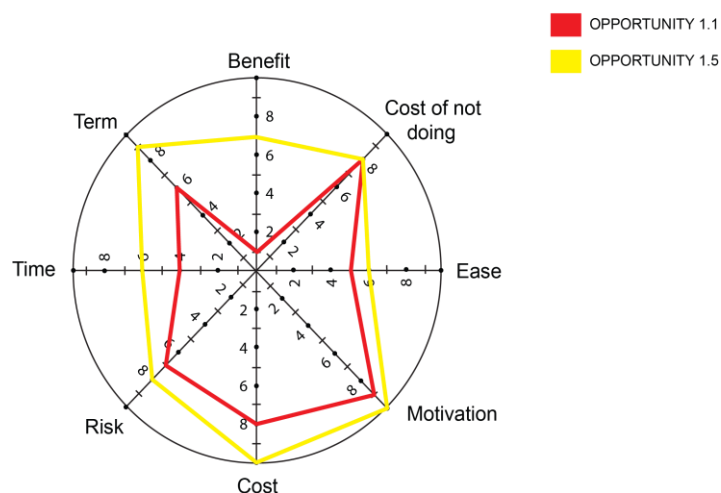


Figure 7.30. Scores for food and market on Eight Dimension Pinwheel Version for Ukhadzilito UK project

Impact and Influence: *TshitakholeRL (TRL) Project*

The opportunities developed from the previous step were assessed on a scale of 1-10 for the level of impact and influence towards achieving the goal. The opportunity of water access (1.1) scored highest impact and influence score 9. The opportunity of constructing ponds (1.2) obtained third highest impact score 7 and second highest influence score 8. The opportunity of obtaining equipments (1.3) achieved third lowest impact score 4 and third highest influence score 7. The impact of obtaining funding (1.4) achieved third highest score 7 and fourth highest influence score 6. The impact of market access (1.5) achieved fourth highest score 6 and second highest influence 8. Fencing (1.6) achieved fifth highest impact score 5 and third highest influence score of 7. Increase food (1.7) scored fifth highest impact and influence score 5 (Figure 7.31).

IMPACT AND INFLUENCE AVERAGES

TRL: CYCLE 1

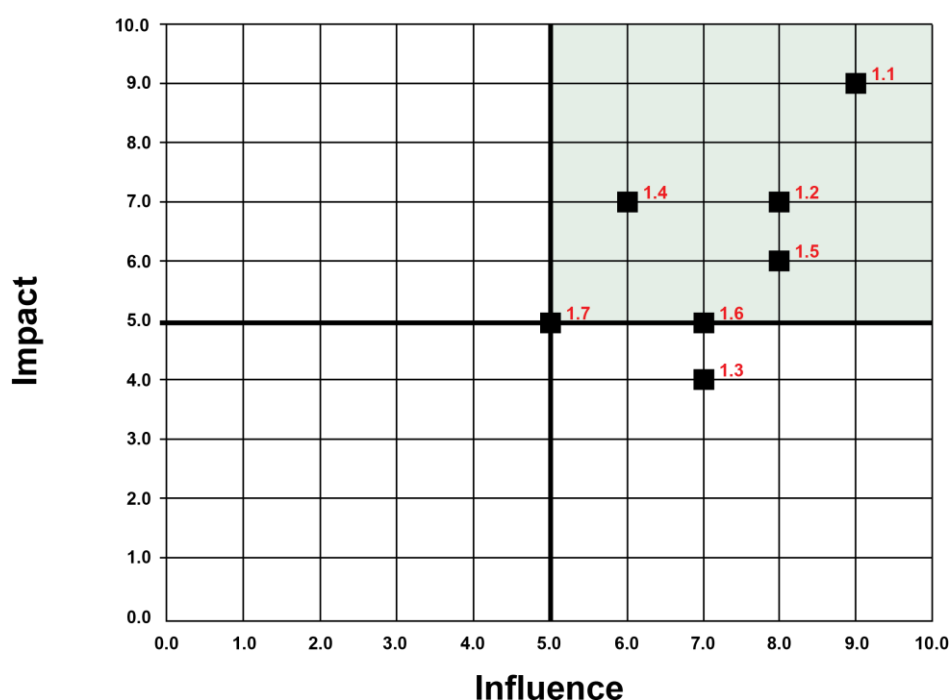


Figure 7.31. The scores of impact and influence tool employed to assess opportunities in *TshitakholeRL TRL project*

Eight Dimension Criteria: *TshitakholeRL TRL Project*

The selected opportunities were assessed on a scale from 1-10 on eight dimensions criteria. The opportunity of water access (1.1) achieved first highest benefit score 9 and third highest score 7 for constructing ponds. The cost of not doing obtained second highest score 8 in both water access and construction ponds. Ease obtained third highest score 7 in water access and second highest score 8 for pond construction. Motivation was high in water

access with the second highest score 8 and third highest score 7 for pond construction. Total score for positive dimension was high in water access 32/40 and lower in pond construction 30/40.

Cost was high with second highest score 8 in both water access and pond construction. Risk obtained lowest score 1 for water access and fourth highest score 6 for pond construction. Time to implement was longer in pond construction with the third highest score 7 and slightly shorter in market access with fourth highest score 6. Term was shorter with fourth highest score 6 in market access and longer with second highest score 8 in pond construction. Total score for negative dimension was high in pond construction 29/40 and low in market access 22/40 (Table 7.22).

Table 7.22: Scores of selected opportunities from Eight Dimension Criteria for TshitakholeRL TRL project cycle 1

Criteria	Opportunity 1.1: Water access	Opportunity 1.2: Construct ponds
Benefit	9	7
Cost of not doing	8	8
Ease	7	8
Motivation	8	7
Positive Total	32	30
Cost	8	8
Risk	1	6
Time	6	7
Term	6	8
Negative Total	22	29

Eight Dimension Pinwheel Version: *TshitakholeRL TRL Project*

The bell shape was bigger on the right in opportunity of water access (1.1) and closer to the middle line in opportunity of pond construction (1.2). On the left side, the bell shape was bigger in pond construction and closer to the middle line in market access. Water access and pond construction were taken further to the next step (see Figure 7.32).

EIGHT DIMENSIONS PINWHEEL VERSION

TRL: CYCLE 1

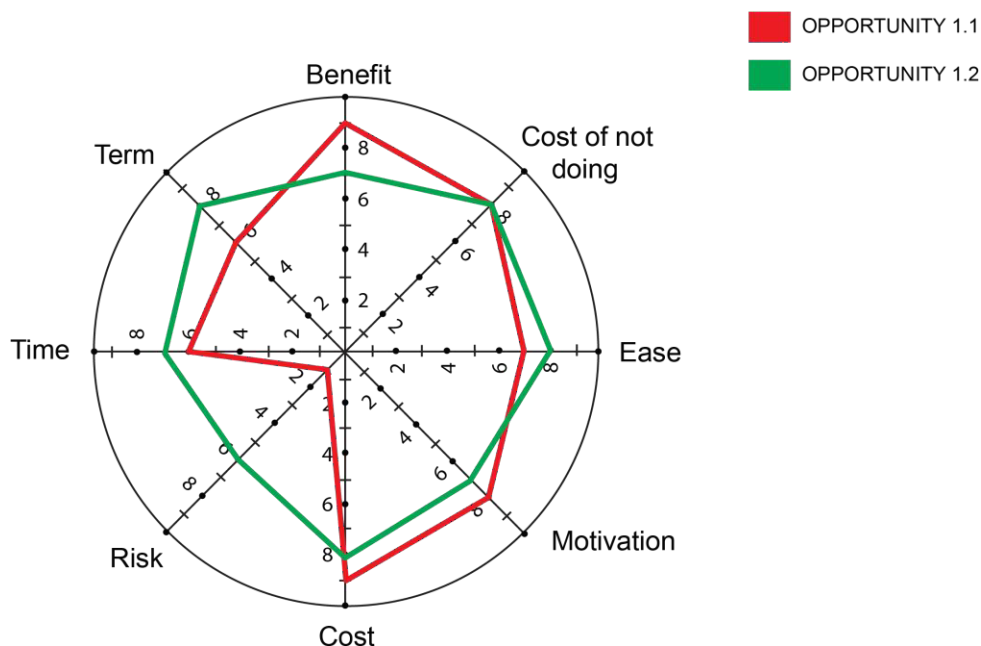


Figure 7.32. Scores for food and market on Eight Dimension Pinwheel Version for TshitakholeRL TRL project

7.3.4. Action Design Step

Tladinga (TD) Project

Partners in this project selected to improve technical skills in terms of catfish farming. Partners would revise the culture of catfish manual, select chapters to study, organize sessions and report. Researcher would organize training on catfish breeding in local College of Agriculture and the local Aquaculture Breeding Station. Items such as equipments for fish dissection and training venue would also be organized by partners (Table 7.23).

Table 7.23: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Tladinga TD project Cycle 1

Opportunity	CSFs	KPIs	KAs
Improve technical Skills in catfish farming	Reading training manuals Training by Extension Officer (EO) Practical breeding training Training equipment Training venue	manual Attendance register, assessment form Attendance register/ Assessment form Proof of purchase/ borrowing agreement Security daily register	Researcher would forward manual to TD05 “the culture of catfish” and make copies of the chapters Researcher would liaise with the local college to offer training to partners Organize with Extension Officer (EO) to find out when would she breed, request EO for transport to Turfloop breeding station, Liaise with aquaculture manager to ask for nets and protective clothing Organize training venue

Phetwane (PT) Project

In this project, partners selected to design the action on the opportunity to obtain market access of catfish (Table 7.24). Partners would design the pamphlets to distribute to the community regarding selling fish. Partners would organize to attend training on breeding catfish. Researcher and partners would design a market survey to administer to the community in order to improve local market. Partners would purchase equipments, harvesting nets and office equipments.

Table 7.24: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Phetwane PT project Cycle 1

Project number	Opportunities	CSFs	KPIs	KAs
PT project	Obtain market access	Record keeping.	Books. Post pamphlets Email confirmation	Meeting to access the record and update; design pamphlets, meeting to access the pamphlets. Apply for funding. Networking with funders. Observing the dams and requirements
		Advertising		
		More fish	Quotation and delivery notes;confirmation from Extension Officer	Email, liaise with local breeding station regarding availability of catfish, Discuss with extension officers
		Transport		
		Market survey	Survey pamphlets Email	Compile a market survey for local community. Process the fish at the project
		Processing and harvesting	Cash slips, quotations, cashslips	Ask for harvesting and obtain quotations
		g equipment,fridge		
		ITC resource	Quotations, cashslip	Obtain quotationof laptop andstationery
		Dirty water	Improved water quality	Test the water from the fish
		Inlet/outlet pipes	Cash slip	To fit inlet/outlet pipes on the ponds

Makhado and Mutale projects

Opportunity of increasing alternative fish food was selected to design action. Alternative food such as chicken droppings, earthworms, chicken intestines, pig waste, cow dung and mulberry would be locally collected and fed on the catfish to assess growth performance.

Tshaundi Tshelwala (TT) and Alianapo (AN), Tshaundi Tshelwala TT and Alianapo (AN) Projects; this projects embarked on increasing water availability by obtaining water license from chieftaincy, constructing a borehole and searching for a water surveyor.

Makhura (MK) Project; this project selected the opportunity of preventing fish predation by obtaining quotations for fencing, constructing a trap machine including purchasing materials and obtain hail net to cover fish ponds to prevent predator birds from eating fish. Partner would search for quotations of fencing material and those of trap machine from local stores.

Nemutamba (NT) Project; in this project partner would improve security by purchasing fencing material, hiring a security guard, purchasing a security alarm and razor wire and spots lights (Table 7.25).

Table 7.25: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Makhado and Mutale

	Opportunities	CSFs	KPIs	KAs
MA; UL; FR; TRL, CF, FF & AN	Increase alternative food for catfish	Grinding mill	Cash slip/quotation	Search on the internet for suppliers and contact them
		Chicken dung	Cash slip/quotation	Request poultry farmers locally and obtain quotations
		Traditional brewery	Quotation	Request local farmers and obtain quotations
		Earthworms	Signed agreement	Request local farmers and obtain quotations. Conduct an experiment to assess growth of catfish fed earthworms and tilapia

Mudau MA, Ukhadzilito UK, Fharanani FR, TshitakholeRL TRL Projects Chikhudini (CF), Funyufunyu (FF) & Alianapo (AN) Project. (Full version Appendix 6)

7.3.5. Action Monitoring Step

Action Monitoring: *Tladinga (TD) Project*

In this project partners gave each other tasks of studying various chapters from the culture of catfish manual and presented their understanding of what they have grasped. The planned aquaculture technical training organized at the Agriculture College did not materialize and a different training venue was sought by the researcher. The partners managed to arrange and attended the newly organized training at the University. The catfish breeding session was not attended due to the stolen transformer at the breeding station. Nets were borrowed from Department of Agriculture and the training venue was successfully acquired (Table 7.26).

Table 7.26: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs), Action Implemented and Support needed for Tladinga TD and Phetwane (PT) projects

CSFs	KPIs	KAs	Action Implemented	Support needed
Reading training manuals	manual	Researcher will forward manual to TD5, copy manual, "the culture of catfish"	The researcher forwarded the copy of the manual to the project. Partners made copies and distributed amongst themselves. A meeting was held to give each other studying tasks. TD5 was responsible for fry production, TD6 studied breeding water conditions, TD 8 was studying fish nutrition	Attend a formal aquaculture technical training from experts and on-going
Training by extension officer	Attendance register, assessment form	Researcher will liaise with Agriculture College to offer training to partners	Researcher organized with Agriculture College trainer and she could not offer the training due to being on leave,	An alternative trainer will be sought

(Full version Appendix 9)

Action Monitoring: *Phetwane (PT) Project*

Partners in this project gave their presentation of action taken to achieve the goal. Partners had time to write down their action implemented and then they were given an opportunity to make an oral presentation. This tool was interlinked with the Observations, Questions, Ideas

and Opportunities (OQIO) tool in such that when a presenter presents other partners were noting down their observations, questions ideas to support the presenter to keep implementing (Table 4.38).

The partner gave feedback of visiting the shops to search for quotations of the inlet /outlet pipes to install in the ponds. However, he encountered a challenge of not knowing the size of the pipes and the old pipes were embedded deep in the water.

'With my homework I was dealing with the issue of looking for quotations for inlet and outlet pipes. So I went to look for them and I had a problem of not knowing the sizes of the inlet/outlet pipes. For me not to know the sizes is because they are underneath the water. So support that I will need is to find someone to check the size of the pipes so that I can continue looking for quotations (PT44).'

Observations, Questions, Ideas, Opportunities (OQIO): Phetwane (PT) Project Partners gave feedback via oral presentation regarding what they have implemented and partners noted observation, questions, ideas, and opportunities (Table 7.27). The presenter Phetwane PT44 gave his feedback as noted above and overall partners pointed out that the presenter showed confidence and knowledge in his task. The questions that partners posed to the presenter were how did he obtained quotations, can the size of the pipe be estimated. Another partner asked if the presenter did anything after he was told they needed sizes of the pipes? The feedback was articulated by partners in the following manner:

'According to me I observed confidence and eye contact is at a high level. The question I would like to ask is how many quotations have you managed to obtain from the shops and how many shops? I think because there are lot of shops the presenter must try different shops, I think it will reduce unnecessary cost (Phetwane PT46).'

'Confidence, good communication skill and the question is, did he never have an idea what the size of the pipe can be (PT48).'

'He understands his work. Question is can he go to other shops, opportunity is he can ask from other shops and determine where it will be less (Phetwane PT47).'

'He was competent, eye contact; he was brave and straight forward. Idea is, they must try to make three quotations because they will be able to save money (Phetwane PT49).'

He was free and patient. The question is what the presenter did after he heard that the sizes of the pipes are needed, I think he was supposed to find those sizes and go back again (PT44).'

Researcher asked if the partners had any ideas for the presenter and partners mentioned to look around for more shops and to also try an estimate the size of the pipes. *'My idea was if there were other shops I was not aware of Afrimart around town, he can try them (Phetwane PT45). He can try while walking around the shop to look at different pipes and estimate which one could be the right size (Phetwane PT48).'*

The presenter also suggested looking for the person who was responsible to install the pipes and might know the sizes of the pipes. *'Pipes are underneath and the person who installed them can be the one who knows the size of the inlet and outlet pipe (Phetwane PT44).'*

The researcher probed by asking if partners had ever had copies of the invoice of the pipes. Partners mentioned the challenge of different committees exchanging terms in managing the project and failing to conduct a proper hand over to the new committee all the time.

'We don't have because in here we operate in different committees and at the time they were installing the pipes in the dams it was another committee and we don't have any information, they didn't hand over anything to us (Phetwane PT44).'

Table 7. 27: Observations, Questions, Ideas, Opportunities (OQIO) for all projects

Partner	Observations	Questions	Ideas	Opportunities
PT 44	Confidence, goodeye contact (PT47)	Did you get aresponse from thefunder? Letter (PT46)	He must try other shops (PT47)	It will reduce unnecessary costs (PT47)
	Good confidence (PT48)	Have you never had an idea of the size of the pipe (PT48)	If estimate thepipe size (PT48)	none
	Free (PT45)	What did you do after realizing that sizes are needed (PT45)	He could have found the sizes and go back to the shop (PT45)	To reduce costby obtaining quotation (PT45)
	Serious with his work, he understand his worker (PT49)		Groblersdal and find more information(PT49)	Go to the shop ask where there is less costs (PT49)
	Confident, eye contact, brave and straightforward (PT46)	How many quotations have youdone (PT46)	At least try to do three quotations (PT46)	At least try to do three quotations (PT46)

(Full version Appendix 10)

Partner Phetwane (PT46) also gave a feedback about his activities. He mentioned being able to apply for funding and publicized the project via social media. Office equipments were not available in the projects which led to information being lost due to lack of safety cabin holders. Additionally, the partners still required training on how to file information and also technology transfer to increase production and generate income.

'I applied for funding and published the name of the project and made sure that people will

be in a position to respond to me, those that know the project. I used my airtime for the sake of the project to be successful. I found people in Agricultural Research Council and emailed the person responsible for aquaculture. I realized that we don't have equipments for the office, like information to file, we don't have a place to file our information and they get lost because of lack of safe. If we can have it maybe inside the computer or memory stick we will be fine. So, on the issue of advertising I didn't have support but ended up getting it from departmental people. So we still need support to see if the community loves our fish. When I look to the issue of transport we would like to lobby government to fund the project, even to borrow equipments from municipality can assist us a lot. We still need technology on the issue of survey, Agricultural Research Council (ARC) and Department of Agriculture, Forestry and Fisheries (DAFF) must meet us somewhere to give us technology information of what needs to be improved yearly through technology to increase income per capita of consumption (PT47)'.

Feedback of partners on the presentation of PT46 was that he was confident and spoke clearly. The questions asked were if the partner received feedback form funders and if they agreed to assess the project. *'According to me he showed a lot of confidence, spoke clearly that's what I liked from him. Questions, I heard him say he was emailing the Agricultural Research Council (ARC) when asking for funds, I wanted to know if he received any reply and another question is on the issue of a survey to say when he asked them did they agree to come and survey the project and did they agree to come. I heard about the issue of buying data I don't know if it is the same thing, I wanted to know how much he used. Ideas here I said she must not lose strength to look for solutions (Phetwane PT44)'.*

Another partner also attested that the partner showed confidence, hard work and dedication. Question was which method of advertising was applied. An idea was to advertise electronically rather than manually to save paper. *'Firstly he was competent, hardworking and dedicated. In terms of questions I heard him speaking about the issue of advertising that he already advertised and I wanted to know which method he used to advertise. Ideas and opportunities will be to give him an idea of using method of advertising electronically to save the paper (Phetwane PT49)'.*

Presenter also demonstrated understanding of his work. The question was, did the presenter keep record of received emails and airtime he bought. An idea given was for the presenter to consider advertising on social media and also at the municipality. The partner did not have an opportunity. *'Observation, he had an understanding of his staff. A question is, does he keep record for his administration. For administration of any email he has received, something he has saved to have proof. Also that airtime he can keep the slips to have something to proof to keep records. Advertising he can start lower via social network, like he can start here at the bottom at our local municipality (Phetwane PT48)'.*

Since partners were unable to write down opportunity, the presenter ad-hoc mentioned that the opportunity will be using social media to increase customers. *'My understanding of the opportunity is the importance that this thing can assist us. Like it can bring us many customers if using social media to get market (Phetwane PT46).'*

The presenter managed to address some of the questions that the listeners asked. He mentioned that the funding organization only respond verbally but not in writing. He advertised on his WhatsApp, Facebook and emails. *'They only respond if I communicate with them telephonically but on the email they don't respond. Their respond is verbally and not in writing. I used electronical advertisement method like I post information that I wrote like PT project it's a newly found project. I did through WhatsApp status and Facebook, others is on email. It also appears on my applications of aquaculture (Phetwane PT46).'*

Researcher asked presenter if advertising on WhatsApp and Facebook enough to get customers and partner mentioned that it would be enough however, they could add awareness campaign for aquaculture locally and regionally. They could also do a market questionnaire to see if their community accepted their fish. *'Is more enough to publish this information. I still need to publish through pamphlets to make awareness here at home. People need to know the importance of eating fish and to make awareness campaign here for local demand and also to do campaign regionally. We have to do a research to see how many people in our community loves our product in which form, they have to respond on the list of our questionnaire (Phetwane PT47).'*

The presenter PT47 managed to approach local municipality to ask for a generator to drain water from the ponds and he was given a form to bring back the day they needed the machine. The presenter also managed to make quotations of tables, bin, scale, knives and packaging material.

'Mine was on the matter of processing facility equipment and the major one here was we are going to help each other to put together harvesting equipment. Firstly, I managed to go to the municipality to ask for a generator to assist our outlet to drain water from the ponds. So I have proof of a document they gave me at the municipality to bring the day I come back to ask for the machine to work in the project. So I also went to the hardware store to check items such as basket and packaging material and scale to weigh that try to see how much it will cost. So per pack are 100 inside and they cost 48 rands. My quotation was only to check prices and write them down I did do that and asked them to officially write them down. I was supposed to have come with that quotation that tells me how much the tray, foil and scale cost. The small scale that you will be able to travel with it cost R420 and then bin was R98 tables were made of plastic anyway I preferred the steel ones that we normally use during functions. On support I need transport to go where I know some of the items I can get them with a less price when you buy in bulk, we can even get the steel tables and cutting knives at

a less price (Phetwane PT48)'.

Researcher asked the listeners if they were any observation, questions, ideas and opportunities noted for the presenter. Partner responded by saying the presenter looked confident and passionate. Question was if the presenter only approached shops in their local town, idea was that the presenter could use another method of searching information on the internet to reduce transport costs. Opportunities were that record keep would assist in storing information. *It was well presented and he looked so passionate. Question did he only go to marble hall for quotations. Idea, I think to get a quotation you can use another method of searching for information on the internet to reduce transport costs. Opportunities you see that record keeping will assist us to have information that we will not forget (Phetwane PT47)'.*

Another partner mentioned that the presenter knew what he was doing, the question was, did he approach the committee to ask for transport to search other places, idea was that to succeed you have to keep trying and opportunity partner failed to understand.

'I think he knew what he was doing. I am asking if he came to the project committee to discuss transport that he needs to reach places where he can get lower prices. Ideas are that to have progress you must repeat. Opportunity I didn't understand it properly (Phetwane PT44)'.

Another partner said the presenter showed a lot of dedication and confidence and he loved seeing black people being pained by progress, question was that if the presenter was doing what he has done for himself or for the community.

'Let me thank him, he was dedicated and confident. So black people who are pained by progress are needed in the project. So from what he has done it was a good job. Question according to your understanding when you do that do you see it doing it for yourself or for the community Motivation is that don't get weary be strong, there is no richness that comes from nearer, continue burning with passion to succeed (Phetwane PT49)'.

Partner, PT45 presented on the issue of water quality in the ponds and explained the manner in which they test water quality manually (Table 4.33). If water quality was not addressed fish may suffer from ammonia and lack of oxygen which led to mortality. Partner also mentioned the need to have water quality testing equipments and government should assist.

'I was looking into the issue of water quality in the manner that the water was, it is dirty water quality to say that water for fish stays there and never moves. So when you test the water you put your hand inside to be able to check if the water is still good for the fish. So if the water is dirty, you will not be able to see your hand and the fish might start struggling to live in water like that because there will be lot of diseases, so at the end they will be ammonia or they can make the fish to lose oxygen because they will be breathing in water that is not

good. Another important thing is that when we go to the ponds we must have a book to record our observations there. Even temperature it must be recorded for in case something happens then they will be able to see what was happening. On the issue of equipment there is temperature machine that makes oxygen. Government must help us to buy them because when you work without equipment because fish is something that is recommended as food that has proteins to have a strong brain that can capture things quickly, so that is why we are encouraging people to eat fish because it has proteins and things that can benefit the body in general (PT46)'.

The feedback of the presentation was that the partner was confident, responsible and free. He also mentioned that that to test water quality manually you put your hand within the water, if the hand was visible then the water was in good condition, therefore how did the partner observe the water. Did he start with record keeping of fish food given? Ideas were that he began with record keeping today by having a book and what he did to have water temperature that he desired. Opportunity was to continue with the work he was doing.

'He really demonstrated confidence, responsibility and freedom. Then on questions he mentioned that it is important for the water to be clean and to show that the water is clean you must be able to see your hand inside the water so my question is how did he see the water now in the ponds, did he see it as clean as he wanted. Another one is that he would like to record how much he feed the fish and other activities he might be doing there, did he start with record keeping. With ideas one thing I advise him to start with today is to look for a book and start recording. I would like to know what he did to have water temperature that he was talking about because he explained that it is important to know this temperature for water is right for the fish, is hot or not what he did there. On the opportunity I was saying he must continue with the work he is doing he did a good job (Phetwane PT44)'.

Partner mentioned that presenter sounded skillful about status of water quality. Partner wanted to know at which level was temperature good for the fish and which equipment did he used to test temperature. Partner mentioned that the presenter must share his knowledge with others to increase awareness that would lead to an opportunity of having more customers.

'Hmm according to my observations he sounds skillful about the water quality and their status, I mean temperature of the water and then he seems confidence. Questions, which level of temperature is good for the fish. The second one there is a machine that checks temperature, what was he using to check temperature. According to his knowledge of status about fish I think it's important for him to share with members and this will increase awareness on fish because I heard him say it can also reduce diseases, it can make a person healthy and think faster. So I think it is important to share with members so that they can see the importance of fish and that one will lead to opportunity that give us more customers. The more the customers are aware of fish they will come to buy (Phetwane

PT47)'.

'He was free during his presentation. Question is besides using a hand for measurement is there something else you can use. Ideas I think you be careful when feeding fish, your measurement and time you feed must be similar. Opportunity is difficult for me but I can say when temperature goes up and down it can give fish problem of diseases and affect production (Phetwane PT47).'

'I think he understand his work. Questions I have are what he is still lacking to increase the knowledge he has. On the issue of feeding the fish, idea, share the knowledge he already has and he can do something about record keeping. Opportunity, the knowledge he has can give us a lot of production and market and we can be able to obtain it quicker (Phetwane PT48).'

In response to the questions the presenter mentioned that he has found the water to be dirty and not in a good condition because his hand was not visible. Another partner supported by saying the weight of the dirt can also be seen with the visibility of the hand in water. *'When I checked the water with hand it was not in a good condition and bad for the fish, it might not be able to survive. To see that the water is dirty too much we see it when we put the hand is not visible, that's where we see that the water is dirty and we need to drain the water half and mix with fresh water to reduce the dirt in the water (Phetwane PT46). On the issue of the putting your hand in the water you can also see the weight of the dirt inside, if you can see your hand a little bit it means dirt is not so much but if you can't see it totally then the dirt is a lot (Phetwane PT44).'*

The respond on the question of recording temperature in a book, the presenter mentioned the issue of using a thermometer, it is not something you can test with your hand and write it down. *'Temperature you check with thermometer because you can't just record testing from your hand, that instrument can record, it has numbers, it can record how cold or hot the water is. You can't just record from your brain and say 25⁰C (Phetwane PT46).'*

Presentation by Phetwane PT 44 and action implemented was, she managed to look for quotations of stationery and computer in two shops and compared the prices. She would like to get support of looking for funding to be able to purchase these items as they were crucial for her work as a secretary in the project.

'My work of record keeping I was given, I found it to very important because I use all items as a secretary. I managed to go to the shops to look for stationery such as books, receipt book, stapler and computer. I managed to go to only two shops, I went to price store and pick n' pay. One price store I only found few items and showed me their computers according to their names. When I added the prices they will cost R45, 000 at one price store.

In Pick n' pay I just checked and most of the things I was looking for were not there but the ones I found they cost R14, 000. Support needed is funding so that I can be able to buy because they are important in the project because without there is nothing much we can do. Another thing that came to mind was while waiting for things like funding, we must sit as a committee and see what we can buy (Phetwane PT45)'.

Partners said the presenter was full of energy, committed and reliable and they asked a question of being able to obtain any quotation in writing and emphasized the importance of being able to compare prices to save money. *'She is very energetic, committed and reliable. Question from the shops that you went to look for quotation did you manage to get proof of quotation or you were just told verbally. Ideas, keep on doing that. Opportunity, it will help us a lot if we can be able to compare prices to buy less costly ones (Phetwane PT47)'.*

Another partner indicated that the presenter is very hyperactive and asked a question of being able to look for quotations from furniture shops. Idea was that she must try shops like Makro that sold almost everything and prices could also be negotiated. Opportunity of this activity was that it would benefit the project if these items were acquired on record keeping and administration. *'Presenter was very hyperactive. Question is that did you try some other shops for office equipment. Ideas, try to get a quotation from one shop like Makro, you can find anything and you might be able to negotiate price. Opportunity was that this will benefit our project to go forward on record keeping and administration (Phetwane PT48)'.*

Another feedback was that the presenter showed lot of confidence and responsibility over the tasks. The question was that if the presenter managed to obtain quotations and she only do two shops because three quotations were normally required. On ideas, the presenter should submit them to the committee for review.

'She was showing a lot of confidence and responsible and was not shy. My question is, is she having those quotations or was only looking with eyes. Another one is did she do only two quotations because normally they want three quotations. With ideas once you make quotations you must come and show the committee to pick one (Phetwane PT44)'.

Feedback from another partner was that the presenter was confident and knowledgeable. The question noted was how many prices was less in price from the shops she went to. Idea was that, she continues working hard and being energetic to the tasks.

'The way she was presenting she showed a lot of self-confidence and knowledgeable about her tasks. Question, the shops that she went to check computers how many prices were better for the project to be able to make profit. Idea is that, she continue doing the good work with lot of energy, people like her are rare in projects. Opportunity was that it will benefit the project because most of the things will be functioning properly (Phetwane PT46)'.

Presenter responded to the question of being able to get a quotation from the shop and she mentioned that she wrote them down on a piece of paper and added the cost by herself. She

managed to go into two shops. On the question of which items were affordable the presenter listed stationery.

'I saw them with my eyes and wrote them on a piece of paper and added them up myself. I only went to the two shops. We can start buying books, receipt book, stapler they are the ones that are affordable (Phetwane PT45).'

PT48 also made a presentation on action implemented on his critical success factors (Table 4.48.6). He mentioned that he was unable to drain water from the ponds because of a blocked pipe that drains the water to where they farm.

'My work was to think about how to net the fish from the ponds, so for all these people to be able to work and have fish is after I managed to drain the water from the pond. But unfortunately that water can't get out. Where the water supposed to go it is closed. So I was always in discussion with the chairperson to think about ways we can make water to move to the farm. This task I was unable to do (Phetwane PT49).'

Feedback PT46 eluded that the partner showed confidence and efficient work. Question was did the partner managed to meet with committee to explain this challenge and how long did the problem existed. Idea was that, the partner should arrange to meet with the committee and resolve the matter. Opportunity was that partner should keep trying harder success would come.

'Terms of your observation he had good confidence and efficient work. Question is that after experiencing this problem did he meet with committee to give them this problem to find solutions. Second question, how long did the ponds not be able to drain water and how can we take action of this problem. And then my idea sounds as a response to my previous question I asked, please meet with the committee and establish the problem so that we can brainstorm especially with stakeholders. Opportunity, I said try harder, working harder is the good of success (PT47).'

Partner assisted the presenter to respond to the question of how long did the problem persist in the project. Partners said since they became members of the project the ponds never drained water until the system was upgraded.

'Since we started being involved in this project we were never able to drain water from the dams. We changed the system inside the dams with one of the machine that is very dangerous (PT44).'

Makhado and Mutale Group

Partners gave feedback on action implemented and support needed from Makhado and Mutale group. Partner Tshaundi Tshelwala TT30 on the Critical Success Factors (CSF) of increasing water availability reported that 19 pipes would be required from the river to his home with a distance of 100 m. Partner also searched for prices of water storage tanks because when pipes blocked or leaked then there would be stored water. Partner also measured the size of ponds and they were 4 x 10 m and four in number. Partner also reported ad-hoc the challenge with frogs in his ponds and described their types by the sound they made. Partner also obtained permission from the chief to utilize water from the river for fish farming quicker than following a long and cumbersome process from Department of Water Affairs (DWA). Partner articulated his feedback as follows:

'What I went to look for was the following, I measured pipes and I found them to be 19 in number and they were of 100 m. I worked it out in the following way, I can start with 25 mm at the river, and they will be 5. Then I join with 14 pipes of 20 mm. All these things I measured, I did them, and I measured them. This is the help that I need, so that the water reaches my home. Currently I have a water storage problem. I went to look for the tanks so that the water does not reach the dams first, because if the water enters the dams the day when the pipes are not working and I have nowhere where I have stored water I will have water problem. So I went to P & L store, then I asked about the tanks, it is just that right now I have forgotten the quotation. I went and did the quotation for tanks as well as the sizes; right now I have forgotten the receipt, that thing. I was told to also measure these dams. I went and measured the dams. I have 4 dams, they are well joined but there are some spaces in between. They measured to be 4 m x 10. Yes, I went and measured. What I failed to do was to find the quotation for the nets. Right now we have a problem with frogs. Not so long ago we were in a huge crisis with frogs, there were big frogs, those frogs came from the stones, everywhere you find the dam full, the dams were full with those ones that make the sound hurr hurr, it's not these ones that make the korr korr sound. I found the dam full with frogs and fish inside. So I failed to make the net quotation. I was told to go get the letter since we are using river water. I contacted one of the employees from Agriculture, thinking that maybe the Agriculture employees were responsible for the letters. He told me that the Water Affairs were the ones responsible, they are in Thohoyandou. I felt it had a very long process and all that. Then I went to the chief instead to get a letter stating that I am using water from the river of which I brought the letter with me from the chief indicating that I am using water from the river (Tshaundi Tshelwala TT30).'

Partners were asked to note question, observations, ideas and opportunities for Tshaundi Tshelwala TT30's feedback on action implementation. Presenter asked if he managed to solve the invasion of frogs into his ponds. The presenter responded by saying they tried to

kill the frogs and since there was grass around the ponds the frogs have also spawned and feeding on fingerlings.

'I hear you say that there is a problem with frogs, you say that there are those frogs and you did not buy a net, are those frogs still available (Funyufunyu FF36). Response from the presenter, those frogs, we have to beat them while killing them, we also have to buy torches, while the other troche's battery is depleted, we use the other one because you cannot sleep at all, and they make a very big sound especially even during the day, even during the day they fight inside the water. So right now I am just trying to kill the frogs. So the grass has grown inside. Those frogs have spawned and now we have to remove the eggs. The ones that are difficult to remove have started hatching and they are now feeding on the fingerlings (TT30).'

The partner further commented to have a difficulty in understanding the type of frogs the presenter is discussing since he is coming from a different place. *'Maybe it is because am from Nzhelele, these frogs that you are taking about, what kind of frogs are they (FF36).'*

Another partner assisted the presenter and gave a description of frogs as bullfrogs, big and can be squeezed during rainy season. Partner further explained their different names and sounds in their native language "Venda" and went further to elude that he saw them broadcasted on an animal television channel.

'They are bullfrogs, they are very big and these frogs can expand greatly on size. It is a frog yes it is a bullfrog. They are those kinds of frogs when it has rained, they can be squeezed. It is a 'tshinana', yes it is a 'tshinana', look here there is that big frog and there is a 'tshinana' and there is a 'lutshele' that ones that does the 'korr' sound. It is just that those ones that make the 'korr' sound are not many. Those ones, you cannot see them when it has not rained, you will find all the dams filled, even at home you do find them, if it just drizzled or rains a little bit, you will find them near the house, they do come, and it's as if they were situated in some place. Didn't you see them in 50/50 in the television, you will see it when it gets inside the soil, they held it, big like this, it is scary because of the 'hurr' sound it makes (Makhura MK 31).'

Another partner also asked if frogs can actually be eaten by fish and partner Makhura MK29 responded by saying catfish was the one that could eat frogs and they would only be fed once a day. *'I hear people saying frogs will make eggs and they need to be removed, I hear saying these frogs can be eaten by frogs (ChikhudiniF CF32). Especially if you can farm catfish with those frogs, catfish will eat them and you will only feed in the morning small amounts of food (MK31).'*

Presenter Makhura MK31 gave feedback on action implemented and support needed on the opportunity of improving security around his ponds. Presenter mentioned that he designed a trapping machine for thieves in his farm and he will not be afraid if people open a case at the

police station if they were injured by the trap machine. Partner also reported that they must have a fish farming license so that when you catch a thief stealing you can report the matter to traditional leaders and they would be able to assist. He further alluded that the apartheid system they used to be arrested if found carrying fish and you will wait for three months without arbitration. The following was the verbatim reporting of critical success factors:

'So at the farm thieves are wise because I once went to the chief's place with trap machine to show them, even now I am going to do it and when I do it, I must buy another trap machine because I can't keep on going to the farm now due to distance. When I finish preparing another pond, I will put it at another place so that when a person comes in must not being able to enter. If I open the case at the police station I will not mind, but one thing I am always talking about is that we must have a license, even at the chief's place, even the extension officer when they come to help us, I normally tell them that everyone must have his own certificate, but I am thankful that they showed us a place where we can get a certificate if you want it, I mean if you can have a certificate, you saw that man showed us his letter [pointing to the previous presenter], when you have a certificate and you approach traditional leaders and tell that you are farming with fish, I have a pond, when you catch a person stealing, you will be able to get help at the chief's place. We are old people, we used to be governed by apartheid system, white people in those time if they find you having two to three fish, they will say let's go, they didn't want to see us with fish, not at all, even if you can have fish small amount to fill a plastic bag, they will still arrest you, you see long ago with government of white people, you would sit for 3 months without adjudication (Makhura MK31).'

The presenter further reported on the issue of obtaining funding mentioning that because of old age they would not qualify for funding. Our government only recognized young people and funded them within a week.

'You see this group will apply for funding from government about three million rands and they will be given the money, but now we looking for funding and we are tired, even you guys [pointing to other old aged participants] they will not fund you, you can be given by luck but if it is this group [point to young participants] six months will not elapse, they will be photographed by department plus minus ten, this one you make him chairman, treasurer, they are all young, before the week ends they will be given funding and they start working (Makhura MK31).'

Partners were requested to note observation, question ideas and opportunities from the feedback of Makhura MK31. Partners commented by saying the presenter must consider constructing simple security measures such as fencing to avoid stealing of fish. *'The presenter must make sure of making a device of security measures; he must make a simple,*

hmm, security fence for trapping. They can make a security fence so that there is no stealing if possible (Funyufunyu FF36)'.

The presenter responded by saying his farm was big to put up a fence and the fence was once available. *'My farm is big, they were available during the olden times (Makhura MK31)'.* Researcher asked if the presenter could not fence around the ponds and he still preferred the trap machine over fencing. *'Yes, it can be done around the ponds, that's why I want around the ponds to do a stronger security, where you know you put a trap to prevent a person from coming in, if it can catch only one person, he will never come back (MK31)'.*

Partner also mentioned reporting the thieves to the police station or court as an opportunity. *'I've got an opportunity of the presenter. The presenter can go to the police station or to the chief's court to report the matter if someone stole his hmm fishes, you see that's an opportunity (Funyufunyu FF36)'.*

The presenter responded by saying he once tried the route of reporting to the police station and traditional house and also showed them the trap. The only things they cautioned was don't put it where people normally walk; put it right in your farm.

'I went to the chief before I put in the trap, I went to the chief and to the police station, first of all I went to the chief and I told them I have people who are troubling me at my farm, so put in this, I showed them the trap it looks like African Buffalo, I get out of there I went to the police, then the police said no please if you put don't put where people walk, put right at your farm (MK31)'.

Researcher added that what I liked you talked about the issue of a license, when you have a license it means you have a permission to use that trap machine, so it chopped a person's feet trying to steal, I don't think they can arrest you. The partner mentioned that the Mutale group was normally asking to be assisted with obtaining certificates. *'That's why us from Mutale municipality, we normally tell them to help us to have certificates (Makhura MK31)'.*

Another partner alluded that application for a certificate was easy for a person owning a farm rather than farming at your house. You make an application that would go to the municipality, they come and measure your farm and you start paying tax of about R5, 000 for one hector farm and you still pay some amount to the headman, followed by the chief and then municipality.

'Certificate, a person like me, this one is better he has an orchard it seems as if myself am just working here with someone, it is a bit difficult because these people say that you need to make an application which will go to the municipality, from there the measuring people come who will measure the orchard it means that it has been registered with that place even taxing because it will be taxed. It is then that you will obtain a certificate. But if it is something from there at home, for you to get a certificate it will be somehow difficult because they will not come and measure except for finding another place however you do pay it means you need

to pay to the headman, then you pay to the chief, and then to the municipality. It is paid for, you need to pay. Right now 1 hector is no longer less than R5, 000 at the chief. When you go to the municipal it rises even the tribal, I mean at the tribal it is R5, 000 one hector (Tshaundi Tshelwala TT30)'.

Another partner further added that in his area they pay R10, 000, the prices went up for one hector, therefore it required money. *'At the chief it is R10, 000 Thengwe village, it just went up now, 1 hector however it needs you to have money (Funyufunyu FF36)'.*

The partner further added that they were having a challenge of money and most of them were relying on social grant. Those owning a farm were better because they were not taxed they just stated what they were doing in the farm but for us it was very difficult because even the type of trees would be inspected.

'Here we also talking about money problem, this one is better because he has an orchard that is being taxed. It is like this, we just relying on social grant, truly you will find it very difficult. This one is better because he has an orchard which is being taxed he just state what it is that he wants in the orchard but for us who are just starting, it is very difficult. There has to be people who come and inspect as to what kind of trees are there which needs to be removed, that thing is expensive (Tshaundi Tshelwala TT30)'.

Partner Alianapo AN35 gave feedback of the action implemented and support needed to continue implementing. She reported that on the water right license, generator and electricity there was no action taken because they were all available on site. Since there was no borehole the partner did quotations of labor, equipments and electricity to pump the water and the total amount was ±R30,000 depending on how deep they would have to drill. The verbatim feedback was as follows:

'Myself I did this one for water of which I was supposed to explain how I went about. I went and searched about water, in this section of design tool, it had water right license, and I did nothing on this one because I already had water which is from the line. The one of electricity and generator from the river, even here I did nothing because I have a generator moreover when you pull water from the river it is available. Then there is no borehole driller and a service provider, so I went and did a quotation for borehole and service provider so that I can find out if I want water what action can I take so that I have water I did those things, I was given a quotation, I have them. Here the borehole driller and service provider while he was showing, he showed that when they drill, the way they wrote, myself I cannot read because I don't do water. They showed how much is it, if maybe the water is very deep how much will it be per that thing of theirs I don't know how many meters it is, he said how much he will charge. The one that I went to who will be just drilling water only and that, he said he would charge R21, 560. Looking at how much work he will be done but if he has to go deep then he will go down. Then there is a borehole machine, when I followed for a stronger borehole

machine I found it to be R5, 500. This is the action I took. Then those pipes and everything that needs to be installed inside together with the control box. Control box cost R1, 500 and pipes cost R800. Then there is the fact that we are using these things if we are using electricity. There will be electric equipment's that we need to use, the ones they did for me costed R1, 200, it means that all these things that I did summed up to thirty something thousand, but I won't say exactly how much it is because I did not add the previous ones. When we come to the furrow, furrow I did nothing, I don't use it, I use water from the ground, so when I did this quotation, I was doing it for the places where there are huge dams because where I did those dams, and I did a second one, I did it in my home yard. I like to have a borehole, where I will take the borehole to the dams but the one I applied to the chief I got what. I went to the municipal, it is already there where am thinking of doing the dams. There is already a space where I am thinking of doing the dams. In short, actually I forgot one thing there is a water surveyor over there where am operating, there is a lot of water there is an indication of water even though they have not drilled as yet there is lots of water there is a time when I gave him and he surveyed and he told me that the water that wants my little orchard this one of mine is not an orchard it is then that I did this quotation, I have it (Alianapo AN35)'.

The researcher asked the listeners if they noted any questions, ideas, observation and opportunities. Researcher asked the presenter the reasons for not wanting water from the furrow. The partner responded by saying her project was far from the river, borehole water was the one required for fish farming. And there was another dam full of hot water utilized by the community to bath, do laundry and some use the water to remove slaughtered chicken feathers. Because of a long distance the water may arrive at the project no longer hot.

'I did not do the furrow water because where I am it's far from the river so for us to use water we need to use borehole water except maybe when it has rained heavily. There is water at the place I want to do which is known as Siloam, whereby people know that the water was once inspected because it was very hot, and it is just flowing. There is a certain place where the hospital did a borehole the other side at the top, so they realized the pipes were burning then they stopped, they just left before inserting those few pipes, so the place where they took it out its closer to a furrow a little bit. When that water falls over there, you don't pump it, the water just comes out on its own, the people close to there, they don't use electricity or geysers, many go there to get water to bath but when they carry it they should have something to protect them because it is very hot. Things like chicken, you do not need to boil water for them, you just arrive there and carry your chickens either 20 or 30, and then you remove the feathers. So that water when it leaves that place it flows and arrives here where I intend to do my fish project, I haven't done anything at the project place, it means the water I can use it for the furrow when it is available, but it only happens when it has rained heavily

however when the water arrives to me, it is no longer hot because of the long distance the water has travelled. It is there where I can use the furrow but at present the borehole is the one operating (Alianapo AN35)'.

Partner asked the presenter if fish perform better with water from the borehole because he heard many say they required river water. *'Here I am asking if whether your fish are growing well with the water from the borehole because I hear many people say fish require water from the river. So I am asking you that if you see your fish growing well with no problems (Funyufunyu FF36)'.*

Presenter responded by saying that fish preferred warm water and they looked happy with borehole water if it was warmer than when it was colder. *'I don't see any problem with my fish because these fish prefer mostly warm water like I said, while that water is warm it's like that thing when they say when you heat the water they get warmth from the water, those guys with the machines they were showing us, I found out that I was not doing the wrong thing, I was doing the right thing because I take them from the borehole to the dam, it means that when that water enters there and if you can come the time when I am pouring that water, while that time it is very cold you will find them travelling in a shoal making a turn, fish are very fun okay, you will find then in shoals of different ages, what do they call them, groups, and if others are not understanding others while fighting and happy but if that water cools down while its cold you will not see a single one of them which means that I do not see any problem at all (Alianapo AN35)'.*

Researcher asked if the presenter have any plans of raising the R30, 000 for the borehole. The partner said the money would come from different sources including selling of male tilapia fish because normally females had lot of eggs and could produce lots of eggs which hatch and becomes fingerlings.

'Yes, that R30, 000 that am hoping to raise will come from different places, it will come from my different projects so that I can raise because the fish that I have I did not want to take them all out as yet because I need fingerlings, tilapia they are expensive when you buy meaning that that's when I remove them, when they are very big, it would be like this by length. So they are the ones that you would need to reduce especially if I take them out, I have to determine if tilapia it's a male or female because female I do take it back because while it is big it can produce many eggs, it can have many fingerlings if it weighs 1kg you need to know that it will make 1000 fingerlings, so when I take them out, I look for the males they are the ones that take them out because others are males and they are still inside (Alianapo AN35)'.

Partner asked follow-up question wanting to know how the presenter differentiates between male and female fish because he was just at start up stage and it confuses him which one was male or female. *'Follow up; I wanted to ask from mam over there, how do you see if this*

is a female, we are just starting, we haven't come across such, I feel like I am getting confused by how you see that this is a female, this is male (Funyufunyu FF36)'.

The presenter responded by saying that you look at the bottom of the fish, male was the one with a small protruding pimple. *'That fish if you hold and look at it from the bottom, they are different, a male one has a small pimple, you will see a small pimple I believe sir here you know that they have a small pimple it means it is a male, this is the difference (Alianapo AN35)'.*

Partner also added that sometimes you can squeeze to see if eggs were coming out. *'If you squeeze them and maybe eggs are released if you not sure you can squeeze it (Funyufunyu FF36)'.*

The presenter emphasized that squeezing the fish can also determine the sex of the fish but the protruding pimple was the correct one to assess with. *'It will show you if you squeeze, it will show you but the small pimple is the one that differentiates fish I do not know how the elderly man know, they are the ones who know that fish more than I do, they can explain what they know, that's how to differentiate between male and female in this way (Alianapo AN35)'.*

Another partner just mentioned that the researcher should teach them how to ask for funding because they managed to secure a farm with no fencing and they wanted to do their critical success factors to make their project lively.

'But you still owe us something, you must still tell us how to ask for money, how to because some of us you see we've got a place, no fence, no nothing, we want to do this thing [pointing on the paper] this plan of us, yes and everything to make a project live (Funyufunyu FF36)'.

Presentation of Funyufunyu FF36 about action implemented and support required on increasing fish food. On the grinding mill Critical Success Factors (CSF) there was no action taken and he needed support of people who could navigate the internet. Chicken dung would cost R20 per bag and support was to obtain more chicken farms to collect more chicken dung. Traditional brewery I would collect it free of charge. Earthworms were plenty on the ground and no further support. Kikuyu grass was found in another place and it would be free. One packet of chicken intestines costed R8. I found lot of soybean and sunflower seeds for planting. Pig waste, cow dung, fig tree and mulberry would be free of charge. Chicken meat costed R80 and support required would be money to purchase.

'My goal is to increase fish food to the project to achieve hmm 2% profit within 12 months. I am going to critical success factor grind mill, grinding mill, it shows here that we will get a slip and a quotation for grind mill. Hmm key action I said I will look for people or the internet using my phone. Hmm I didn't do anything, action I haven't done anything. Support that I need, help that I need is to find people who can help me to browse the internet or make

these calls to people who have this. I am going to chicken dung it is number two, I will need a slip and also how much it costs. I will ask the community to obtain quotes so that I can know how much it costs. I went found out that those chicken dung costs R20 per bag. The support that I need, I make sure that I have plenty from people who farm with chicken. Number three, I have traditional brewery, I said I will take a picture of traditional brewery, I will ask the community. Hmm community agreed that they will give me free of charge and I don't need any support since the community will give me free of charge. I am going to earthworms: Earthworms I agreed that I will look for it on the ground and I found so many of them. For support I don't need it because I saw them in the soil. Kikuyu grass, I need to go and look how much it cost if I wanted to buy. I found them in another farm and I will just cut it. I don't need support also here. Chicken intestines, I need to find out how much they cost from the shop. Hmm I went to the shop where they are sold, then I saw that one packet cost R8. Hmm I will ask the shop owners for donation to donate me some few free of charge, I don't need much. I went for number seven: Sunflower and soybeans, hmm I said I will ask word of mouth asking from community. I saw lot of seeds for soybeans and sunflower. I need support so that I can plant these things for my fish. Number eight is pig waste, I will speak with people, and I will speak with community. At action implemented I will get them free of charge, no support. I have found lot of pig waste in my community I just need to ask. Number nine, its cow dung, even here I was supposed to talk to people, and I must speak with community people. I found a lot of cow dung even here I don't need support because I will go pick them up. Fig tree, I said I will take pictures of the trees, I saw a lot of fig trees, even here the fig tree are a lot so I don't need support because I will go and pick them up. Then I go to mulberry, I said I will take pictures of berry trees, action implemented I found them free of charge, no support. I am going to the last one number twelve, it's a chicken meat, and hmm I said I will look for quotations and a slip. I obtained quotation from the store, hmm it costs R60 each per chicken. I will need donation, so I need help to plead with shop owners so that I can feed my fish (Funyufunyu FF36)'.

Researcher asked if partners had any observations noted and one partner said the presentation was good and covered all aspects to enable the presenter to have alternative fish food. 'The manner in which they presented, I saw it being very good because he went to all areas that can make him be able to have fish food (Alianapo AN35)'.

Researcher asked partners if they had any other comment or question and Tshaundi Tshelwala TT30 mentioned that they realized there were lots of alternative foods you can feed fish with. 'Hmm... my comment is, fish has a lot food that you can feed with without buying (Tshaundi Tshelwala TT30)'. Additionally, MK29 also mentioned that they normally looked for fish food from the shops when there was plenty of other food out there, cow dung and chicken waste. He further asked if fish could be fed with chicken meat and the earthworms

would require a lot of effort to fill a container. *'I am shocked by the presentation because fish truly speaking has a lot of food, we love going to the shops looking for food leaving plenty of food out there, you just go hunting in the wild, you can go to the cow, to the chickens to get food; 'Hmm on the chicken do you mean fish can be given chicken meat. I also wanted to say because they say this worms you must dig them up and trap fish with them. For you to fill a container it will require a lot of work (MK29).'*

The presenter responded by saying there were people actually in his community who sold earthworms, they could fill up in the wheel burrow. *'They are people who sell them, they can fill wheel burrow, he can fill a wheel burrow and person sell them to the community. So it's a lot, my neighbor sell them (Funyufunyu FF36).'* Further another partner asked how many earthworms fishes would eat daily. *'How many earth worms does a fish need per day (Ukhadzilito UK37).'*

Another partner responded on behalf of the presenter and said the fish would enjoy a container filled with earthworms as each one would pick for itself. *'No but with earthworms it's like this, let's say I am farming with them, isn't we have lot of food, they will enjoy let's say if you take small container and throw in the water, each one will pick for itself (MK31).'*

The presenter also mentioned that on the contrary brewery waste the fish will not consume it all and waster build-up in water would occur. *'It's like this brewery waste when you pour it, it won't eat and finish, and they will be a lot of waste remaining in water (Funyufunyu FF36).'*

Presentation by partner ChikhudiniF CF32 was conducted to give feedback on his action implementation. On grinding mill, there was no action taken, the partner was still planning to visit the stores and requested for quotations. On Chicken dung there was no action implemented also. Traditional brewery was free of charge. Earthworms, partner mentioned that they were plenty and he also explained the process of farming with them as easy. Kikuyu grass would be taken from other partners projects. Chicken Intestines no action implemented. Pig waste would be obtained free of charge because his friend farmed with pigs.

'For me to be able to reach 2% within 12 months, here with me I have grinding mill, with grinding mill it shows I went and obtained cash slip at NTK (Agricultural products and services retailers). So I have the slips. Action implemented is that I haven't done anything so it means I have to go to those people with grinding mill so that they can tell me that I can have it for how much. So that I can ask and know how much this will cost. I am moving to chicken dung, cash slip, I had to see the community, and I didn't do anything. Traditional brewery, I will speak by mouth with others who are doing this free of charge so that I can have the waste to feed the fish because fish eats a lot of things. They don't sell, they will prepare and we get them free of charge. Earthworms, the earthworms are a lot, even myself I can farm them because I can take grass, water and mix with soil in the whole, then you can

have lot of worms and I don't need lot of support because it's something I can do by myself. Kikuyu grass, with this one I didn't do much but there are others with fish that told me they have the grass, I talked to them on the phone, if they have the grass, I will go with their phone numbers so that I can call them to let them know when I am coming to take the grass. I am at number six, chicken intestines, here I didn't do anything, so for me to have support because I didn't do anything, and I have to go to the people who have chicken intestines. I am at pig waste, I will have them free of charge because there is someone who was given pigs, I will go to him, when I arrived at his home he is my friend by the way, so he said my friend you can take them free of charge, I did take some bit and give to my own fish, they were eating a lot (ChikhudiniF CF32)'.

Observations, questions ideas and opportunities noted by partners were as follows: pig waste during feeding, was it spread or poured in the ponds? *'When you feed them with pig waste, do you pour them or do you spread them, or you must put them little by little or the whole food (Tshaundi Tshelwala TT30)'.*

Another partner responded by suggesting to put pig waste into small bags and throw them in the ponds and the fish would be in a position to consume slowly. *'For pig waste, I suggest you pour them into small bags and throw those small bags in the pond, fish will be able to eat and the food will not be consumed quickly. The bags are those ones that they sell tomatoes in, because I have more ponds, I will through one here the other there, I will throw another here, those bags will be finished because if you put in one bag they will quickly eat them, with the food I bought that's how I feed (ChikhudiniF CF32)'.*

Additional question came asking the presenter if pig waste would not spoil fish water quicker. *'Before you sit down my question is, the food from pig waste, doesn't that pollute your water and have a bad smell quickly (Alianapo AN35)'.*

Presenter responded by saying water from one pond feeds into another pond moving in a pipe and they made a lot sound indicating that oxygen levels were high. The water from the last pond moved away, therefore water would not have a bad odor.

'Water don't get polluted because water from here goes into another pond, there is a pipe that runs and when it gets into another dam they make a lot of sound, and when they make the pour sound they will make oxygen, there is no way those food can smell bad at the ponds because when the water moves and moves, I don't make them, they move by themselves to another pond, the last one will be the one that pours the water on the ground and water can move away. I don't pour new water because there is a river; I put a pipe to deliver water to the ponds (CF32)'.

Additional idea from partner was that the presenter must visit stores and places he has mentioned to obtain the alternative food. *'Hmm I've got the ideas, my ideas is this hmm the*

presenter must make the follow-ups to the places where i mentioned to get those hmm foods and also to make follow-ups to the stores in order to get foods in order to hmm feed those fishes (Funyufunyu FF36)'.

Presentation by Ukhadzilito UK37 was made and feedback on action implemented was given. The partner mentioned to have a scale to weigh fish food and he obtained quotation from a store. Chicken waste would cost R10 per bag and partner required support of starting up his own chicken farm. Traditional brewery would be obtained free of charge. Earthworms would be obtained on the river banks and also there was someone with earthworm business. Quotations of soybean and sunflower were obtained from the store and partner required support of ploughing. In kikuyu grass no action was implemented. Chicken intestines were R8.99 per packet. Pig waste was available because I was a pig farmer myself.

'My goal here is to have food so that I can feed this my project of farming with fish. So I had an idea that I must have a scale that I can weigh this food to feed my fish. Here on key Performance Indicator (KPI), I had an idea of making a quotation and also have a slip, I went to NTK (Agricultural products and services retailers) to make a quotation, I found bigger sizes and I can be able to feed my fish. Number two chicken dung I went to as those who farm with chickens, farmed and egg layers. Action implemented, they showed that they can give me chicken waste for chicken egg - layers, they said they can give me one bag which cost R10. When we come to support, I need to be supported so that I can farm my own chickens, when I farm them myself, I will be able to take chicken waste and feed. And for traditional brewery, people who prepare traditional beers have confirmed that they can give the waste free of charge. For earthworm I don't have to ask anyone, near my home there is a river, there is lot of worms and there is someone who farms with earthworms. He took cement and pours soil, water and grass and sells them. For sunflower and soybeans, I went to make a quotation and asked prices NTK (Agricultural products and services retailers) and I had sunflower and soybeans, I didn't get. Support, I need a place where I can plough sunflower; I can take and grind it with grinding mill and be able to feed my fish properly. Kikuyu grass, I didn't do anything, we are lucky because one of us has it, and I didn't go but I promise I will go. Chicken intestine because we can feed with them the fish. I went to Shoprite store and saw that one packet costs R8.99, from Indian shops it costs R5. 68, hmm I didn't make a quotation. The support I need is the donation, I can farm with chickens so that I can be able to slaughter and sell the meat to feed that to fish but the biggest one is donation. Pig waste, those ones I don't think I will need, I am a pig farmer, I have pigs at home, I will see if I can use this pig waste. I don't need any support because I have (Ukhadzilito UK37)'.

In observation partner mentioned that the presenter presented with confidence and question was the type of alternative food fish would like to eat. *'Observation the presenter presented*

well with confidence. Question, I want to know what type of food does the fish like the most because he mentioned the natural foods like hmm...dungs and a chicken intestines which he can just get it from the stores, I just want to know what type of the food does the fish like the most, is it the one made of dung or the ones made of meat (FF36)'.

Presenter responded by saying his fish prefers brewery and chicken waste, in which brewery was the best and mostly the partner feeds with manufactured pellets.

'Fish prefers the food made of brewery and chicken waste, this one for pigs and meat I never used them. Brewery is number one for fish, the other ones I used also pellets (UK37)'.

Further on ideas partner advised the presenter to go to the stores before his fish were fully grown because if he could delay he might lose all his fish. *'Let me say further on the ideas, the presenter must first contact the stores before his fish are growing, because if he can contact later he can lose most of the fish is the idea yes (Funyufunyu FF36)'.*

Another partner questioned if the fish would grow fed with all these alternative food and whether the market would accept them because normally the market prefers fish that was grown with manufactured pellets only. *'I also want to ask, my question is if you feed fish will all this written natural food, will they gain weight, fish can lose weight or gain weight, will they be good for market or they become good when you use the manufactured pellets. Whatever you used before, do you think it is fine for market (AN35)'.*

The presenter said he was feeding his fish with mixed food, pellets and chicken waste and marketing them to the community; their growth performance was very good. *'Mine I fed them mixed food but the one we buy and the one for chicken pellets but selling for community, they gained a lot of weight and looked good, they also show growth (Ukhadzilito UK37)'.*

The partner further clarified the question by saying feeding fish with intestines and cow dung, fig tree etc. would the market accept the fish.

'I was referring to feeding fish with intestines, cow dung, fig tree etc., when you take them to market do they like it, maybe someone can answer, do you think it will be good for market (Alianapo AN35)'.

'The fish were fed on grass while others were fed on proper food that I bought from feed scheme. The fish that were fed on this thing grass, they don't grow similar to the fish that they were fed bought food. Because those for manufactured pellets when you throw them, you will see the fish happy and playing because of this food. With this other food they don't run for food but with pellets they even grow faster (ChikhudiniF CF32)'.

Another partner suggested that for them to know which food was good, they must have a pond and stock fish inside and feed with earthworms for six months and in a separate pond

feed with manufactured pellets. You might find that fish could lose lacking vitamins that make them quickly grow just like wild fish was very thin. I never used this alternative food; I only used starter, grower and finisher. Government was supplying us with small quantities of finisher and that makes our fish not to grow because they ate wrong pellets for their age.

'For us to have the right things for food, let's have a small pond and put fish that will fit in that pond and feed with the food that we want and do it for six months feeding with what we want. We must go and net some and put them separately and use manufactured pellets, sometimes fish can lose fish and be unable to just like human being if eating only pap he will lose weight because of lack of vitamin in his body. So if fish eats all this will lack vitamin to make it quickly grow. Even the one from the wild is very thin and eats a lot, I never used them myself, I only use the manufactured pellets, grower, finisher and starter I use the three types of food. There is small types of food when you pour they quickly disappear from the water, the small fish will run to eat them and finish them quickly. There is also grower and I mix them sometimes they also finish quickly. Government is giving us small quantities of finisher pellets only and I asked them why do they give us only finisher pellets not starter and grower, that's why they don't grow, because they have to eat the age appropriate feed (Tshaundi Tshelwala TT30).'

Partner asked where were they selling pellets and response was NTK (Agricultural products and services retailers chemist). *'I want to ask a question, the starter feed where do you get them (AN35), NTK chemist, and it's more expensive than the grower size. There is starter and a grower and a what (Funyufunyu FF36). Finisher, but Messina finisher is not available it ends with grower type, finisher we are given by the department officials even grower sometimes (Tshaundi Tshelwala TT30). The pellets look like small faeces (Ukhadzilito UK37).'*

Another partner added by saying out of experience fish preferred flakes than cramps because when she started with the project, fish pellets were not sold. The partner bought the coloured pellets for koi fish and the flake ones, pellets made moderate growth and exponential growth was seen on fish eating flakes.

'Yes, that's what I wanted to say that fish likes flakes more than using cramps that you buy. I had a good experience, when I started farming with fish there was no place where I buy fish pellets, then I got those type of pellets with three colours or four colours in another shop for animal feeds and also bought those flakes the brown ones that we normally eat. Those ones for the fish to be able to eat, I must blend it. When I give them flakes, I had a period where I gave them flakes, the fish liked them and they were growing very well but if I feed them with the one I blended growing reduced, it became moderate than when I gave them flakes.

Flakes are quite expensive, it's too expensive, so the other food that I saw that the fish ate and became happy is milling and not expired ones. When you open sometimes even yourself can smell that something is not right there. I was lucky that where I farm with fish my borehole water is warm, meaning that during winter i pump straight from the river because tilapia in winter does not want cold water it needs moderate water, so when I pump water in there, you can see the fish are very happy, then you throw in that food, there is lot of small fish and they can enjoy in there. When it's cold please check your fish if they come up the water and when you feed food can just float on top of the water or eaten waiting five minutes if I am not mistaken. Within five minutes food must be eaten all and fish is at the bottom that food will no longer be good for fish. I never used cow dung, I never used all those that we discussed, I never used one that's why I asked a question regarding this type of food to say water does not get polluted because even fish its waste can also pollute the water. Yes, I have no idea about this traditional food (Alianapo AN35)'.

Other methods of feeding with alternative food partner said he took one piece of cow dung and place it on a cemented surface next to the pond and the fish would finish it. Partner was farming for subsistence and sometimes during break times he could start fishing with the worm in his pond. *'My fish, I have food they can fill a bucket, me at home I scoop pellets and take chicken dung, the thing I want to agree is that we must not dig deeper than 2 m, it can't eat properly if the pond is too deep. I can take one piece of cow dung just put it on the cemented surface, you don't break it into pieces you just put in only, chicken waste you can put but you will be surprised the waste from the cow it will finish it, I normally don't sell is just for home consumption. If I am tired from working in the orchard, I take my chair, I have worms and fish and I find their stomach full and they have lots of fats (Makhura MK31)'.*

Another partners said waste assisted in making food available and it was successful in irrigation dams unlike our small ponds. *'Waste helps to make food in ponds. It does not need its own small ponds, they are good for big irrigation ponds with soil so that plants can grow inside they help with producing oxygen (Tshaundi Tshelwala TT30)'.*

Another partners explained the correct form of constructing a pond was doing a wheel burrow shape. You could line it with cement at the corners to save water and on the other side you put chicken waste in bags and mix with soil to create a breeding ground for worms. *'Something that I think it is proper to do when you construct a pond in a wheel burrow shape [shown by hands], you can cement, isn't it a pond has four corners, you can take the big corners and use cement in order to save water and make water to be clean. Then on the other side hmm I took 12.5 kg bag and you put in chicken waste and mix with soil and pour in the bag, and the back them along the other sides. The worms will come out with plants right there. It's just that when I began I made a mistake of making the pond wall straight. So*

people can even use 80 kg bags and soil and mix with chicken waste or cow dung and also plant seeds if you have, they will grow and worms comes out then fish can eat (Alianapo AN35)'.

7.3.6. Performance Assessment Step

Results Assessment: Tladinga (TD) Project

Partners were asked what they achieved regarding reading the manual of catfish in order to achieve the SMARTT goal. Partners gave oral presentation regarding self-study of catfish manual. Tladinga TD06 explained about how the water condition and temperature must be and the stocking size of catfish.

'Chapter one was talking about biology, the life of the catfish. So catfish I have realized that here in South Africa (SA) is the one which is right too much and it requires lot of water, clean water that is running it must not be water that is standing still and full of mud. And catfish also must be put in one pond in large numbers and you can put them at a small size of 5 mm, as they grow big they finish all the space and you must take half out so that they can sit properly. Another one is breeding, to breed in a proper way, you have to check temperature, it must be 35⁰C and water must be 18-22⁰C, meaning that water that you are going to put fish must warm to that level (Tladinga TD06)'.

Researcher asked the presenter what he has learned on the training that they attended at the university. The partner mentioned that they learned about recirculating aquaculture system, the hot temperature inside the house and breeding fish can occur all year round in the system. Partner also mentioned that the ponds that they say were portable and they can be constructed on site if budget allows.

'That day we learned that we can farm fish inside a house and there are ponds inside the house, water can circulate go outside to cool down and come back again. Inside the house was very hot, when we entered the house it was very hot those are the Celsius I was referring to and they were breeding at 35⁰C. We were able to see that you can create fish all the time in spite of whether its summer or winter, you can do production like that maybe sometimes it is our ponds. We don't have enough ponds but the way they did it in small ponds you can be able to do them and produce something if you have money. So it was just materials and expenses the way in which I observed because they were water pumps that take water outside and drums that bring water back for circulation. I learned that water can play, cool down and come back again (Tladinga TD06)'.

Achievement Stacker Tool: *Tladinga (TD) Project*

The listeners also gave feedback of what they thought the presenter has achieved, partner mentioned that she was impressed by the presentation and it was informative especially from someone who can barely read. Other partners mentioned that they heard about water cleanliness and level of temperature *'for someone who can't read I was impressed especially with that one of controlling population the way he managed to count even centimeters and then from there you can separate it (Tladinga TD05). Ok with the result they achieved I heard him talking about water saying water must always be clean, it must not be dirty (Tladinga TD08). I heard about water to say water is hot 80°C (Tladinga TD09).'*

The second presenter gave a feedback about what she read from the manual. The presenter mentioned the process of catfish breeding in captivity. There are two methods of breeding catfish which is injecting with a hormone or pituitary gland breeding.

'I was doing Chapter 4 artificial propagation and fry production to breed fry so that we don't buy fry, we must have our own fry. So I read that our fish must be 1 - 5 kg to be able to breed. And then when it is 1 - 5kg it can produce 3000 - 5000 eggs and the time to be able to produce fry is between September and October because of the temperature that water temperature must be 20 - 22°C. And when you check from the ponds maybe it is hot, water on top is hot but at the bottom you must go 1m or 1.5 m and check the water if it is 20 – 22°C, and we do this around September, October because temperature is okay. There are ways that you can do to have fry production because the natural way you are not sure if you will get fry, so there are ways that they use. The first one, you can take female and inject with hormone named Dihydrotestosterone Hormone (DTH) hormone and then when you inject with hormone it make the female to be ready to lay eggs and then you check the fish, if the fish is ready the belly becomes swollen and the you gently press on the abdomen if eggs comes out then she will be ready but if you are pressing and eggs are not coming out then she is not ready, then put her back and take her again and press if the eggs are coming out, then you can take the eggs, you must be two, one holds the head and then the other press the abdomen and another put a container to collect eggs and you keep pressing until you see blood squeezing out, then you know it's a sign that eggs are finished. Then you can take the eggs and fertilize with semen. You take male fish, you give him anaesthetic injection to fall asleep to avoid pain, then you cut the testis and squeeze on top of the eggs and put in water slowly and keep on squeezing the testis, and you continue doing that until they are fertilized and put in an incubator until they hatch. So there is something that sell here in SA pituitary hormone genetics, there is pituitary gland in the head of catfish in the brain, so you kill fish and remove the pituitary gland and you must have alcohol or methane solution and put pituitary gland then you will inject female fish, it can stay for a year. Pituitary gland goes

with the weight of a fish, if you removed it from 1 kg fish, you need two 500 g fish, then eggs will be produced and then you must put them in their own pond because they are aggressive and cover the top, the cheaper one is hormone injection (Tladinga TD05)'.

Researcher further asked what the presenter benefited from the training hosted at the university. The response was that manual didn't explain some of the things at length and there they were shown all sort of production systems and the equipments they use to breed. *'Yes, it was useful when you read the manual it doesn't explain how is the thing that make fish, what do they look like. We had a session where we sat down and then we went to see their facility and then we went to cut fish, and they said they will come on sit as well to do practical training, the people from university (Tladinga TD05)'.*

With achievement stacker researcher asked the listeners what the presenter achieved with her presentation. They mentioned knowing temperature and the period of hormone injection in preparation of breeding the fish. Additionally, they mentioned removal of the pituitary gland from the brain.

'She achieved temperature, she achieved time of when the fish needs to be injected to get fry fish (Tladinga TD08). She mentioned an important thing of the brain of the fish, yes it is very important and it happens, and even the issue of making small fish she touched on it, she touched even the issue of temperature (Tladinga TD06)'.

The third presenter gave a feedback about nutrition and she mentioned that the fish needs to be fed correctly, water must be in a good condition and she mentioned the benefits of a fish to a human body, however, the community is struggling with catfish consumption.

'Chapter 5 nutrition, I will talk about nutrition and how to feed the fish. You must feed them properly and water must be clean and rotate and it has vitamins catfish and you must look at temperature and how it affects the fish and it is important because it does not have a lot of bones. You must check temperature to find out if the fish is living in what kind of water, the water must be clean. And according to our culture here lot of people do not eat catfish but you must look into selling it so that people end up loving it (Tladinga TD08)'.

The researcher asked if the researcher learnt anything from the training and she mentioned that the temperature in place where fish is housed is very hot and they also saw fish tanks and ponds constructed inside a house.

'At the training I learnt a place where they grow fish and the temperature is very hot, they also showed us ponds that they built inside the house (Tladinga TD08)'.

The researcher asked the listeners to list achievements that the presenter achieved. One listener mentioned that the presenter catfish and tilapia and learned how to breed and felt she was just shy. The other presenter mentioned benefits such as vitamins and proteins that fish has on children.

'She is just shy because they showed us catfish and tilapia and even how they breed them, how do they open them, she is just scared (Tladinga TD06). Fish has vitamins and proteins and it is important to know that proteins are important to children to grow up properly, they must grow up knowing what fish has and catfish in particular has no bones, you can feed children (Tladinga TD05).'

Results Assessment: Phetwane (PT) Project

The researcher asked the partners if they managed to get someone who can assist with the inlet/outlet pipes. The response was they managed to liaise with their extension officer and he promised to visit them and he never came.

'Ok, the time I mentioned that I will find someone I was looking at the people from Agriculture, the ones who made the ponds for us, our extension officers, so I asked them to come and check the pipes for us (Phetwane PT44).'

The researcher asked the partners who were the extension officer whom they talked to, partners mentioned he was someone who was given the responsibility to support aquaculture. *'He comes from Lebowa kgomo but he is working with us on the aquaculture side. So since he promised to come and he never came and that caused not to know what do again (Phetwane PT44).'*

The researcher asked the presenter what support does he need and the partner mentioned that he still need someone from government to assist with especially the one who was part of the process when the ponds were prepared.

'The support that I can get is to get someone that will be able to check the pipes because I want to know the sizes of the pipes. Government is the one that can help me (Phetwane PT44).'

The researcher probed by asking the partner what was the biggest problem with pipes, the inlet and the out pipes. The partner mentioned that the pipes were wrongly installed because inlet pipe is at the bottom where they can't see it and the pipes connect from pond to the other.

'The one that drains the water is not totally working and I don't know what the problem is. So the one that brings water in is only one that connects all the ponds, so fish can move from one pond to another and it is moving underground and we want it to be on top (Phetwane PT44).'

Researcher confirmed with partners that the problem was that the pipe was one and it connects to all the ponds and fish can move freely. *'Yes it doesn't have screens at the bottom and we also want to be able to see the water when it moves inside, so that we can see that this pipe pours in this pond and that one in the other pond. So now they are in the bottom we don't see anything. That's why we want inlet to be on top (Phetwane PT44).'*

Achievement Stacker Tool: *Phetwane (PT) Project*

The researched asked the other partner about what was achieved from his presentation. The response was he did put in an effort, it is just that government did not respond.

'I can say he tried to find his things it is just he did not get any help. Yes because he managed to talk to the people and they did not respond (Phetwane PT49).'

The researcher asked partners if they managed to organize a transport to attend training. The partner said they did liaise with the manager and they promised to give them.

'We went but they did not give us they just promised, and we talked to extension officer because here he is the one responsible for transport, he is the manager of Agriculture in town. We asked that we requesting for transport to go and see when they breed fish, then he said we will need a driver because sometimes they are strict with transport (PT44).'

The manner in which aquaculture is moving here is there anything to add. The partner mentioned having harvesting nets that does not take out small fish and protective clothing. The other partners added by saying that if they can have slaughter house nearer to the ponds it will assist them a lot.

'I think that will assist us a lot, we must also get the clothes to go inside the water we will be able to move forward (Phetwane PT49). You know what I was thinking, I was thinking that we must have slaughter house there next to the ponds, we must not harvest and travel a lot like this to come here, slaughter house must be next to the ponds (Phetwane PT44).'

Makhado Group

Result Assessment: *Alianapo (AN) Project*

The results that were achieved by Alianapo (AN) project indicated that the quotation of the grinding mill was not achieved by the partner, chicken dung was put in a bag and placed in a pond were fish can have an easy access and this method made the water to have a bad odor, brewery waste does not grow fish and makes them very weak. The fish loves earthworms and they grow very well when feeding on earthworms. Fish do not like Kikuyu grass and they may feed on it only if they are subjected to starvation and the grass also changes the color of the water.

'I did not research about the grinding mill, reason being that the results were almost the same as the one from brewery waste but I promise to make further research so I can see or realize the difference between brewery and the mill. I therefore did not do anything because of that. I did chicken dung in my dam, I have put some net so that the chicken dung can slowly pass through it over to them dam. I have realized that water becomes very quick to have bad odor because of chicken dung. Because of that I did not want to continue with it anymore. They have been growing very well and strong. We have the traditional brewery waste in it, I have discarded that, the fishes do not grow strong and bigger and I have

realized that they become very weak. It only helps them to increase their lifespan so that they do not die in the early ages after feeding. But there is no brewery. Earthworms are very good for fishes that are in accordance to my research. Fishes love earthworms and as a result they grow stronger and became very good. When fish feed on grass it's very likely that they will eat, they eat grass only on condition where they are starving. I haven't seen the grass they eat because I will be feeding my fishes in the morning then that odor caused by chicken dung makes it very difficult for me to work. Fishes eat chicken dung but the water is quick to have bad odor. There is still a lot to learn about traditional brewery for the fishes. Earthworms are good for the health of fishes and therefore the fishes are quick to grow. Moving on to Kikuyu grass, when Kikuyu grass is given to fishes in water, the water is very quick to change color (Alianapo AN35)'.

Achievement Stacker: Alianapo (AN) Project

Partners were requested to listen to the presentation and note down the achievements that the presenter has achieved. One partner mentioned that chicken dung made the fish water to have a bad smell, traditional brewery is not good for fish as they don't grow, growth performance is good for fish that feed on earthworms and partner does not know if fish can grow on grass.

'I think she has achieved a lot of things because she did what was expected of her and she can see success and no success. When she explained about chicken dung, she said when she put it in water it makes a bad smell and that smell makes her not to be able to work well because that smell is not good. When coming to traditional breweries the fish are not good because this type of food makes the fish not to grow, when they feed them they continue becoming small so traditional brewery is not good. The earthworms are the ones that are good for fish, fish loves earthworms a lot and you can see that those fish they grow quickly more than the ones you can buy in shops. The Kikuyu grass requires that you cut into pieces the fish can be able to pick it up but we don't know if they grow fish (ChikhudiniF CF32)'.

Result Assessment: ChikhudiniF (CF) Project

The partner mentioned he requires support in the form of money to be able to buy the grinding machine, chicken dung good because it is readily available in the community, traditional brewery they also get it free of charge, partner mentioned that he can make worm farm on his own, he prepares a hole, put grass and water and after three days there will be lot of earthworms and the fish likes them. Partner mentioned that his fish does not eat grass because if you put it in ponds it can remain there for many days uneaten.

'Hmm, first one is grinding mill, here in grinding mill I need a support of money because it is too expensive, I go there another day where I sell that grinding mill and the price of it was

very high. I can't afford that money. Therefore, chicken dung here chicken dung is very easy because we've got those people who make hmm brewery at our village, I go there and it doesn't need any money, you just get it free of charge, you know me I went to school so chicken dung I don't need any support because it is free of charge. Traditional brewery I've also explained of it because we get them free of charge. Earthworms hmm even here I don't need support because I can make them, we just hmm make grass just a little bit hole you put some soil there after 3 days when you mix them you will find many earthworms there, you just take them and put them in your ponds, it is very easy because even the fish they need them. Hmm Kikuyu grass, here in Kikuyu grass, I don't need support because hmm because many fish doesn't eat those grass, you can go there in your pond you will find it even tomorrow and another day until you'll never get them eaten by the fish that is all (ChikhudiniF CF32)'.

Achievement Stacker: ChikhudiniF (CF) Project

The supporters mentioned that earthworms are the ones that grow fish very well and he was not sure of the grass and how it grows fish, but overall his work is commendable because his fish are growing well with earthworms.

'According to me I think the things that really make fish to grow well are earthworms and chicken waste, even when they smell but the fish eats them. So this one for grass I am not sure if there is another way that is been used, I don't even understand myself how does the grass work. I think he did a good job because her fish can grow alright with earthworms (Funyufunyu FF36)'.

Result Assessment: Funyufunyu (FF) Project

The FF project reported their results and they mentioned that they have managed to register their project and they have a cooperative certificate, tax clearance from South African Revenue Services (SARS) and managed to put some savings in a project bank account. The partners still don't have ponds and fencing in their project.

'Here I am talking about our project, the thing that was holding us was certificate and certificate we have achieved now and we also did South African Revenue Services (SARS) and we also managed to put money in the bank. So the thing that we are running short of is fencing at our project, we don't have fence, we don't have ponds, it is something that we don't know how we will get it because the money that we contribute monthly is very small and we use it when we take small trips, so now we want to build a pond maybe one, we don't know how we will build it because there is no fence, we are still lacking measurements of the farm because we don't have experience to measure. We are still waiting for people who will come and measure, they must tell us how many hectars because we don't know. I

think those are the things that are delaying us; we don't know how to act in our project because we don't have money (Funyufunyu FF36)'.

Achievement Stacker: *Funyufunyu (FF) Project*

Partners gave feedback of what they thought the presenter has achieved and noted on the achievement stacker. Partner mentioned that the presenter achieved business certificate and still struggling with fencing and advised that this project can start on their own to prepare ponds because she also has done it. She asked assistance from government after she has finished with her pond and they were very surprised that I did that by myself.

'Hmm they achieved that hmm business certificate and they are struggling of having funds for finishing their fences and doing their ponds but what I can advise them is that I myself did not get funds, you are men you can be able to make ponds by yourself, you can dig yourself and have the measurements hmm if I still remember the measurement of the ponds going to the bottom is about 1.5 m but you can go deeper if you want but they said they must be 1,5m because when go inside the ponds you will not be able to drawn. So how to have fish I think if they already finish the ponds even myself you can ask me I can tell you how to get it. In my dam I have only tilapia which I bought those small fishes from the other farmers of the fish, we have many people who are doing aquaculture here in Vhembe so I think there I can help you if you dig yourself even now I already dug another pond. It's just unfortunate you came where I am when is too much water, so I am doing the foundation inside the ponds, so when I finish about the foundation inside the ponds, I am going to do the upper ones but that dam when you dug the ponds it must be like a wheel burrow like this [show of hands, cause if you do it straight it will not work because some fish the soil will cover them inside, it is what I experienced in my dam, so I think if you are doing that aquaculture, I came here I told them I have a problem I don't know where to get them and they are all surprised how and when, why you don't tell us, oh I think those ones you can be able to start and once you start you will able to get support (Alianapo AN35)'.

Business partners also added on their presentation by saying it is often difficult to take measurements of your farm by yourself, they have to obtain a letter from the headman that the property belongs to them and submit to the royal council and ponds can be constructed from them.

'You can't do it yourself, you cannot, so what we are going to do as from today, hmm we made an agreement to get a letter from the headman where we are residing and then we have it, so by Wednesday that is when we will be having the exact measurement of that area which we operate on paper. So we need to submit the letter to the royal council and they will go through it, if they can say is 1.5 ha that will be it, then we will be able to know this is our area and then from there we will be able to know as to how to do our aqua ponds and the measurement of it, so that is the stage that we are at now (Funyufunyu FF36)'.

Another member added by saying they have to obtain Permission to Occupy (PTO) from the allocated space and once they have those things they will start running smoothly.

'That means now we don't have hmm PTO yet we can't do nothing, we have to go to first, I think they will accept our measurement and what we waiting for and we are waiting for them they will grant the PTO then when that is finished, we are alright (FF36).'

Result Assessment: Tshaundi Tshelwala (TT) Project

The activity looking for someone from Agriculture regarding water procedure, water license, and water rights were obtained from the chief, so that is achieved. The one to obtain water license from water affairs the partner mentioned that he did not go to water affairs due to lack of money and another problem is the monthly charges that they have put in place.

'I didn't go this one for water affairs, I didn't go. Sigh, its money because I am supposed to pay every year for the license, it is paid for, yes, I have paid R60 every month and it was long ago then I applied for water to use at my home (Tshaundi Tshelwala TT30).'

The researcher asked the partner if there is anything that has happened in the borehole activity and he mentioned that he managed to get hold of a person who surveys the water and he is also charging expensive price to do that.

'The person who survey water must come first and then followed by the ones who drill the water. No, we didn't get him, we only got the one who surveys water and we spoke to him, and they need lot of money. Just to survey you must pay last of last month and he spoke about charges but he specializes with surveying the water (Tshaundi Tshelwala TT30).'

The researcher mentioned that the kind of support needed was money and does he still need the borehole or that river water was enough. The response was that he still needs a borehole because the river water was not enough and sometimes he can't exchange the water because he will not be able to fill it with water.

'No the river water is small, I have to change but I can't change if they get dirty. I can't change because if I can change the water I won't be able to have new water to fill the ponds, I have his number we can call and hear how much he charges (Tshaundi Tshelwala TT30).'

On the one to get quotations for pipes to bring water from the river the partner mentioned it was not completed due to lack of money.

'I could not do it because of lack of money but I got the quotations from the hardware to say how much they charge for 25 mm is four hundred and something at the hardware store (Tshaundi Tshelwala TT30).'

The researcher asked the partner the number of ponds he managed to construct. Partner responded by saying it was two and they have catfish and he was feeding the fish with the manufactured pellets and he did not see any fingerlings inside.

'Two has catfish and I feed them with 50 kg of tilapia feeds I obtained it from Messina. Seventy something of catfish in the ponds but they don't have babies, every day, I see three

and I realized there are no babies in here, it takes out its water and move on top and eat all the pellets (Tshaundi Tshelwala TT30)'.

Another partner commented on the issue of the presenter not having fingerlings in his ponds and he once saw in another farm they will put a screen in the middle of the pond and the smaller fish will pass and bigger ones will remain behind.

'They ones took us to Madzivhandila in a catfish farm and they put them in screens and the fish can't move to the other side, we once went with extension officer, those catfish are one size (Mdau MA39)'.

Result Assessment: Mudau (MA) Project

The partner gave a feedback of the results achieved on the action monitored in the previous step. The partner mentioned that there is lot of market around his community and he does not have to look for market outside. Another reason for not looking for market outside was that his fish were stunted but the communities are ones who purchase them anywhere.

'With market fish are sold very fast in my community, it goes very fast business of fish, they finish while you are still on the way. The community buys from my village. But because our ponds are small, they buy all of them and they finish and they still come looking for them. Our market moves, we don't have to sell far because they are very small, you don't have to look for transport to move them, they become sold out around here. The major problem is water, the river is there but we don't have pipes, once we can have pipes we take water from the river to our project, even if they don't give me money and give me only pipes I will be satisfied (Mudau MA39)'.

The researcher asked the partner for reasons for not approaching restaurants for market access and the partner said his fish are not growing and he can't take them to restaurants and the project has ponds but they don't have water. *What will I be taking because I will be having small fish, I have about five ponds big ones, they just need water and the water rights from the chief it will be easy for me to get (Mudau MA39).*

7.3.7. Creation and Synthesis Step

Black Hat: Tladinga (TD) Project

Researcher asked the partners to list negative things that happened on the issue of business plan. The partner mentioned that aquaculture business plan can be integrated with Agricultural activities such as chicken and vegetable farming. Fish can feed on the waste of chickens and rich fish water can be used as fertilizer to grow vegetables.

'With this one of business plan, let's say we have fish and here in fish farming there are things that the fish are supposed to eat like egg laying chicken droppings, so we must also

include it because it will help us with support, I am speaking on the side of egg laying chickens. This type of chickens in fish they help us with support because you have chickens you will be able to take the dropping and support fish and they will grow. This is another one in which in the business of fish it can be mixed, and it can also be funded inside the project of egg laying chickens. We will know that we will feed the fish with chicken droppings. Because fish from water comes out with vitamins and then you irrigate with it so that your vegetables can be able to grow. You see it will move from chickens and then go to the garden so that you get rich water full of fertilizer to be able to grow vegetables (Tladinga TD06)'.

Another partner mentioned the issue of not having market access because there was no point in having a business plan without having access to market.

'You might not know where to sell your fish, you can have a business plan but where are you marketing your fish (Tladinga TD08)'.

Another partner mentioned lack of financial information regarding fish farming to reflect correct figures in the business plan and lack of expertise in aquaculture.

'You don't have a lot of information with fish especially financial information; you find that you want to make business plan but you don't have information. You might end up having business plan and say you want this amount, only to find it is small and there is no lot of experts as well that will be able to help you with business plan of fish farming (Tladinga TD05)'.

The researcher asked partners to list the negatives of not having funding and one partner mentioned lack of market access. *'Market (Tladinga TD08)'* and the researcher probed by asking if one cannot access funding without a business plan. The other partner said lack of business plan will cause you not to know your production capacity and you will not be able to have access to market.

'When you don't have a business plan you don't know how much you can produce, so you can't go to the market and say would you be willing because you don't have a business plan, you don't know how much you can produce (Tladinga TD05)'.

Yellow Hat: Tladinga (TD) Project:

The researcher asked partners to think about the positive things that will happen if they have a business plan. Partners mentioned that they can be able to approach funders and assess whether what you want to embark on makes business sense.

'You can approach the funders and you can also know if what you are working on does make business sense or it does not (Tladinga TD05)'. Additionally, another partner mentioned being able to predict cash flow whether there will be losses or gains. *'Business plan can help you to know your cash flow whether you are going to gain or lose (Tladinga TD08)'.*

Partners mentioned that having funding will enable them to have high concentration on the production capacity than inputs costs and you will have the correct business plan that speaksto the business.

'You will be able to concentrate on the business without worrying about inputs costs. When your business talks to business plan in detail it will succeed but if you get funding with a business plan that you don't understand you will see miracles (Tladinga TD05).'

The researcher probed by mentioning that she did not realize that projects are submitting business plans they do not understand. The partner mentioned that most projects fail because they have been allocated funds that they do not know where to spend them effectively and that leads to failure.

'That is the failure of the farmers, it does not mean farmers can't look out for their money but it is because they give you money but you don't understand that this money I must spent it where, I must put it where and to do what. So you just deciding ok let's buy this and at the end of the day money is finished but if you have a clear indication you will know ok, when I get this money, the important thing is this, so we can do it later maybe with our profits but people will be talking about you saying you have mismanaged government funds (Tladinga TD05).'

White Hat: Tladinga (TD) Project

The partners were requested to think about the facts or importance of having a business plan. Partners mentioned that they will be planning to fail because you will not be able to gauge if the idea will generate income if you don't have a business plan.

'If you don't have business plan, hmm, you are planning to fail because you don't know that the things I am doing, you might have your own idea and it is not profitable, so business plan helps you to know what you are doing exactly and how much of the things you are doing are going to generate (Tladinga TD05).'

Another partner mentioned that most of the business plan that is compiled by government officials is failing to reflect their plans and ideas since they do not compile them in consultation with the members.

'Let me say I will take my documents and give to another person to compile a business plan and he will be doing it according to his own thinking and maybe I did not think it in that manner, so we have to be involved when the business plan is compiled and my own ideas must reflect in the business plan (Tladinga TD06).'

The partners were asked to list the facts of having or not having funding. One partner mentioned you can have an opportunity to succeed. *'A short at success at least you can be successful (Tladinga TD05).'*

Red Hat: Tladinga (TD) Project

Partners were asked to reflect on their emotional feelings or frustrations regarding the issue of a business plan. Partner mentioned that they do have a business plan as a project and it does not reflect their daily activities. Somebody compiled that business plan for them without any face to face interaction and he also amended an existing business plan of another company to suit what they want. The frustration was that there are no experts who can compile professional business plan for them in their area.

'Because there are no people here who can help you with a business plan for instance I have a business plan, yes we do have a business plan, we were helped by someone who does not stay here, so there was no consultation, so it's like when someone tells you it's like this and that for instance the one they have mentioned on business plan it's not even something that we are doing on the farm, so because you don't have people who can help you with business plan, you just say come and do a business plan for us, they come only once to see you and then write it, so it's like a template and you can see that some of the words were changed from another company, so they just take business plan that belongs to another company and change here and there, so this thing that there are no people who can make us proper business plan, he does not give you that attention and come to you and say ok I am thinking this and that and that. So you just have a business plan for the sake of presenting that I have a business plan but it is not talking to our project (Tladinga TD05).'

The researcher asked partners if their department does not have an economist who can compile a professional business plan for them. The partner mentioned that they once worked with an official from government who was looking for financial information from them regarding aquaculture, so they got stuck and they ended up paying someone external to compile a business plan for them. The only challenge was that this person did not make any effort on need analysis so that they are reflected in the document.

'Before there was someone who came to us from government and you end up falling in this trap of looking for someone who is going to help you at a cost. She once came to the farm, I mean you are also still starting with the business you don't have financial information, she once came for first consultation and she said I must give this type of information, I mean where am I going to get this information, I am just a farmer, I can only give you information about things that I have done already, yes in a way she is supposed to help you so that you can plan ahead but if she tells me that I have to give her information we will be stuck. That is why we paid someone for business plan. This one from government we got stuck because she wanted information from us, how can I have that type of information because I also needed light about this things, so we were stuck because of that, that is why we ended up paying someone else just for us to have a business plan but I am looking for something like that, someone who will interact and who will help us to plan ahead and say I hear you are

saying this but with my experience I know we can do it like this and we might encounter this and that challenge, because he is working with business plan, things like that. That's why we ended up having this trap of saying let's pay someone else so that we can have a business plan because they want information like financial information and we haven't sold fish yet, we haven't sold to other companies (Tladinga TD05)'.

The researcher probed by saying the old business plan did the project ever submit it for funding applications. The response was that sometimes you can obtain funding with a business plan that does not reflect your farming activities, however, chances of succeeding will be slim and you will end up carrying a bad name of failing under projects that misused funding and failed.

'Ok, it is dangerous for us to have that kind of a business plan, it's fine we do have it in terms of looking for funding but in reality when you want to have a business you have to have true information. Now I am submitting that business plan and it does talk to our business; it's fine they can give you funding but if you want to succeed in business you must be able to translate it. So they will be funding me for tomatoes and when I arrive here in the farm I plant cabbages and say ok maybe planting tomatoes is cheaper and planting cabbage is more expensive, from this money I can take this amount and do this and that, so my success is compromised. You have written there that you will plant vegetables on 18 hectares and here you only have 12 hectares, where will you get the 18 hectares, already there is a problem. A true one will help because we want to grow, we are not only looking for funding to eat money from government and be like the other projects, we want to have a business, so having something that reflects the truth is what we need (Tladinga TD05)'.

Researcher probed and asked how long they have been looking for a professional business plan designer. The partner mentioned the whole year being stuck with government officials, so they ended up hiring an external person for the sake of having a business plan.

'It is already the whole year trying to look for a business plan. We opted for this person given by the department; he managed to assist other projects to get their own care takers, so we were stuck with people from government like for the whole year just for a business plan. So you end up routing to this one who is charging it doesn't matter, I need a business plan just for us to have a document of business plan so that we can move forward but that's not the way to do it. You need someone who will help you and reason with you (Tladinga TD05)'.

The partners mentioned their emotional feelings or frustrations about the unfair treatment from their extension support. An official who normally does aquaculture site visits on their project failed to mention their name on Small and Medium Enterprise (SME)'s forum held in Bloemfontein. Since the partner was an affiliated member of the Greater Sekhukhune Region Secondary Cooperative (GSRCS), the chairperson was also present at the event and managed to inform the people about the existence of this project.

'Funding is not given to people who want to work, it's more like who do you know and will they help you, do they have interest, normally they give them to projects they normally have an interest on. We were very hurt, there was one of this imbizos from the department; it was different departments at Bloemfontein and different stakeholders discussing about SME's and farmers. So one of the focuses was aquaculture, and they said aquaculture is lacking behind and it does not have a lot of farmers who are doing aquaculture and government wants to focus on aquaculture. They were asking different provinces, and they asked about Limpopo who were the farmers doing aquaculture, they mentioned people from other parts of the province, and they never mentioned anything about us. I am a member of Greater Sekhukhune Region Secondary Cooperative (GSRCS), it's a secondary cooperative and I was still a new member, I had only a month being a member but they know that we are doing fishery, so this guy from GSRCS said no, there is another cooperative under us they just joined and they are doing fish and they have ponds. It was hurtful on that meeting there were officials who do site visits here in the farm and they don't mention anything about our project that we have fish, so that is our red hat, we had a lot of emotions to say why they didn't speak about us but they do come here all the time (TD05).'

The researcher mentioned that most of the time the officials are the ones who are representing farmers on platforms such as those. The partner further mentioned that the fisheries forum from that meeting organized with the official and the Greater Sekhukhune Region Secondary Cooperative (GSRCS) chairperson to make a site visit and also register the project on Department of Agriculture, Forestry and Fisheries (DAFF) database, and they visited the project and the official was the one who is always on site all the time and they were shocked why she said she did not know us.

'The panel asked what is the name of the project, the CSGR person mentioned the name of our project, and they asked the official and the Freshwater Fisheries Research Centre (FFRC) to make a site visit, and suddenly now she remembered us. They did an appointment and they came here and I was shocked that it is the same official who is working with us all the time, and we thought maybe they were talking somebody different, so it was very hurtful to say why are you always here and when you are out there you say you don't know us (TD05).'

Green Hat: Tladinga (TD) Project

New ideas that the partner wanted to implement included searching for a private person who can compile a professional business plan in consultation with them so that they can be able to confidently present it to funders. They want to avoid this issue of having a business plan for the sake of attaching to funding applications.

'In this case of fish I will have to go and get somebody private, and when you get somebody private maybe somebody from Pretoria, will he come here to the farm. No, so I only want business plan, so that's why they don't even sit down with us to discuss the business plan because it is not business plan, even ourselves we don't understand it because when a person has made you a business plan he has to come to you and discuss it, so that you can know it and be able to present it but in this case no, you will just see figures that you don't understand and for the purpose of a business plan and I will just print it. When funders are looking for it I just print it and staple it and attached it to the application form, so we want someone who will help us with a proper business plan that we will understand so that we will also be able to plan (Tladinga TD05).'

The partner additionally mentioned that he already searched for someone who is willing to visit their project but they have to pay every kilometer travelled and accommodation for days to familiarize him with the project.

'I contacted someone who wrote he is doing catfish, I wanted business plan online and I was enquiring if they can do it for me about catfish, but they want information from you to help you make a business plan. So now you want somebody who knows the industry of catfish and give him information so that we can make our business to come alive. He charged R24 per kilometer when he comes to you. No he told me that when he visits your project you have to organize accommodation and pay for his accommodation for a week maybe so that he must understand your project (Tladinga TD05).'

Another partner suggested if government could be the one who organizes this expert and incur travel costs; the costs for project assessment and training can be cheaper for them.

'It just that our government, we don't know, let's say if he was asked by the department to come, it can be easy and also cheaper unlike us asking him. If he is asked by the department and also train us and write us one business plan of fish explaining step by step, he will be able to cover all areas because he is knowledgeable about fish (Tladinga TD06).'

The other partner supported by saying she has liaised with an organization such as Small Enterprise Development Agency (SEDA) to pay for this expert to compile a business plan. Their response was that he was not on their database; they normally will bring a business plan person on site who will assist. However, the partner mentioned that she felt she will still be sitting with same challenge since Small Enterprise Development Agency (SEDA) does not have aquaculture specialists.

'I was asking that thing to say government will help us, and they said I must apply at SEDA and SEDA will give you someone. It will come with someone because I gave them this one

because of catfish, it is not a lot of people who knows about cattish, they know business plan government people but they don't know about catfish but this guy knows it. He is farming with it; he also trains, so I was asking if they can't pay this guy at SEDA. You remember SEDA they will pay for business plan person but he must come from their database but you can be sitting with the same problem of having a business plan that does not talk to catfish honestly (Tladinga TD05)'.

The idea that partners came up with they said they will approach DAFF to request assistance with hiring a business plan expert who conduct feasibility studies of the projects. However, partners were also cognitive of not jumping line function to avoid conflicts between them and the department.

'But also you also don't want to have bad vibes at the end of the day, I must talk to the local department, if they don't know then I will go to provincial, if not successful approach national they will know ok I have tried to follow procedure, we don't want to burn bridges, one day they when you come back they might say tell Member of the Executive Committee (MEC) (TD05)'.

Blue Hat: Tladinga (TD) Project

Partners were asked to give a summary of all the hats together. Partners mentioned that they are looking for an aquaculture expert who will be able to predict the number of tanks they should have, conduct soil analysis, the type of filters to use and also check the availability of water in the farm.

'The person who deals with fish can be able to tell you that you can have 12 tanks maybe you will be creating ammonia like the last time they were telling us you will create what if you are doing this, I will have financial information, spreadsheet that will be given to me. Somebody who will be giving us information that is available and you know this fish thing is complex; they make soil analysis for fish and not vegetables, do the topographies and tell us if our soil is right for building a pond, even water they can check if the water will manage. Even when you look at the systems, the water must circulate so what type of filters do you need, what do you have in your water, we needed somebody like that because they can give us a system and we run it and they give us fish and then they die and then you will have problems afterwards if there was a lot of ammonia, so we want someone who knows from the bottom and that our business plan talks about that (TD05)'.

The other partner summarized by suggesting that the project should engage top management in Agriculture to discuss with them their project needs, things might work out for the better.

'Maybe let me just say we have different department and here in our area we have extension officer, we have directors, when we can call the people from top management like Member

of the Executive Council (MEC) to discuss with him sitting down with him and tell him all this things we are discussing now. I mean MEC has power because he is up there and he can be able to help us (Tladinga TD06)'.

Black Hat: Phetwane (PT) Project

The partner mentioned the negative of funding in their project was caused by not knowing the steps to follow when looking for funding. *'Something that I've realized was that most of the time we could not obtain funding because we did not know the methods of asking for funding (Phetwane PT44)'.* The researcher asked the partner to elaborate further on the various methods he is referring to and he mentioned not been able to know which office to approach for funding. *'Funding is normally requested from the offices, not been able to know which offices, address of those who offer funding (PT44)'.*

The researcher asked the partners to list other negatives of fund that they might think about and one partner mentioned that their project is not been recognized by government. *'I think if our aquaculture is not been recognized by government it can be something that prevents us from getting funding (PT44)'.* The researcher asked the partner to elaborate further on this statement and the partner mentioned that most of the time if government loves a particular project, it will be funded and visited regularly and on the contrary if they don't prefer you will struggle on your own and it will be difficult to even qualify for funding.

'If government does not take care of your project, if they don't recognize it and remember if they love something they will really bring funding and make a lot of site visits. If they neglect you that is where it really make things difficult because even this things of submission of forms if they are been done by the extension officer he can also go there and motivate for them and say I have a project of aquaculture, we are in need of this and they can quickly ask him. So if it is just us like this with your application form it will not work (PT44)'.

Yellow Hat: Phetwane (PT) Project

The researcher asked partners to list positive things that funding will bring to their project. It was mentioned that they can add more fish ponds and re-arrange the inlet and outlet pipes and cover the nets with a shade net and also obtain market.

'If we have funding we will increase our ponds and make them beautiful. We will remove the inlet pipe and outlet pipe from the bottom and bring them on top and then we cover all of our ponds with shade nets that move on top of the water. Now we will see that we will be working in a good environment, we will go and look for market of high standard understanding that we're delivering our products. We will also have an abattoir (Phetwane PT44)'.

The other partner mentioned that they can purchase grass cutters to be able to clean their ponds and also purchase waders and harvesting nets.

'The good things that we can do when we have funding is, we can be able to buy machines to cut grass because sometimes the grass grows really tall, yes, if we can get machine so that we can be able to clean our ponds so that they become beautiful. Even those suits to wear when we are harvesting and also the nets (Phetwane PT49).'

Partner further added the necessity of having a boat to be able to move around the pond.

'I suggest that we must have a small boat so that when there is something that we want to keep from the middle of the pond, we can climb and be able to go (Phetwane PT44).'

There is a need for having a vehicle to be able to attend aquaculture meetings was also mentioned by the other partner. *'We must also look for a vehicle so that when we have meetings, we must not go ask people, we must just start our car and go there (Phetwane PT49).'*

White Hat: Phetwane (PT) Project

The researcher asked the partners to list the facts about funding that they are thinking about and partners mentioned that it is a fact they are looking for funding to make aquaculture successful in their project.

'It is true that we are looking for funding for aquaculture so that we can make aquaculture to be alive because would have got the funding and our management will also be good (Phetwane PT44).'

The other partner mentioned that they will be in a position to demonstrate to their community that aquaculture works and they will be able to travel around.

'If we have funding we can be able to show our community that indeed aquaculture can work because we will be showing that we are going far and we will be able to travel in our car because now they can see that it's been long having fish, they are not important (Phetwane PT49).'

Red Hat: Phetwane (PT) Project

Partners were mentioned to think about their emotional feeling or frustration regarding funding. One partner mentioned that lack of capital makes things very difficult for them because a lot of activities revolve around money.

'Something that is very hard for us is that nothing will be easy if you don't have capital, even to attend meetings you need capital, let's say they are saying we have to go to meetings we need money, when we look for jobs also we need money. To use your telephone also you need money to be able to talk to people, even when you need labor to assist you here in the project you need money, so yes money is what we need (Phetwane PT44).'

Green Hat: *Phetwane (PT) Project*

Partner mentioned having strong board of managers that will foresee the correct expenditure of funds as a new idea to have a successful project.

'Sometimes we do get some funds but you find that us internally we don't manage them well and we end up not implementing anything. And then when we have to put strong management we can be able to account (Phetwane PT44).'

Another partner suggested been able to hire fish breeding consultants to offer them training. *'If we have received funding according to me we can be able to call the fish breeders to come here because we will be able to have an abattoir (Phetwane PT49). The statement was supported by another partner emphasizing the need to have a vehicle if abattoir is in operation. We can buy a small Hyundai bakkie because if you have abattoir you need to transport your products (Phetwane PT44).'*

The researcher asked the partners to give feedback on the lesson of catfish value adding held in the project. Partners mentioned that they did not like the manner in which their harvesting net was also catching fingerlings and damaging their gills and the manner in which it was illegal to process the fish without proper equipments.

'With that harvesting of yesterday it was difficult, we love those fish so the way in which the net also catch fingerlings when looking for the bigger fish, so it means we must have a bigger net so that we can harvest and we also have containers as well because according to the law of aquaculture we are not supposed to handle fish with our own bare hands (Phetwane PT44).'

The partner further added that, the way in which he was looking dirty if a client could have come to buy fish; they would have refused to buy. The partner suggested having different types of clothing for different tasks in the project and the correct equipments.

'The way in which we were slaughtering the fish it was scary if a buyer could have come at that time, he would have refused to buy. We must be able to change the harvesting clothes and wear the ones for slaughtering the fish. So even the processing clothes and knives if we can buy them, we can buy all the equipment of processing (Phetwane PT44).'

Blue Hat: *Phetwane (PT) Project*

The researcher asked the partners to give a summary of all the hats together. Partner mentioned that funding will assist them to purchase items in the project, can be able to create jobs and also hire experts in aquaculture to offer them training.

'Aqua funding will help us to increase the demands and to buy all the equipments plus transport, abattoir. Funding will help us create jobs and we can be able to call the breeders to train us on breeding. We will be able to slaughter fish in the right manner wearing the right clothes and using the right equipments (Phetwane PT44).'

Black Hat: Makhado Group

The researcher asked the focus group to list the negatives things that could occur regarding funding and one partner mentioned the challenge of not reflecting the correct physical address and contact details during funding application.

'Unfaithful to the organization or institution for example wrong address hmm, wrong telephone number, area hmm so many things (Funyufunyu FF73)'. Another partner mentioned lack of available information regarding location of funding organization. 'I don't know the place where you do find funding (ChikhudiniF CF, 32)'. Another partner mentioned failure to attach required documents on the application form and lack of commitment by members. 'If you haven't got enough papers for example a letter from the chief, and then the other one if one is not serious about what we are doing together (Funyufunyu FF75)'. Another partner also mentioned lack of permission to occupy land from the chief can prevent them from obtaining funding. 'The thing that can be bad for us not to get fund can be the Permission to Occupy (PTO) because we can't ask funds if we don't have a place for the business (Funyufunyu FF76)'. Another partner mentioned requesting large amount of money and having complicated business plan that covers all farming activities could lead to disapproval of funding application.

'I said the problem could be the amount of money it is huge, large sum of money and complicated business plan can lead to funds not been approved. Another one if our priorities are not clearly stated when making requisition of funds for example priorities of farming fish, animals or vegetables (Funyufunyu FF78)'.

Yellow Hat: Makhado Group

The researcher asked the partners to list positive things that funding could bring to their project. Partners mentioned business growth and they will be more motivated.

'It will improve my business (ChikhudiniF CF32), when we have the fund we can improve our business quickly and to encourage ourselves and our nephews (Funyufunyu FF736)'.

Another partner mentioned working hard to produce healthy fish in order to generate money.

'Working very hard, making our fish looks nice to make more money (Funyufunyu FF68)'.

Another partner mentioned funding will enable them to purchase equipments immediately.

'Buying material or equipment in time (Funyufunyu FF736)'. Another also added that their

projects will be able to operate smoothly and sustainably. 'It makes the project to run or sustainable easy to achieve the main objectives of the project goal reached. Resources will be easily purchased. Hmm money will encourage people to work with collective efforts (Funyufunyu FF73)'.

White Hat: Makhado Group

The facts about funding partners mention business growth, *'business improvement (Funyufunyu FF73); generating income because of funding they give us more money in our business (ChikhudiniF CF32)';* having more food to feed the fish and increase growth rate, *'making our fish to eat more food to make them big enough for selling (Funyufunyu FF68)'. Another partner mentioned that funding will assist in demonstrating to the community that their business is growing and creating employment, 'fund will be good for us and the community if they see what we are doing if our business is doing well and create the job for people (Funyufunyu FF73).'*

Another partner mentioned that funding will enable them to meet their priorities, fix equipment, have transport for product distribution and their community will also be able to access cheaper protein locally.

'With money we have, we can be able to make sure all the prioritized activities are done to the project it will be nurtured due to the fund we have. When breakdown occurs then we will be able to fix it. Our production which is fishes will be distributed to the nearby areas because transport will be provided. The last one, more people in our area will get fed due to lower prices of our fishes and we will be next to them (FF73).'

Red Hat: Makhado Group

The researcher asked the partner to list their emotional feelings or frustrations about funding. Partners expressed hope of one day been able to access funding.

'If I apply funding to this people, one day they will approve it and give me funding (ChikhudiniF CF32)'. Other partners mention feeling of joy and business boom. 'I will be very happy about the funding and to improve our project to grow very fast (Funyufunyu FF36)'. Furthermore, a feeling of joy, sense of direction and been able to purchase material easily was also mentioned. 'I will feel good because I will be having the right direction for, maybe let's make it like this, hmm I will have the right direction for things that I can manage to buy my materials simple doing things simple, easy (Funyufunyu FF68)'. Other partners expressed lack of self confidence in the manner in which the funds are requested and sometimes when things did not work out other members will be able to offer encouragement. 'You have the mentality of not trusting your format of requisition that the money can be approved. You become sometimes excited hmm, when you share the information with the rest of the project members during meetings, just because some of them are going to encourage you, no let's hope for the better, we might get the funding lets pray for all the kinds of things (Funyufunyu FF68)'. However, another partner still showed lack of understanding regarding this hat and did not contribute. 'I don't understand it properly (Funyufunyu FF73).'

Green Hat: Makhado Group

The new ideas about funding partners mentioned new feeding equipments, project expansion and construction of more ponds. *'To improve our project by buying our instruments by feeding our fish to grow very fast, to expand the place where we are before and in our place we can do more ponds if possible (Funyufunyu FF36)'*. Another partner mentioned extra water cleaning chemicals. *'By having extra chemicals for cleaning water and improving the business (Funyufunyu FF736)'*. Another partner would be purchasing fish feed and constructing additional ponds. *'Funding will buy more food, funding will improve my ponds (ChikhudiniF CF32)'*.

It was also mentioned that obtaining various fish species for profit making, purchasing fish food, increasing production systems could be good ideas.

'I will start by looking for different types of fishes and get what will make us quick profit. Buy good food for our type of fishes we have. Improve our fish ponds, increasing the number or sizes of fish ponds if what we have seems small (Funyufunyu FF68)'.

Blue Hat: Makhado Group

Partners we requested to give a summary of all the hats together about funding. Partner mentioned incorrect information during application as a black hat, purchasing of material and business growth as yellow hat, feeling of joy and business boom when the funding is obtaining as red hat.

'Funding will help us have a good name because we are not lying or giving wrong information, it means we will have a good name to the funder. So it, also help us to buy material or equipment easy so then the business will improve. Hmm then us as a project we will feel good when the business improve and it won't fall down because we have a right or enough money (Funyufunyu FF73)'.

Another partner mentioned disapproval of exorbitant amount of funding as a black hat, sustainable business growth if funding is acquired as a yellow hat.

'When you apply or request a large sum of money you are not sure whether it will be approved or not but if approved then the project will be sustainable and starts growing and it will be good for our community's work (Funyufunyu FF68)'.

Not knowing the location of funding organization was mentioned as a black hat, however if they are known the business will improve as the partner will be in a position to buy fish food as a yellow hat. *'If I find the place where funding is, it will improve my business because fish needs money to feed. I'm sure in my mind funding I will get it (ChikhudiniF CF32)'*.

Another partner mentioned a yellow hat saying that obtaining funding will be good for their community because they are the only fish farming project in the area. *'Funding will form what*

appears first from black to blue will be very pleasure to our people in our place is only our project who came with that dream for fisheries (Funyufunyu FF36)'.

Another partner also summarized the yellow hat only mentioning that funding will fast track business growth and it will be able to generate income. However, partner was also confused by how to do the blue hat. *'Funding will make our fish grow very fast our project will improve by making more money. Others are mixing with others and I am failing to understand how they are mixing (Funyufunyu FF68)'.*

Black Hat: Mutale Group

The researcher asked the partners to think about the negatives that could prevent them from obtaining funding. Partners mentioned that funding has age restriction and they prefer young people than old people, lack of government support.

'Age restriction because we are and government fund youth and women, men no. Being lazy to fill in applications, extension officer don't care about us, they are not giving farmers enough support (Tshaundi Tshelwala TT30)'. Other partners mentioned living in poverty without jobs and funders funding only their relatives or people they know. *'Poverty, joblessness and nepotism (TT79)'.* Another partner mentioned that other funding organizations fund only projects that are in a cooperative than individual. *'Some funding requires cooperative registrations (Mudau MA39)'.*

The researcher probed by asking partners to give reasons why they are not working in a cooperative setup. It was mentioned that cooperatives mismanage funds and materials given to them and they also steal from the project.

'To work in a group is difficult, they are not working hard most of the time and they steal money and fail to produce receipts. There was once a poultry project and they were supported with chicken feeds and everything and also funding, today they are nowhere to be found, others were given pigs and they were slaughtering them and selling (Tshaundi Tshelwala TT30)'. Another partner added by mentioning that it is demotivating to be funded in a group. *'To funded in a group is really demoralizing (Mudau MA39)'.*

Yellow Hat: Mutale Group

The positive things about funding mentioned were business growth, job creation and good financial management when they are funded individually.

'Business will grow, we will work, you can create jobs and if it is my own business I will make sure that I don't play with money, I will only work truthfully, I will look for market as well (Mudau MA39)'. Another partner mentioned effective time management and high enthusiasm during implementation. *'You come to work on time and leave on time and you will be highly motivated (Tshaundi Tshelwala TT30)'.*

White Hat: Mutale Group

The researcher asked the partner to give facts about funding and partner mentioned that hard work brings success. *'It will make us successful if you work hard (Mudau MA39)'*. Another partner mentioned that production improvement and acquisition of materials if funds are properly managed. *'Production will improve and you will have all equipments and if you manage it properly you will succeed (Tshaundi Tshelwala TT30)'*.

Red Hat: Mutale Group

Partners were asked to give their emotional feeling about funding. One partner expressed the feeling of joy and being able to plan properly if he has funding. *'We will be happy if we have funding. I can also be motivated and do it; I can plan properly (Mudau MA39)'*.

The researcher probed by asking partners if they have experience of asking for funding and one partner mentioned that they don't have experience of applying for formal funding, they only tried asking for donations from community members who failed deliver on their promises. *'We don't have that experience; we tried asking people in our community to assist with money so that we can buy cement. Normally they don't refuse to help, you will just realize with time that they are not contributing anything, it was just empty promises (Tshaundi Tshelwala TT30)'*.

The researcher probed by asking partners if they ever tried to request funding from government. One partner mentioned that their extension officer mentioned that government only fund cooperatives and the partner emphasized that cooperative system is a failure already.

'We went to the extension officer to ask for funding but he said we have to be in a group, in a cooperative. With cooperatives, they will fail (Tshaundi Tshelwala TT30)'. Another partner supported by giving an example of a cooperative that abandoned their project and only show up when there was money acquired.

'Cooperative people in the community they only come when they have the money. I am talking about someone who once asked for funding in a cooperative. Others left the project and he continued working alone. When they heard that, that person has received funding they came back to claim the project, they wanted shares. Even today that person has abandoned the project. He had beautiful fish and he also hired people to build ponds for him. Those members are no longer coming now, they only wait when he sells fish and demand their share of money (Mudau MA39)'.

Green Hat: Mutale Group

The researcher asked the partners to come up with ideas that they can implement to raise capital. Partner mentioned being able to access individual funding to ensure success.

'What can I do to be able to qualify for funding alone and not in cooperative so that I can be

able to be in control (Mudau MA39)'. Another partner mentioned that they can make enquiries in the department to look for someone who can compile a business plan. 'We must please enquire for us so that they can be able to help us with a business plan (Tshaundi Tshelwala TT30)'.

Blue Hat: Mutale Group

Partners were requested to summarize all the hats together. Business growth was mentioned as a yellow hat and black hat was mentioned as cooperative funding model that no longer serves them better. Searching for information to compile a business was mentioned as a green hat.

'Funding is good because the business will grow and I will work hard to make it successful but I am afraid of being forced to be in cooperative because it doesn't work but I need information and a business plan (Tshaundi Tshelwala TT30)'.

7.4. North West Province

7.4.1. Step 1: Focus Step

Disaneng (DS) Project

The draft goal was to supply the community with fish and business generating income. In specific partners articulated their goal as follows;

'High water pressures, aeration in the production are high, bigger production tanks to hold catfish and keep optimal temperature (28°C) throughout the year. To increase voltage of electricity at the transformer and meter box (Disaneng DS01)'.

'To increase the bacterial count in the biofilters to minimize levels of ammonia (DS03)'.

'To obtain quotation from aquaculture engineer (service provider) and also increase the number of vortex filters in the hatchery (DS04)'.

In measurable, partners were asked how they would assess whether the goal was achieved and they mentioned that, *'the number of farmers, profit and increase in capacity are all measurable. Fish will reach market size in time; there will be less mortality in tanks, minimal electricity trapping (DS01)'.*

Partners indicated that the goal was achievable and it was relevant because *'there was need to sell fish to customers in time through best performing fish (DS04). The goal would reach a target of 2% profit and within a time-frame of 6 months'.*

SMARTT goal was to enhance the low system performance of our project by improving water pressure, aeration, temperature, filters, electricity and appoint aquaculture service provider to improve the system thereby ultimately improving profit by 2% within six months (see Table 7.27).

Catfish Supreme (CS) Project

The draft goal was to make the catfish production system operational again. In specific, this was how the partner was clear about what was going to be achieved. *'Acquire import permits for new broodstock and fry, upgrade filters and pumps to increase capacity (Catfish Supreme CS43)'*.

This was how the partner would assess if the goal was achieved in measurable, *'by receiving permits; fully functioning systems and building with brick walls (CS43)'*.

The goal was realistic because it was, *'within the capacity and scope of the company to achieve goals (CS43)'*.

The goal was relevant and targeted partner would reach the export levels he was in before. *'To get back to the export levels before the land claim stopped production (Catfish Supreme CS43)'*. Time - frame was 9 months and the SMARTT goal was to obtain permits for catfish broodstock and upgrade the system at CS farm to reach export capacity within 9 months.

Table 7.27: Outcome of draft and SMARTT goal developed by DS and CS projects

Research Partner	Draft Goal	SMARTT Goal
DS 01, 02, 03 & 04	The main reason is to provide fish for our customer, just to have more fish to supply. We want to see the project growing and making money	To enhance the low system performance of our project by improving water pressures, aeration, temperature, filters, electricity and appoint aquaculture service provider to improve RAS and the profit by 2% within six months
CS 42	Get the system into production again	To get permits for catfish broodstock and upgrade the system at CS farm to be able to reach export capacity within 9 months.

Disaneng (DS); Catfish Supreme (CS)

7.4.2. Situation Analysis

Disaneng (DS) Project

The variable system had the highest frequency score of 5, followed by hatchery (Figure 7.33). Partners indicated non-functional fish system with poor water quality parameters. *'The aquaculture system that is not working well, that gives our fish problem to grow well, lack of oxygen in the water, water that produce ammonia, the under feeding of fish because the system cannot handle waste well and food that is left by fish, heat pump trapping (Disaneng DS4); system not running well (Disaneng DS01)'*.

The bacteria in the biofiltration system were few and caused high fish mortalities. *'Unable to keep bacterial count in the biofilters and high mortality rate (Disaneng DS03); bacterial count is low (DS01).'*

Oxygen occurred two times. *'Lack of oxygen in the water (Disaneng DS04), and oxygen is not enough in the production tanks (Disaneng DS03).'*

Waste had frequency score of 2. The fish waste was not removed effectively from the system. *'The faeces of fish because the system cannot handle waste and food that is left behind by fish (Disaneng DS04).'*

'Not enough pressure in the system to clean the waste material and faeces of fish (Disaneng DS03).'



Figure 7.33. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Disaneng DS project adapted from ATLAS.ti8

Catfish Supreme (CS) Project

The word hatchery had a frequency count of 4 (Figure 7.34). Partners indicated hatchery revamp of installing new filters, pumps, and build an inner wall.

'Fit production system filters, fit new pumps and production system, build new inner walls to separate system (Catfish Supreme CS43).'

Installation of heaters and electrical controls. *'Fit filter material for hatchery, build heaters for hatchery, and install electrical controls in hatchery (Catfish Supreme CS43).'*

The word wall was indicated 3 times. Partner will reconstruct the hatchery wall, *'breakdown dam walls rebuild dam walls and build new inner walls (Catfish Supreme CS43).'*

Permit was mentioned two times by the partner, *'Get permits from Department of Environmental Affairs (DEA) and Department of Agriculture, Forestry and Fisheries (DAFF) (Catfish Supreme CS43)'*.

Plankton appeared twice, *'seal plankton ponds and stock plankton ponds (CS43)'*.

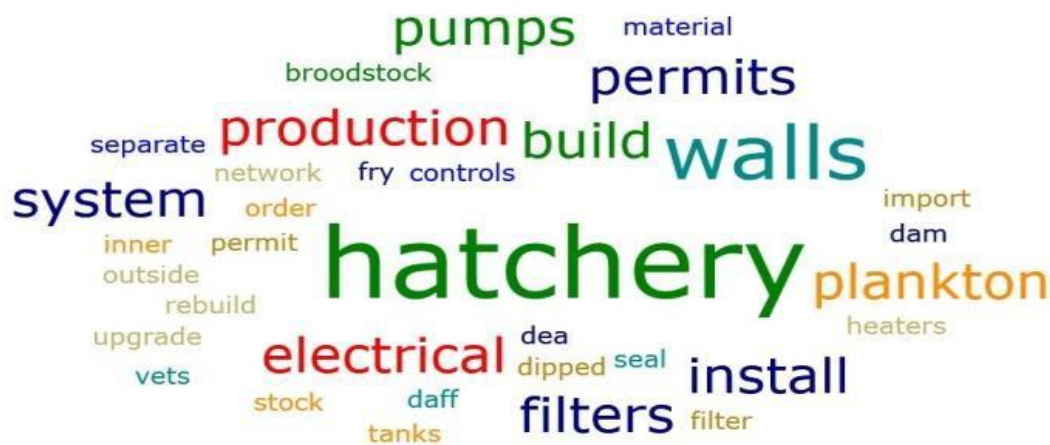


Figure 7.34. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Catfish Supreme CS project adapted from ATLAS.ti.8

7.4.3. Impact Analysis Step

Impact and Influence: *Catfish Supreme (CS) Project*

The developed opportunities were assessed on a scale from 1-10 the level of impact and influence. Opportunity to influence the permitting system (1.1) achieved first highest impact score of 9 and fifth highest influence score 5. Partner listed the various kinds of permits he plans to obtain. *'Get permits from Department of Environmental Affairs (DEA); get permits from Veterinarians, get import permit from Department of Agriculture Forestry and Fisheries (DAFF) (Catfish Supreme CS43)'*.

The opportunity to import broodstock (1.2) achieved first highest impact score 9 and fourth highest influence score 6. Partner indicated that the broodstock from international possessed excellent genes, *'we order broodstock and fry from Holland and the reason to import is better genetics (Catfish Supreme CS43)'*.

Opportunity to ensure live food production (1.3) achieved third highest impact score 7 and influence score 8. Partner would produce live food for fry catfish to prevent cannibalism and also reduce the dependency on the highly priced manufactured pellets.

'Seal plankton ponds and stock plankton ponds to produce zooplankton or live food in a pond, harvest and feed the fish in the system. Catfish starts hunting at two days old, it starts hunting at two days old, and hmm I've struggled for many years with very expensive artificial feeds and plankton feeds from hmm the kraal and staff like that, imported feeds to get rid of cannibalism in catfish and cannibalism starts at two days old. So they are hunting from that day one and then i changed completely too organic system where i only feed plankton and

staff like egg yolk. Then i got rid of cannibalism completely. And the basic principle is if it opens its mouth the food must go in. I fed every two hours, 24 hours a day. You don't go to sleep when you have small fish. So i had people at eight hour shift and we produced our own live plankton then you must harvest them, you must grade the fish according to size and in those catfish there was no cannibalism problem, nothing (Catfish Supreme CS43)'.

Furthermore, probing revealed that lack of dedicated feed factory was a problem faced by the country at large and even the existing animal feed companies had stopped production of fish food due to loss of profit as compared to dog food.

'The animal feed company published a circular saying they are no longer doing fish feeds anymore. And you must look at it from that point of view, they produce dog food and they make a lot of money on that, so why should they stick with fish food, i worked with them for quite some time ago, hmm when we grew that 50 tons of fish and i asked them for a quote, they said we had to stop a production line for dog food, so that we charge you for the down time, if we made 50 tons in that period of dog food and our income was that and our profit was that, we want to get it from your catfish feed as well, my catfish worked at R18 000 a ton, there is no way you can grow fish economically at that price, there is no way (Catfish Supreme CS43)'.

Partners further indicated that owning a feed company as a business can be a solution to these costly pellets and his business was strategically located near a silo.

'I am going to do it myself, the feed for sure for sure. I am going to put up a factory for my fish here in my fish farm, there I can put a feed factory right there next to the silos, so that I do it there because there is a railway connection to my farm and i've got the silos, so I have maize, sunflower and soya on my door step, right there. I don't know from you this whole Phakisa thing from 2015, my farm was identified as an Aquaculture Development Zone (ADZ), so but markets and funding are non-existing (Catfish Supreme CS43)'.

Opportunity to upgrade electrical networks (1.4) achieved fourth highest impact score 6 and fifth highest influence score 5. Opportunity to upgrade production facilities (1.5) achieved impact score of 3 and influence score of 5. *'Fit filter material for hatchery, fit pumps for hatchery, build heaters for hatchery, fit production system filters, fit new pumps and production system, breakdown down dam walls, upgrade electrical network. Install tanks and dipped filters (Catfish Supreme CS43)'.* The scores were plotted on the impact and influence electronic spreadsheet (see Figure 4.35).

IMPACT AND INFLUENCE AVERAGES

CS: CYCLE 1

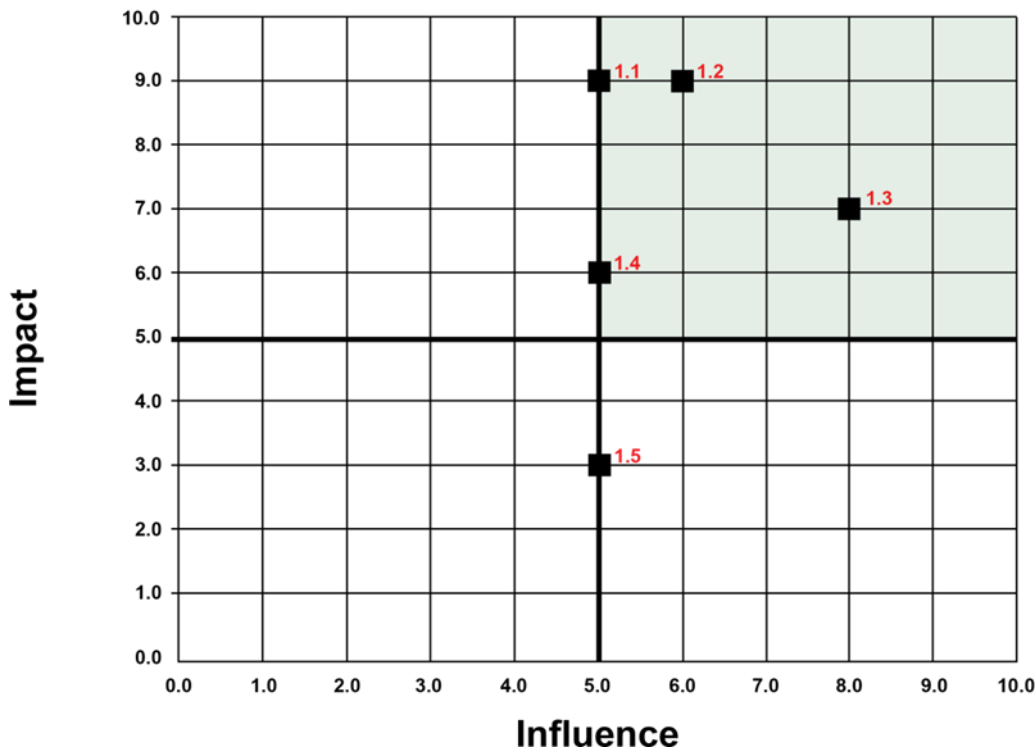


Figure 7.35. The scores of impact and influence tool employed to assess opportunities in Catfish Supreme CS Project

Eight Dimension Criteria: Catfish Supreme (CS) Project

The selected opportunities with high scores of impact and influence were assessed on a scale of 1-10. On the eight dimensions bar graph, benefit scored first highest score 10 in obtaining permits (1.1); importing broodstock (1.2) and electrical networks (1.4). Cost of not doing achieved the highest score 10 in electrical networks and second highest score 8 in the remaining opportunities. Ease achieved third lowest score 4 in permits and live food production; followed by importing broodstock with the second lowest score 3 and lowest score 1 for electrical networks. Motivation achieved the highest score 10 in all the opportunities. Total score for positive dimension was 32/40 in obtain permits and 31/40 in importing broodstock, live food production and upgrade electrical networks.

Cost achieved the highest scored 10 in importing broodstock and upgrading electrical networks; second highest score 8 in live food production and first lowest score 2 in obtaining permits. Risk achieved second lowest score 3 in live food production and first lowest score 2 in the remaining opportunities. Time achieved the third lowest score 4 in obtaining permits, importing broodstock and electrical upgrade. The second lowest score 3 was obtained in live food production. Term scored third lowest score 4 in importing broodstock and upgrade of electrical network; second lowest score 3 in live food production and the lowest score 1 was

also in obtaining permits. Total score for negative dimension was 21/40 in importing broodstock; 20/40 for upgrading electrical networks; 17/40 in live food production and lower negatives were 9/40 in obtain permits (Table 2.28).

Table 2.28: Scores of selected opportunities from Eight Dimension Criteria for Catfish Supreme CS project

Criteria	Opportunity 1.1: Obtain permits	Opportunity Importing broodstock	1.2: Opportunity Live production	1.3: food Upgrade network	1.4: electrical
Benefit	10	10	8	10	
Cost of not doing	8	8	8	10	
Ease	4	3	4	1	
Motivation	10	10	10	10	
Positive Total	32	31	31	31	
Cost	2	10	8	10	
Risk	2	3	2	2	
Time	4	4	3	4	
Term	1	4	3	4	
Negative Total	9	21	17	20	

Eight Dimensions Pinwheel Version: *Catfish Supreme (CS) Project*

The scores from eight dimension table were further plotted on the eight dimension pinwheel. According to the pinwheel, the bell shape on the right hand side was bigger in obtaining permits (1.1; followed by importing broodstock (1.2), live food production (1.3) and upgrade electrical works (1.4).

On the left hand side the bell shape was bigger importing broodstock; followed by upgrade of electrical works; live food production and smaller in importing broodstock. Opportunity of importing broodstock was taken further to the next step (Figure 2.36).

EIGHT DIMENSIONS PINWHEEL VERSION

CS: CYCLE 1

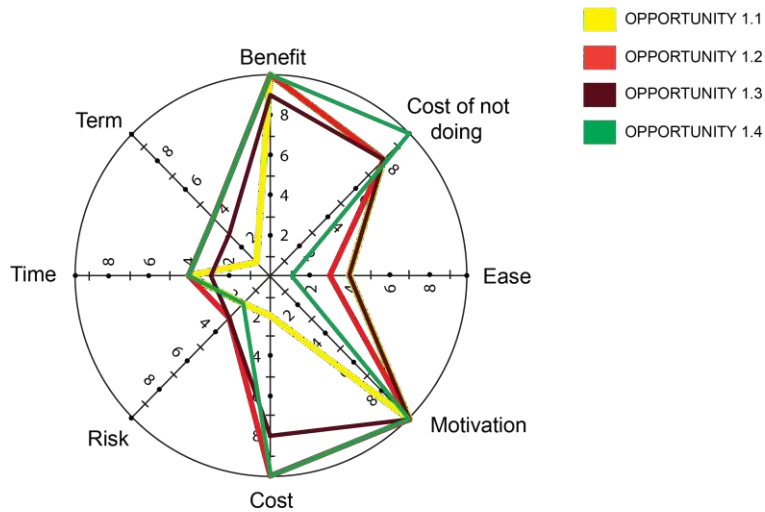


Figure 2.36. Scores for permits, broodstock, live food production and electrical networks on Eight Dimension Pinwheel Version for Catfish Supreme CS project

Impact and Influence: *Disaneng (DS) Project*

Opportunity to improve system performance (1.1) achieved highest impact score 10 and first highest influence score 9. Opportunity to fix trapping electricity (1.2) achieved highest impact score 10 and first highest influence score 9. Opportunity of retaining fish system bacterial count (1.3) achieved first highest impact score 9 and third highest influence score 7. Opportunity of improving aeration (1.4) in the system achieved highest impact score 10 and second highest influence score 8. Opportunity 1.5 improve late feed supply (1.5) achieved third highest impact score 7 and fifth highest influence 5. Opportunity fix fish system vortex (1.6) achieved second highest impact and influence 8. Opportunity to improve pressure to circulate water (1.7) scored highest impact 10 and second highest influence 8. Opportunity to improve fish growth to reach market size (1.8) achieved highest impact 10 and third highest influence 7. The opportunities were best articulated by partners in the following manner:

'Number one is system does not run well. Number two, I wrote electricity it must be upgraded because they once installed lots of pumps so now those pumps trap electricity. Hmm... bacteria count must stay in the biofilters, so they are few they can't eat up ammonia so that it doesn't go back to the fish, so these bacteria are very few in the biofilters. Another one is water test kits, we don't have water test kits to check ammonia, they also check oxygen if it is available in the system. Fish foods are bought late. Vortex filter not working well, vortex is something that supposed to catch fish waste so that they don't return back to the system, meaning they must not go back to the sump, they go to the sump and then to biofilters and

return back to the fish, they can create salmonella disease. Vortex is basically fish toilet it is supposed to catch fish waste and be drained outside. They do work but not hundred percent (DS01)'. The impact and influence scores were plotted on the electronic spread sheet (Figure 2.37).

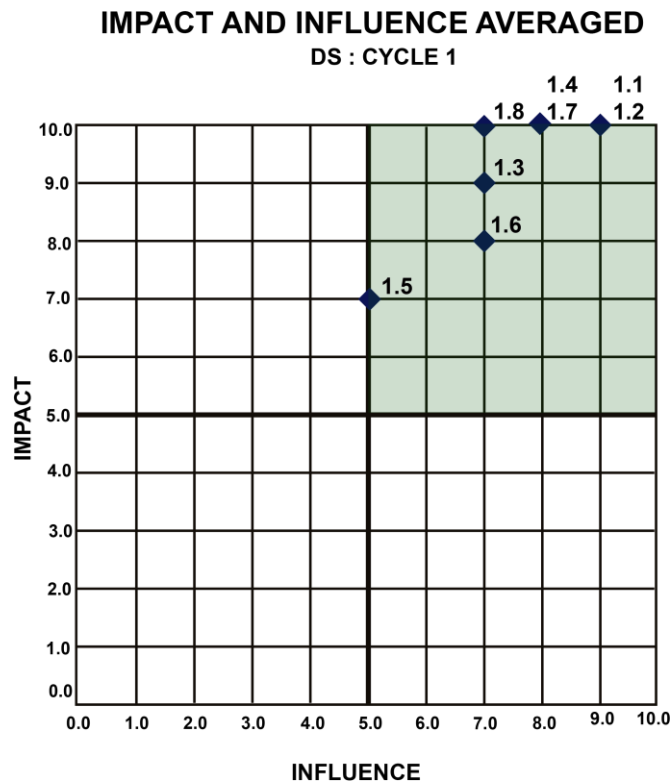


Figure 2.37. The scores of impact and influence tool employed to assess opportunities in Disaneng DS project.

Eight Dimension Criteria: Disaneng (DS) Project

The selected opportunities developed from the previous step were assessed on the eight dimension criteria. Benefit achieved second highest score 8 in system performance (1.1) and fixing trapping electricity (1.2). Researcher asked partners how the system performance would be improved. Partners wanted the system to be restored to its original form of producing fish that reached market size on time.

'If the engineers can make the system to be back to its first pattern it might be fine, the people ruined it. The system was working well initially, it was producing well and the fish were fed enough food not a few like now, so someone from Rhodes came and changed the system here and there, so if it can be taken back to its original design, it will be okay (Disaneng DS04)'. Partners requested government to intervene a lot of times. 'We have tried for a long time to ask our government to fix the system and change it into its original design (Disaneng DS03)'.

Researcher had an opportunity to request the assistance of the original system designer to assist the project with their Recirculating Aquaculture System (RAS). Partner indicated that the project lacked experts to drive the business, the electrical cable was struck by lightning and the people also lacked business management knowledge.

'That system, it's a good idea to get people from the community and empower the people from the community but if you don't have a driver, a jacky that knows aquaculture because within 18 months of me finishing their system, the whole system was dead, hmm nobody told them listen guys you need to take out insurance on this and like where the generator is alongside that brick building there is a generator there lightning struck the cable from the generator to the building its just half the meter and that's where the lightning struck it, so all the time to try start-up they are single faced and all three systems the pumps burn out the whole system fell flat because they didn't have the money to put a new pump. Then nobody took ownership there, you can't expect the guy there to know everything, he is willing but the knowledge is not there, especially the management of that farm to do the work, to work with the fish I think he knows it, but hmm they were just left alone, then ok, Rhodes University came on board so let's see what they did (Catfish Supreme CS43).'

Total score for positive dimension was 33/40 in system performance and 30/40 in upgrade electricity.

Cost of not doing achieved first highest score 9 in system and also scored fourth highest score 8 in electricity. Ease obtained fourth highest score 6 in system performance and third highest score 7 in electricity. Motivation obtained the highest score 10 in system and third highest score 7 in electricity. Cost obtained third highest score 7 in both system performance and electricity. Risk obtained a score 6 in system performance and 5 for trapping electricity. Time obtained fifth highest score 5 in system performance and fourth highest 4 in electricity. Term obtained third highest score 7 in system performance and second lowest score 3 in electricity. Total score for negative dimension was 25/40 and fix trapping electricity was 14/40 (Table 7.29). Partner indicated that the electrical fault was with utilising two phase electricity instead of three phase which was a lot higher power.

'It traps right through even in summer it traps. It is important to solve the electricity because the problem for electricity to trap, there are too many pumps plus blowers. Electricity at the meter is 25kva and at the transformer is 50kva and they supposed to upgrade to 50kva into 100kva and 25kva into 50kva, that's the problem with electricity (Disaneng DS01).'

Table 7.29: Scores of selected opportunities from Eight Dimension Criteria for Disaneng DS project

Criteria	Opportunity 1.1: System performance	Opportunity 1.2: Fix trapping electricity
Benefit	8	8
Cost of not doing	9	8
Ease	6	7
Motivation	10	7
Positive Total	33	30
Cost	7	7
Risk	6	5
Time	5	4
Term	7	3
Negative Total	25	14

Eight Dimensions Pinwheel Version: *Disaneng (DS) Project*

On the right hand side the bell shape was bigger in system performance (1.1) indicating high positives and smaller bell shape in fixing trapping electricity (1.2). On the left side of the pinwheel, the bell shape was bigger in system performance with high negatives and smaller in fix trapping electricity showing low negatives (Figure 7.38).

**EIGHT DIMENSIONS PINWHEEL VERSION
DS : CYCLE 1**

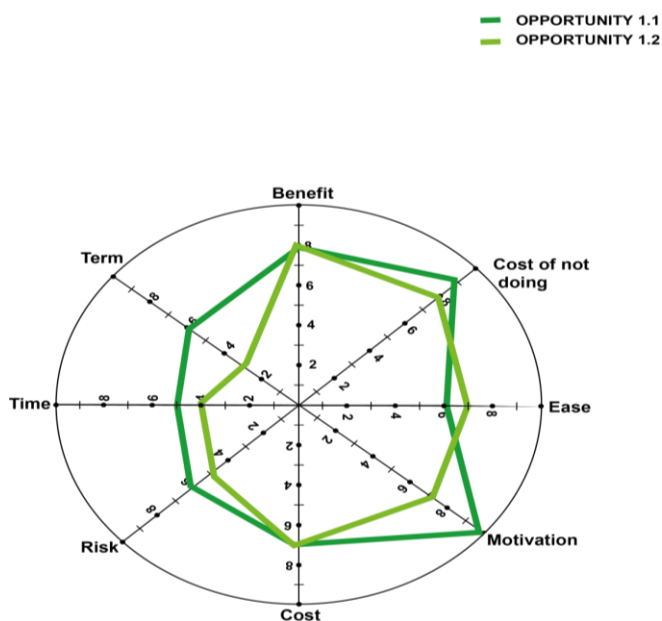


Figure 7.38. Scores for system performance and electricity on Eight Dimension Pinwheel Version for Disaneng DS project

7.4.4. Action Design Step

Catfish Supreme (CS) Project

In CS project, action was designed on the opportunity of obtaining permits from various state organs. Partner would search for the requirements to apply for the permit, complete the application form, and make follow-ups until a copy of the permit was obtained (Table 7.30).

Table 7.30: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Catfish Supreme CS project

Project number	Opportunities	CSFs	KPIs	KAs
CS project	Obtain permits for catfish broodstock	Obtain requirements	Written responses	Forward an E-mail to the state organs
		Submit applications	Received acknowledgements	Complete permit application forms
		Follow-up progress	Email, phone	Contact the responsible unit in the departments and make follow-ups
		Receive permits	Received permits	Receive confirmation of permits

Disaneng (DS) Project

The researcher asked partners in Disaneng (DS) project what was critical to have to improve low system performance (Table 7.31). The partners mentioned that high oxygen levels, less ammonia, optimal temperature, increased fish growth performance, less waste in tanks and balanced water.

'Aeration in the production system is high, when the fish are growing, when we see less ammonia and temperature is okay (Disaneng DS03). When the waste of fish is no longer there in the vortex and not having waste in the tanks (Disaneng DS04). When the water is balanced from all of the production tanks (Disaneng DS01).'

Researcher asked partners to explain the meaning of high water pressure and they reported that water in the tanks was unbalanced and not pumped with high pressure.

'It is water that can't balance one side, it goes down and the other side goes up, the experts said water is not coming with a lot of pressure in the tanks, they are not moved by suction pipe, it is the one that moves pressure so that water can be able to go inside the pumps, vortex of the pump is weak (DS01).'

The researcher asked partner to list key things necessary to have (KPIs) to achieve their goal. Partners mentioned that there would be no fish waste in tanks, installed water pump and pressure pump in the system.

'Not having waste in the system (Disaneng DS03); to put water pump (Disaneng DS04); when the water is balanced, I can see by the balancing pipe, pressure pumps (Disaneng DS01).'

The researcher probed by asking what made water not to balance in the system. Recirculating water does not have pressure because of wrong installation of pipes.

'Isn't water is running short of pressure, pressure runs away, engineers did not install the pipes properly in the biofilters because the pipes on one side they are fine and on the other side they put wrong pipes, so replacing water pipes will fix most of the things written down (Disaneng DS01).'

Researcher asked partners to explain the Critical Success Factors (CSFs) of improving aeration in fish tanks and they explained that for ammonia to be less, oxygen needed to be high to enable bacterial growth.

'For ammonia, when the oxygen is a lot in the water the bacteria grows, they are happy when oxygen is more in the biofilters, it goes hand in hand with oxygen, isn't oxygen supposed to be there so that the bacteria can be able to be created in large numbers (Disaneng DS01).'

'The waste in the biofilters should be in small quantities, isn't fish waste the small amount that enters is the one that makes bacteria to be there, fish waste should not be a lot so that they can be there because fish waste is the one that makes the bacteria but not too much, because ammonia can be produced (Disaneng DS03).'

Researcher probed by asking partners what would be the key action to have aeration in the system? Partners indicated they needed to install aeration unit and air tubes in the tanks. One partners also explained that the experts indicated that oxygen generated in biofilters was enough to grow fish and that came as a surprise. The lack of oxygen in the system was also viewed as an abuse of fish by partners.

'By installing airstones and finding aeration tubes. It is only blowing inside the biofilters and they blow for bacteria, but in the production system they are not there (Disaneng DS03). I'm surprised because they said oxygen that enters the biofilters, when water is returned back to the fish they said it goes with oxygen inside, but because there is bacteria, bacteria produces oxygen, I didn't believe them (Disaneng DS01). Society for the Prevention of Cruelty to Animals (SPCA) will arrest us because we are abusing the fish by not giving them oxygen (Disaneng DS04).'

The partners listed the action of increasing bacterial count as testing fish water at a laboratory on a monthly basis.

'By taking water to the laboratory (Disaneng DS01); by having less ammonia, get printed results to show levels of bacterial count. To take the water sample to the laboratory in Potchefstroom; testing water with test kit to check ammonia, pH and nitrite at the laboratory they check bacterial count and we check ammonia and nitrite ourselves, we have where we record (Disaneng DS03).'

'It is something we do every month taking water to Potchefstroom; I can follow-up with Animal Health Technician to measure ammonia, nitrite with water test machine because it can last long (DS01).' The fish stress under unfavorable water conditions, *'the fishes are unable, they*

will stress and when they are stressed they are not feeding, temperature should not be less than 11°C, and it gets below 11°C during winter, even in winter -1 to -4°C (DS03)'.

Increase vortex was also listed as a Critical Success Factors (CSFs) and partner explained this by mentioning the growth of bacteria on a filter media caused by faeces and enabling the bacteria responsible for conversion of ammonia to ammonium possible. *'Inside the sump there is a filter media, faeces makes bacteria in the sump, filter media makes the bacteria to be created, in the vortex the waste makes the bacteria to be present (DS01)'.*

The Critical Success Factors (CSF) of upgrading electricity, partners mentioned that it was mostly handled by their department and electricity service provider visited the project for assessment and they were awaiting payment for the upgrade. Partners have made lot of attempts to follow-up on this matter and nothing was done. Partners expressed that services from their department demoralized them and there was lot of inconsistencies with the quoted prices. Additionally, their department does not want to give them proof of payment and them also having a mind of sourcing funding elsewhere.

'Get a quotation from Eskom, Eskom submitted the quotation to Agriculture, we wanted the department to pay for Eskom to come and upgrade. Eskom once came to check what is needed here, they are waiting for payment so that they can come and upgrade, this is the second quotation from Eskom, one was made in May and another one in June, we talked with the extension officer, she talks to her supervisor who talked to the one on top of her, we write minutes, sometimes we write letters, sometimes we email (Disaneng DS03)'.

Officials from government responded verbally on the request addressed to them in writing by partners. *'Even in writing there are no changes, even previous years we were writing, writing to chief director and he will reply verbally (Disaneng DS01). They reply to us verbally and also send officials, they demoralize us (Disaneng DS04)'.*

'When we are in the meeting and we ask if electricity was paid, they gave us nothing that showed that electricity bill was paid, last week we heard that electricity bill was paid, R42, 000 for twelve months, we don't have anything to show that electricity is paid. Department don't want us to be independent; they don't want others outside to help us also (Disaneng DS01)'.

Partner also elaborated on the process of obtaining assistance from electricity service providers for private usage. *'Understand, people we do fix electricity at our homes, you call, then it goes to Bloemfontein, they bring someone to fix the electricity. This one we don't understand because is for project in North West that falls under the department; we don't know if we do it like that it can cause problems for us, to cause friction. Because Eskom sends quotations and subcontractors through the department (Disaneng DS04)'.*

The Critical Success Factors (CSF) of appointing an aquaculture system designer to assess the system for slow performance. Partners wanted to hire someone who was an expert in aquaculture system design and not any other engineer.

'You know what I am looking at guys, I am looking at aquaculture strictly, our system required

someone who will understand it, that engineer works with bricks and roads, we are working with fishes (Disaneng DS04)'.

Replacing water pumps was also identified as a Critical Success Factors (CSF). Partners mentioned that a service provider contracted by their department replaced the right pipes with the wrong pipes and their reason was that the old ones were consuming a lot of electricity. Partners were surprised because they never experienced high power consumption with the old system. Partner felt that they bought cheaper material for them to save themselves a lot of money after rendering services.

'We have the right pumps but the problem when Rhodes University came here they changed the right pumps, and said the pumps we were using, the right ones, consume electricity too much meaning we are going to pay lot for electricity, but the time we were using we didn't see ourselves paying lot of money for electricity, they wanted to change them and put cheap ones, the reasonable ones so that their budget can remain with lot of money (Disaneng DS01)'.

Partner mentioned that the service provider upgraded their system without fish inside and they never tested if the upgraded system will grow fish in time. *'Another thing is that when they changed the system there was no fish inside, they didn't run it and they just changed only and said it is consuming electricity (Disaneng DS03)'.*

The partner indicated the issue of being excluded by their Department from meetings held with the service provider and they were not updated afterwards. Furthermore, partners embarked on a protest but unfortunately many things were changed in the system already without their knowledge. *'At that time Rhodes University was holding lot of meetings with the Department and left us outside, when they were having those meetings with the department there was a protest to say what are they saying about us when we are not included, unfortunately they already changed lot of things, we came in as owners when it was too late (Disaneng DS01)'.*

Partners wanted to take monthly records of fish weight to assess growth performance of fish. They mentioned that the fish in the system were stocked in 2014 and three years later they only managed to reach 2 kg. Partners did mention that they lacked a skill of taking correct fish measurements.

'Our catfish are from 2014 but they did not reach 2 kg. The 2016 fish managed to reach 2 kg, we don't know how to measure length, and we only know weight. We can weigh food for the whole system. We sample three fish and weigh them to see the size of the fish, others we sample and weigh without counting and even fingerlings we do weigh (Disaneng DS03). I prefer to weigh the whole tank, and then sort them accordingly so that I can see that they are 5 grams, their weight (Disaneng DS01)'.

Table 7.31: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Disaneng DS project

Project number	Opportunities	CSFs	KPIs	KAs
DS project	Improve low system performance	High water pressure for circulation	Not having fish wastes in the tanks. When water is balanced from all of the production tanks.	Liaise with initial system designer. Obtain a quotation to fix the system. Travel and accommodation. Replacing water pressure pump.
	Improve aeration in tanks	Aeration in the production system is high	Airstones. Air tubes	Install airstones and aeration tubes in each tank. Connection of the air blowers

(Full version Appendix 8)

7.4.5. Action Implementation Step

Action Monitoring: *Catfish Supreme (CS) Project*

Partner gave feedback on the action implemented and he mentioned that there was no action taken on all the designed activities. Partner was fully committed on the poultry farming business more than fish farming and he mentioned how they had to work around the clock to complete a chicken house for a new batch of stock received lately.

'To be honest with you, I didn't think about it for atleast a month, then I wanted the activities I could not find them. To be honest with you the last time you were here I received 126 000 chickens, hmm we had to finish the chicken house we worked until 12 o' clock at night and then started 7 o' clock once again. So I haven't done anything about your paper. To obtain requirement written response from whom, that should be Department of Environmental Affairs (DEA) and Department of Agriculture, Forestry and Fisheries (DAFF) I think. To obtain requirements from state departments for permitting, I haven't done that. Submit application I haven't done that. Ok this must be finished by the end of November, ok then I will have to pull my finger and do something (Catfish Supreme CS43).'

The researcher asked the partner if there was any kind of support he needed to keep implementing. The response was there was no support at the stage he was in.

'At this stage I can't say if I will need support. I think what I will need to do, is to make contact with this people and then I will be able to say listen this guys are not willing to play ball or whatever the case maybe (Catfish Supreme CS43).' The partner managed to make ad hoc visit to one of the state department while in town visiting his lawyer and he could not get any assistance from officials due to lack of aquaculture expertise in their department.

Partner still showed determination to keep implementing his Critical Success Factors (CSFs) when the poultry business slowed down.

'I went to see a lawyer about the chickens and I couldn't find him and said let me run to Department of Environmental Affairs (DEA) quickly, I drove there and they said but no there is nobody here that knows anything about aquaculture and I said ok I will come back so it was completely unproductive. No action taken due to other commitments. I will definitely do this in November because today is my last delivery for this month and it will be a little more quiet and it will start again in December, I hope so (Catfish Supreme CS43).'

Disaneng (DS) Project

System design feedback by partner Disaneng DS01 and he mentioned that the activity was not acted upon due to historical conflicts regarding fish performance that the service provider and department of Agriculture had and they were afraid it would be conflict of interest.

'I was supposed to talk to system designer but because the department once bought niloticus from him and they did not grow, we thought it would be conflict of interest and we decided not to engage him. A system designer, we met him through the department (Disaneng DS01).'

Another partner gave feedback mentioned that they obtained another quotation for Recirculating Aquaculture System (RAS) assessment, water test tubes and vortex. Electricity upgrade account was settled and fish feed were also bought.

'I have a quotation from another service provider to assess our system, water test tubes and vortex. They paid for the upgrade and bill of account for twelve months, and fish feed (Disaneng DS03).'

Another partner added further by mentioning that they had proof of payment for electricity and delivery note for fish feed. They were not in possession of a copy of an invoice since deliveries were made at the department and then the extension officer delivered them on site.

'For electricity we have proof, for feed delivery note we have, invoice was not given to us because the person who delivers, delivers at the department and then the department brings them here (Disaneng DS01).'

Additional examples were given where the water testing equipments were purchased by the department and were never delivered on site. The service provider forgot to give the partners during fish feed delivery and left them with extension officer and they never reached the project.

'There are water quality things that were paid for, the delivery note said delivered but we did not receive them, and then last time the person who brought fish feed, did not come in three months and said he had them and forgot them in his car and left them with the department, we contacted the department and they said they are there, they will bring them to us, but

they never did (Disaneng DS03)'.

Partner also attested that there were conflicts that existed between the project and the department of Agriculture and he further mentioned that one of them attended training at Free State about catfish breeding organized by the department at ad hoc.

'There is a conflict between us and the department. Training in Free State was attended for catfish breeding, water quality, filleting, dissecting, bacteria and parasites for five days (Disaneng DS01)'.

7.4.6. Performance Assessment Step

Result Assessment: *Disaneng (DS) Project*

The presenter gave feedback of looking for a quotation from system design expert and the results were that the expert was concerned about who will be carrying the responsibility of payment between the project and the Department of Agriculture. *Results of action, I called the expert to assess the Recirculating Aquaculture System (RAS) and write the detail report on the matter. He asked who is going to pay the travelling costs. I asked how much, he said I want to know who is in charge to pay between you and the department of Agriculture, tell them to write full details to me (Disaneng DS01)'.*

The presenter further mentioned that on Critical Success Factor (CSF) number two there as not action because there is a huge conflict between the project and the department.

'CSF number two: I didn't call the department because of the conflict between us and department. Support needed: renovations of the system putting vortex in unit 3 and putting drum filter in unit one (DS01)'.

DS04 gave feedback on results achieved on increase bacterial count in the biofilters. The partner contacted extension and support to test their fish water and they did not come because of the unresolved pending issues between them and the department.

'Result of action to increase bacterial count in the biofilters and minimize level of ammonia. I did call extension officer to test the water; he didn't pitch because there is still pending issue with the department. Support needed: we need to buy test kit machine or tablets to test water every morning (Disaneng DS01)'.

The activity of appointing system designer the partner managed to contact their local municipality to look for an engineer who can assess the system and they are still waiting for response. *'To appoint aquaculture system designer: I have contacted the municipality to assess the system, still waiting for answer from the manager about the letter I wrote to her (DS04)'.* Support needed the partner said I am thinking of searching for her number to talk to her in person in the newspaper because she is always in newspapers about municipality, they usually have her personal number.

On the activity of designing visitor's book the partner designed the visitor's book and no

support is required. *'I have designed visitors log book for visitors. Support need: I don't think I need a support people just need to write their names (DS04).'*

The researcher probed by asking partners to explain further about the type of conflicts they have with their department. Partner mentioned the issue of department failing to ensure that Rhodes University settled an account of a person who delivered bricks that were used to build the hatchery until the contract expired. The department decided to buy him new bricks instead of paying him and the person took the generator from the project as ransom. *'Department owes the guy who delivered bricks here and the bricks were used to build the hatchery. He has been sending invoices to the department for them to pay, but they said to him they will give the invoices to Rhodes University. They never did that until the contract of Rhodes expired. They kept telling the guy to look for his money from Rhodes University and he doesn't know Rhodes University. There was a generator here from department and the guy took it, and said the department will pick it from him after they pay him his money because the bricks have been used for the work already. So the department bought new bricks instead of paying him, and they said he must come and pick the bricks and return the generator. So he said those bricks are not his, his bricks have already built the hatchery, he wants his money (Disaneng DS01).'*

Partner mentioned that another conflict was between the local chief and the Department who also repossessed the boat demanding to know the proof of ownership of the boat. The Department ceased support services to the project until the generator and the boat were brought back to the project.

'The chief here, there was a boat sitting here in the project bought by Rhodes University, and the chief took it and put it at his home and said if department wants the boat they must come to his home and pick it up. He wants to know if the boat belongs to the project or the department. Then we told him that it was for the department, he said where are the papers to show that it belongs to the department because it was bought by Rhodes University. Then the department said they want the generator back and the chief must also bring back the boat, they will not help us until those items are returned. But they said it verbally they never wrote a letter to us saying they are stopping to render services to us. They told us in a meeting because they came here with the police (Disaneng DS01).'

The other partner elaborated further on the matter of the boat by saying that the problem started when national department wanted to visit the project, the chief supposed to be informed about everything that is happening in this village so the department was no longer doing that. The chief started to complain to them and with this visit the department did inform the chief and unfortunately the chief was not going to be present and he requested that the visit be postponed and the department didn't postpone and that caused huge problems.

'The major problem started when Department of Agriculture, Forestry and Fisheries (DAFF)

was supposed to visit us. They normally make an appointment every time, everything started at the chief to let him know that visitors are coming. All along they were no longer doing things like that so chief was complaining about them. Now they did call him and let him know that DAFF is coming, then chief asked them to shift the date since he is committed so that he can be present in the meeting, and they didn't. That created problem of the boat being taken. Rural, Environment and Agricultural Development (READ) were no longer coming to our meetings for a while now, then the day they came they found that the boat is gone, it became another issue on top of another issue (Disaneng DS04)'.

Partners were asked what transpired on the issue of the water test kit. The partner mentioned that the department bought the water test kit and fish food. The person who delivered fish food forgot them in his vehicle and said he will give the extension people at the department. He did give them but they never gave us the water test kit but they wanted the project to put a signature to say they have received water test kit.

'The guy who brought fish food forgot them in his car, and dropped them at the department, extension officer said she will come with them and they are there, the guy left equipment with them. I also refused to sign for the water test kit because I didn't receive them, they were bought by Agriculture (Disaneng DS01)'.

Ideas are to breed catfish to sell, partners were asked to elaborate further.

'Because we will move the fish faster so that if they become stunted they must not be stunted while they are in this business. We would have sold because our system is not breeding well. Put more oxygen in the tank (Disaneng DS04)'.

Is breeding part okay, it was just the grow-out part that was not.

'The hatchery is okay, but now the problem the electrical earth is trapping, the upgrade will assist in that. Upgrade is for pumps that are heavy causing electricity to trap. There is someone who works with earth from the other town, when I told him he said it was plugs. We checked the plugs, put them properly but the problem continued, he promised to come and check for us (Disaneng DS01)'.

Researcher asked if partners had to look at various other service provider to run smooth the project.

'Those who are working and making money are not stunted, no stunt fish. Those that their system is working and it's working well with no renovations, since standing working properly and raising fish in time to reach market size in time, those are people we can look at their history (Disaneng DS04)'.

Researcher asked partners if they are interested in tilapia because it was mentioned during waste build-up in the system that they sit in one corner. Partners mentioned that they want to feed catfish with it because catfish grows faster when they feed on live food.

'No, the interest is dying so that we can feed the catfish (Disaneng DS04). For catfish to grow faster because catfish grow faster when they eat live food (Disaneng DS01).'

Growth of African catfish fed earthworms and fish

Results showed that tilapia group had high mean weight (28.2 g) than earthworm group (22.2 g) and pellets group (16.8 g) and the difference was significant ($p < 0.001$).

Average Weight (AW) was high in tilapia fish group (4.46g); earthworm group was (2.98 g) and pellets (1.10 g). Food Conversion Ratio (FCR) was very high (2.58) in tilapia group; earthworm (3.51) and pellets (3.36). Specific Growth Rate (SGR) was 0.64 in tilapia fish group; 0.16 in earthworm group and 0.43 in pellets group. Survival was high in pellets group (97%); earthworm (86%) and tilapia fish group was 84% (see Chapter 5 for full details).

7.4.7. Creation and Synthesis Step

Black Hat: *Disaneng (DS) Project*:

What are negatives of having a slow performing fish system? Partners mentioned that hiring system experts will be costly. *'High cost of a service provider (Disaneng DS04).'* Another partner mentioned lack of government support and high electricity costs. *'Government support, high cost of electricity (DS01).'*

Yellow Hat: *Disaneng (DS) Project*

The researcher asked the partners to list the positive things that could happen if their system was performing optimally. *'Fish reaching market size in time, fish eaters being able to get fish anytime; supply the demand, being able to supply, business blooming (Disaneng DS04).'*

Another partner mentioned that poor system performance slows down feeding amount and time. *'When the system is not running well, we feed slowly because you give it dirty water, so feed slowly not three times a day (Disaneng DS01).'*

White Hat: *Disaneng (DS) Project*

The researcher requested partners to list the facts about having good performing system. Partners mentioned enough oxygen in the water, fish will feed properly and also the quality of water will be good. *'There will be oxygen in the water and the fish wants oxygen to grow; feeding will improve because we be feeding a lot for them to grow faster, water quality will also be good (Disaneng DS04).'*

Red Hat: *Disaneng (DS) Project*

Partners were requested to list their emotional feelings or frustration about the state of their fish system at the moment. Partner mentioned that government support is required to fix the

system or looking for funding so that they can do away with government support.

'Fixing the system, I need support from government funders, making partnership to get help, getting rid of government to upgrade the project (Disaneng DS01).' Another partner mentioned the unreliability of experts in aquaculture to fix the system.

'Every Tom, Dick and Harry of this aquaculture industry is not reliable about knowing to make a working system. People do not know about Recirculating Aquaculture System (RAS) (DS04).'

Green Hat: *Disaneng (DS) Project*

The new ideas that partners mentioned that will improve the situation were erecting a solar system and installing new pumps and heaters. *'Putting solar system, putting pumps that put high pressures, heater to heat water, more oxygen (Disaneng DS04).'* Another partner mentioned doing value adding on their fish products. *'Making many fish products in the project example fillets, petty, burgers and biltong (Disaneng DS01).'*

Blue Hat: *Disaneng (DS) Project*

Partners were asked to summarize all the hats and one partner mentioned that hiring an expertise with credentials of a functioning system. *'Finding a good Recirculating Aquaculture System (RAS) designer or engineer whose system is working very well, fish being able to meet market size in time and able to meet the demand (Disaneng DS04).'*

Another partner mentioned obtaining government financial support to fix the system and costly electricity and technology are setbacks; they can fish from the local to make value adding and sell. *'Government support to fix the system; high cost of electricity; new technology; good environment; fishing everyday from the dam, and making many products in the project to make money (Disaneng DS01).'*

7.5. Free State Province

7.5.1. Focus Step

One Vision (OV) project; the draft goal was best articulated by partner in this business as follows:

'To make money, to undertake the marketing of Agricultural products, to improve the livelihoods of rural people particularly those rural communities, small fishery project where by netting permits for certain dams are provided recommendations based on productivity, biodiversity, consideration and socio-economic development (One Vision OV60).'

Partners specified their goal as to be profitable, create jobs and improve technical skills in aquaculture farming. In achievable the scale of improvement was reasonable. In relevant there was a huge demand of fish in the community, therefore, the goal was relevant.

Targeted was 2% profit and 5 jobs within a time-frame of 12 months.

SMARTT goal was to achieve 2% profit, 5 jobs and improve technical skills in order to manage a viable catfish business in a year (Table 7.32).

Lephoi (LP) project; in this project the draft goal was to attain business growth and sustainability. The goal was specified as being profitable in a long term. Fish and growth were measurable and the goal was achievable. In relevant partners indicated that there was huge demand of fish in their community due to its nutritional benefits, the target was 2% and time-frame was 12 months. The SMARTT goal was attaining 2% profit in catfish farming within 12 months.

Gotswametsing Project (GMP) project; the draft goal was cited as business growth, profitable and feed the community. In specific partners mentioned business growth and income generation. Money from sales and number of fish were measurable and this type of a goal is achievable. In relevant, partners indicated that their community would benefit from consuming more fish. Target would be 2% profit in a time-frame of 12 months. The developed SMARTT goal was to achieve 2% profit in catfish farming within a year.

Boiteko Fisheries (BF) project; partners were asked to develop a draft goal and this was articulated in the following two quotes; *'I want to see the projects development distributing fishes to companies like Econo-Fish, I & J etc. (Boiteko Fisheries BF63); make money and to develop fish farm (BF66)'*.

In specific, partners reported business growth and profit making. Partners will measure profit and the number of fish sold and the scale of improvement was achievable. Fish farming business was relevant because there was no fish project in their area. Partners target 2% profit within a time-frame of a year. The developed SMARTT goal was to achieve business growth and 2% profit in catfish farming within 12 months.

Ludlow (LL) project; in this business, draft goal was to make the Recirculating Aquaculture System (RAS) operational and improving government funding transparency. Partners specified the goal as improving profitability of all the RAS in the Free State. Measurable was best articulated by partners as, *'The number of fish and profit earned and a description of available funds (Ludlow LL50)'* and the goal is achievable. The goal was relevant because there was a need to feed the community with fish products. Targeted partners indicated *'2% of global production to be reached in 12 months (LL50)'*. SMARTT goal was to assist in reaching 2% offering of global production of catfish in 12 months.

Gariep Dam (GD) project; the draft goal was reported as follows, *'Is to make more money in*

our fish project and to create jobs in our community for our youth (Gariepdam GD57)'.

In specific, partners reported that they need to increase capital and create employment, the goal was achievable. The goal was relevant due high demand of fish products from the surrounding communities. Targeted was a minimum of two jobs created within 12 months. The SMARTT goal was to achieve a minimum of two jobs from catfish project within 12 months.

Table 7.32: Outcomes of developed draft goal and SMARTT goal in Free State projects

Research Partner	Draft Goal	SMARTT Goal
OV 56, 57 & 58	To make money, to undertake the marketing of agricultural products, to improve the livelihoods of rural people particularly these rural communities, small fishery project whereby netting permits for certain dams are provided recommendations based on productivity, biodiversity, consideration and socio-economic development	To achieve 2% profit, 5 jobs and improve our technical skills of catfish farming at OV fisheries within 12 months.
LP 51, 52, 53, 54, 55 & 56	I want to see my project sustainable and make more money and grow	To achieve 2% profit of catfish farming in LP business within 12 months.
GMP 63, 64 & 65	To go forward and grow and make money to feed the community	To achieve 2% profit in catfish farming at GMP business within 12 months
BF 62, 63	I want to see the projects development distributing fishes to companies like Econo-Fish and make money and to develop fish farm	To achieve business growth and 2% profit of catfish farming in BF business, within 12 months
LL 50	Getting plant operational, funding transparency	To assist in reaching the 2% offering of global production of catfish farming in this LL within 12 months
GD 57, 58, 59	Is to make more money in our fish project and to create jobs in our community for our youth	To achieve 2% profit and job creation in catfish farming in GD project within twelve months

One Vision (OV); Lephoi (LP); Gotswametsing (GMP); Boiteko Fisheries (BF); Gariepdam (GD); Ludlow (LL)

7.5.2. Situation Analysis

Lephoi LP Project

In this group water appeared 4 times (Figure 7.39). *'Problem of water (Lephoi LP51); warm water was not available (LP52); Lack of water because Bloem water closed due to lack of payment (LP51); fix borehole to increase water (LP53)'*.

Market, expired, growth, system and temperature followed and they were mentioned two times each.

'No market to sell fish (LP53); marketing is too low (Lephoi LP52); lack of market (LP51); Problem of expired food making fish not to grow (LP53); feed expired (LP51)'.

'Fish was not growing (LP53); assistance and teaching about how to grow catfish (LP52); catfish grow slow from econofish (LP51)'.

The word temperature was mentioned less frequently. *'Problem of system and had low temperature (LP53); our system is low quality and the species was from Limpopo, it did not get used to our temperature in the Province (LP52)'*.



Figure 7.39. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in LP adapted from ATLAS.ti8

Boiteko Fisheries (BF) Project

In BF business the word frequency was one (Figure 7.40). Partners expressed that there is no communication between their provincial department and their district, lack of catfish information or training and there is no market, their system is old and it needs new machines, they are also lacking access to water.



Figure 7.40. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Boiteko Fisheries BF project adapted from ATLAS.ti8

One Vision (OV) Project

In this group financial was mentioned two times and this is the scenario that the partners explained: 'Financial constraints (One Vision OV60); we don't have funds and financial problems (OV61)'. The partners also mentioned two times that they are depending on government support a lot as expressed below: 'Dependency on government (OV60); Depending on government too much (OV62)'. Other words such as lack of training, market and electricity had a frequency of one although they are very critical to achieve the goal (see Figure 7.41).



Figure 7.41. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in One Vision

OV adapted from ATLAS.ti8

Gariep Dam (GD) Project

In this business, all the words were mentioned only once, lack of market, training on project management, harvesting nets, cleaning equipments, protective clothing. No word appeared more frequently than the other (Figure 7.42).



Figure 7.42. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Gariep Dam GD project adapted from ATLAS.ti8

Gotswametsing Project (GMP)

Identified issues in this business were lack of training in breeding catfish, no market, shortage of solar panel, no diesel for generator, no harvesting equipment and their word count frequency was one for each (Figure 7.43).



Figure 7.43. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Gotswametsing Project GMP adapted from ATLAS.ti8

Ludlow (LL) Project

In this business partners listed their issues in the following manner: No access to funding options; no market access; lack of training in catfish and skilled labor; inter - departmental problems/ bad communication; implementing agencies incompetent; lack of electricity; no processing facilities; environmental conditions shut the growth of catfish; poor support from government partners (see 7.44).



Figure 7.44. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Ludlow LL project adapted from ATLAS.ti8

7.5.3. Impact Analysis Step

Impact and Influence: Boiteko Fisheries (BF) Project

The opportunities developed from the previous step by partners were assessed on a scale from 1-10 for the level of impact and influence. Opportunity of breeding fish (1.1) obtained the highest impact score 10 and fifth highest influence score 5. Partners articulated that their first indoor system did not grow the fish and current system was upgraded, however, it came after waiting for long periods and they were not in a position to tell if it could actually grow fish.

'Sometimes we had a system an old one, the fish were not growing and then department decided to look for deep blue aqua to put in new system that will be able to grow fish quicker. So there were other plants that were fixed already but ours waited longer and then they came to upgrade since we are waiting for fish from Gariep Center, the fingerlings. Those fingerlings we will see with them how they are growing and what size they become to sell (Booiteko Fisheries BF63). We need a good place for our fish a good place where we can store the fish inside to grow (Booiteko Fisheries BF66).'

The opportunity of market access (1.2) obtained first highest score 9 and fourth highest influence 6. Improve communication skills (1.3) obtained second highest impact score 8 and first highest influence score 9. Partners mentioned that the other members had a tendency

of not sharing information with them while she was the only one who government communicates information with.

'When information comes from another person she can store it for himself, lack of information because the person will store the information for himself, this cooperative when information comes the person stores it for her (Booiteko Fisheries BF66). Chairperson is the only who receives information alone, if there is something they call her, even our extension officer, they only speak to the chairperson (Booiteko Fisheries BF67).'

Opportunity of improving technical skills (1.4) obtained first highest impact score 9 and fourth highest influence score 6. Opportunity of water access (1.5) obtained the highest impact score 10 and third highest influence score 7. Researcher probed partners by asking, the water that is in the system now where does it comes from?

'The water comes from the municipality; we don't have equipment to fix the pipe burst. Sometimes we are struggling to get water for the whole month. Lack of tools, machines have broken and we have no tools to fix water pipes (Booiteko Fisheries BF66).'

Opportunity of reducing fish mortalities (1.6) attained third highest impact score 7 and fourth highest influence score 6. Opportunity to obtain equipments (1.7) obtained the first highest impact score 9 and second highest influence score 8. Opportunity to obtain tools (1.8) scored highest impact score 10 and the highest influence score 10. Opportunity of constructing slaughter house (1.9), obtained third highest impact score 7 and fifth highest influence score 5 (Figure 4.38.1). Partners articulated that value adding would depend on the customer preferences; however, they would still travel to the nearest town for slaughter.

'When they bring us catfish it will depend on the person whom you are selling, how he wants it, slaughtered or not, so we don't have slaughter house, when fish is available we have to go to nearby projects to slaughter there The department is the one that put that rule that when they upgrade systems in all these towns each one has to have slaughter house. So we were surprised when they upgraded the system only and left (Booiteko Fisheries BF67).'

Partners took the impact and influence scores and plotted them on the electronic spreadsheet and quickly assessed which opportunities had high impact and influence. Increase number of fish (1.1), increase water availability (1.5) and increasing number of tools (1.8); harvesting equipments (1.7); slaughtering house (1.9) were taken to the next step (Figure 7.45).

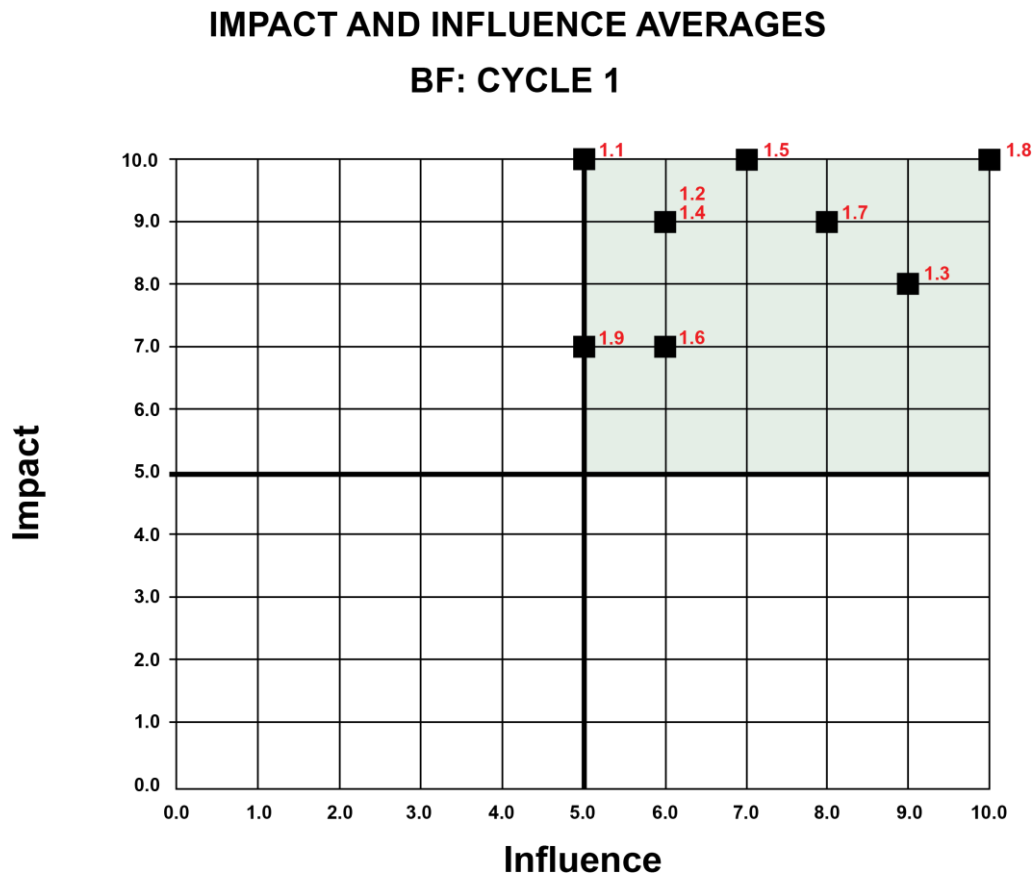


Figure 7.45. The scores of impact and influence tool employed to assess opportunities in Boiteko Fisheries BF project

Eight Dimensions Criteria: Boiteko Fisheries (BF) Project

The selected opportunities from the previous step were assessed on a scale of 1-10 on the eight dimension criteria. Benefit obtained first highest score of 9 in breeding (1.1); water access (1.5); tools (1.8) and equipments (1.9). The second highest score of 8 was achieved in opportunity of tools. Cost of not doing obtained the highest score in the opportunity water access, first highest score of 9 in breeding; second highest score of 8 in slaughter house, third highest score of 7 in tools and fourth highest score of 6 in equipments.

Ease obtained the highest score in the opportunity of tools, followed by first highest score of 9 in equipments, followed by fourth highest score of 6 in breeding and water access. Slaughter house obtained fifth highest score 5. Motivation obtained first highest score of 9 in opportunity of obtaining tools, second highest score of 8 in breeding, equipments and slaughter house and a score of fifth highest score 5 in water access. Total score for positive dimension was high 34/40 in obtaining tools; 33/40 in water access; 32/40 both in breeding and equipments and 30/40 in slaughter house.

Cost obtained first highest score of 9 in tools and slaughter house. Followed by third highest

score 7 in water access and equipments, and fourth highest score 6 in breeding. Risk obtained third highest score of 7 in opportunity of slaughter house and fifth highest score 5 in the remaining opportunities.

Time obtained second highest score of 8 in opportunity of water access, third highest score 7 in breeding and fifth highest score 5 in the remaining opportunities. Term achieved second highest score 8 in breeding and equipments and a fourth highest score 6 in the remaining opportunities. Total score for negative dimension was high 27/40 in slaughter house; 26/40 in breeding and water access and 25/40 in tools and equipments (see Table 7.33).

Table 7.33: Scores of selected opportunities from Eight Dimension Criteria for Booiteko Fisheries BF project cycle 1

Criteria	Opportunity 1.1: Breeding	Opportunity 1.5: Water access	Opportunity 1.8: Tools	Opportunity 1.7: Obtain Equipments
Benefit	9	9	8	9
Cost of not doing	9	1	7	6
Ease	8	6	1	8
Motivation	8	5	9	8
Positive Total	32	33	34	32
Cost	6	7	9	7
Risk	5	5	5	5
Time	7	8	5	5
Term	8	6	6	8
Negative Total	26	26	25	25

Eight Dimension Pinwheel Version: *Boiteko Fisheries (BF Project)*

The scores from eight dimension criteria table were further plotted on the eight dimension pinwheel version. On the right hand side of the pinwheel increasing number of tools (1.8) had the biggest bell shape on the right hand side of the pinwheel. Followed by water access (1.5), breeding (1.1) and obtain equipments (1.7) with similar bell shape on the pinwheel. Constructing slaughter house (1.9) had a smaller bell shape situated near to the middle line on the pinwheel.

On the left hand side, the bell shape was bigger in constructing slaughter house (1.9), followed by breeding (1.1) and water access (1.5). The smaller bell shape was found in tools (1.7) and equipments (1.8) (Figure 7.46).

EIGHT DIMENSIONS PINWHEEL VERSION

BF: CYCLE 1

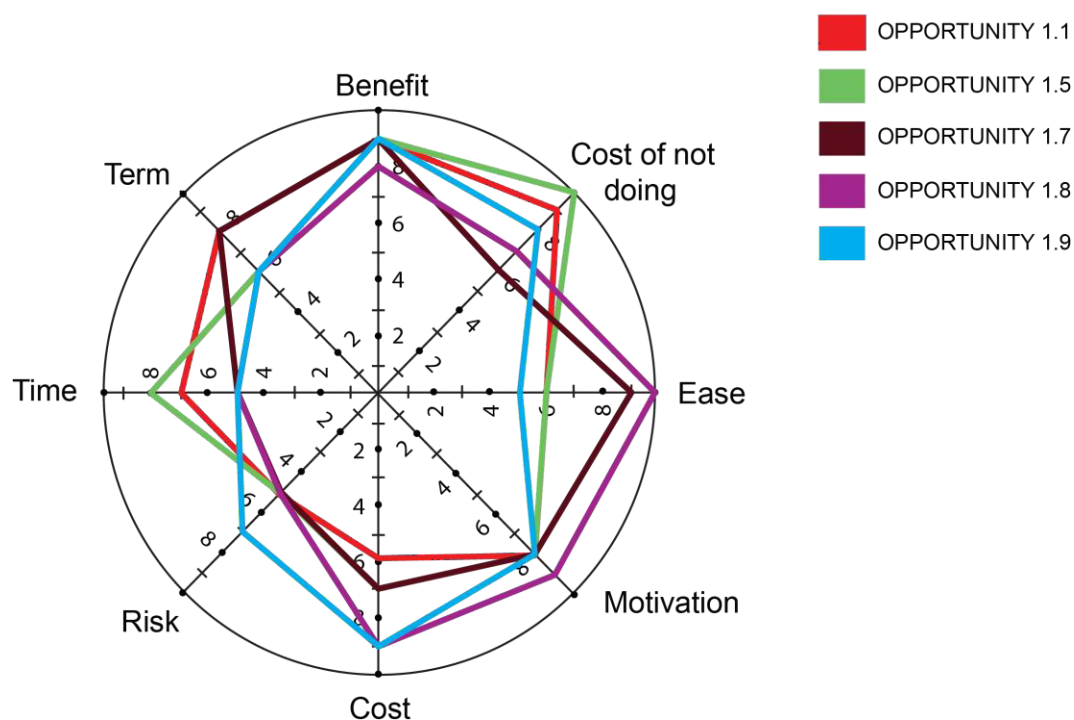


Figure 7.46. Scores for breeding; water access; tools; equipments and slaughter house on Eight Dimension Pinwheel Version for Boiteko Fisheries BF project

Impact and Influence: *Gariep Dam (GD) Project*

The impact of market access (1.1) obtained highest score 10 and second highest influence score 8. Obtain harvesting equipments (1.2) obtained highest impact score 10 and fifth highest influence score 5. Harvesting nets (1.3) obtained highest impact and influence score 10. Opportunity of obtaining grass cutter (1.4) attained highest impact score 10 and third lowest influence score 4. Opportunity of obtaining protective clothing (1.5) attained highest

impact score 10 and third lowest influence score 4. Opportunity of improving management skills (1.6) obtained highest impact score 10 and fifth highest influence score 5. The scores for the opportunities were plotted on the impact and influence electronic spreadsheet (Figure 7.47).

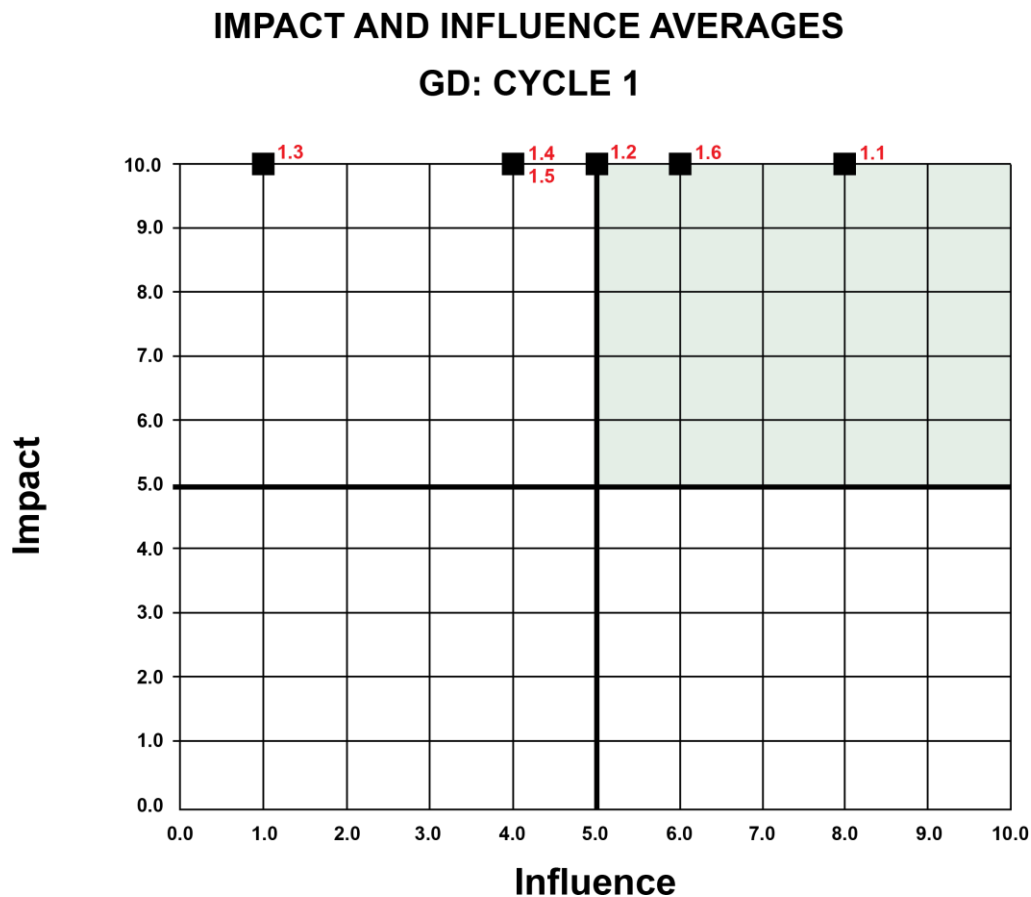


Figure 7.47. The scores of impact and influence tool employed to assess opportunities in Gariep Dam GD project

Eight Dimension Criteria: Gariep Dam (GD) Project

Benefit achieved the highest score of 10 in the opportunity of market access (1.1), harvesting equipments (1.2) and management skills (1.6). Cost of not doing achieved the highest score 10 in all the opportunities. Ease achieved fourth highest score of 6 in market access and harvesting equipments and fifth highest score 5 in management skills. Motivation achieved highest score 10 in all the opportunities. Total score for positive dimension was 36/40 in both market access and harvesting equipments and 36/40 in management skills.

Cost was high in market access with highest score 10, second highest score 8 in management skills and fifth highest score 5 in equipments. Risk obtained third lowest score 4 in market access, lowest score 1 in equipments and no risk in management skills. It would take partners a slightly longer time to implement market access with the third highest score

of 7 and middle time in both equipments and management skills 5. Term would be slightly longer with the fourth highest score of 6 in market access and fifth highest score 5 in both equipments and management skills. The total score for negative dimension was high 27/40 in market access; followed by 18/40 in management skills and 16/40 in harvesting equipments (see Table 7.34).

Table 7.34: Scores of selected opportunities from Eight Dimension Criteria for GD project cycle 1

Criteri a	Op por tuni ty 1.1: Mar ket acc ess	Opportunit y 1.2: Harvesting equipments	Opport unity 1.6: Manag ement skills
Benefit	10	10	10
Cost of not doing	10	10	10
Ease	6	6	5
Motivati on	10	10	10
Positiv e Total	36	36	35
Cost	10	5	8
Risk	4	1	0
Time	7	5	5
Term	6	5	5
Negati ve Total	27	16	18

Eight Dimensions Pinwheel Version: *Gariep Dam (GD) Project*

The scores from eight dimensions table were further plotted on the eight dimensions pinwheel version to select the best option. The results showed that opportunity of market access (1.1) and harvesting equipments (1.4) had similar bigger bell shape on the right hand side of the pinwheel and a smaller bell shape was observed in management skills. On the left hand side the bell shape was bigger in market access and smaller in harvesting equipments and management skills. Market access and harvesting equipments were taken further to the next step (see Figure 7.48).

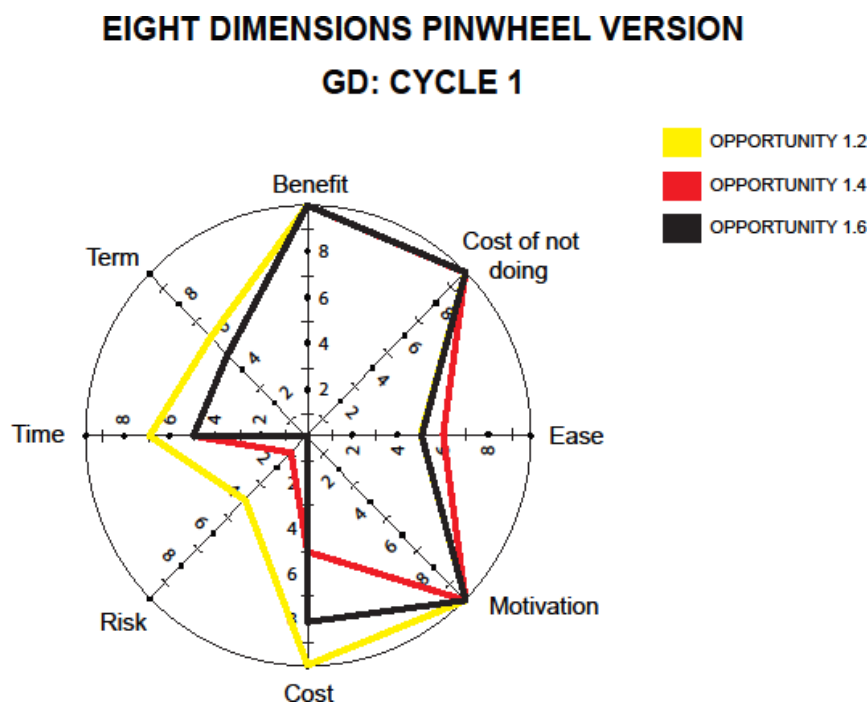


Figure 7.48. Scores for market access, harvesting equipments and management skills on Eight Dimension Pinwheel Version for GD project

Impact and Influence: *Gotswameetsing Project (GMP)*

The opportunities developed from the previous step were assessed for level of impact and influence towards achieving the goal. Opportunity of installing a solar system (1.1) had highest impact 10 and fourth highest influence 6. Opportunity to obtain diesel (1.2) achieved highest impact score 10 and first highest influence score 9. Increase number of fish (1.3) obtained highest impact score 10 and third highest influence score 7. Market access (1.4) achieved highest impact and influence score 10. The opportunity to obtain harvesting equipments (1.5) achieved highest impact score 10 and third highest influence score 7. Opportunity to improve technical skills (1.6) achieved highest impact score 10 and first highest influence score 9. The opportunities were plotted on the impact and influence on the electronic spreadsheet (Figure 7.49).

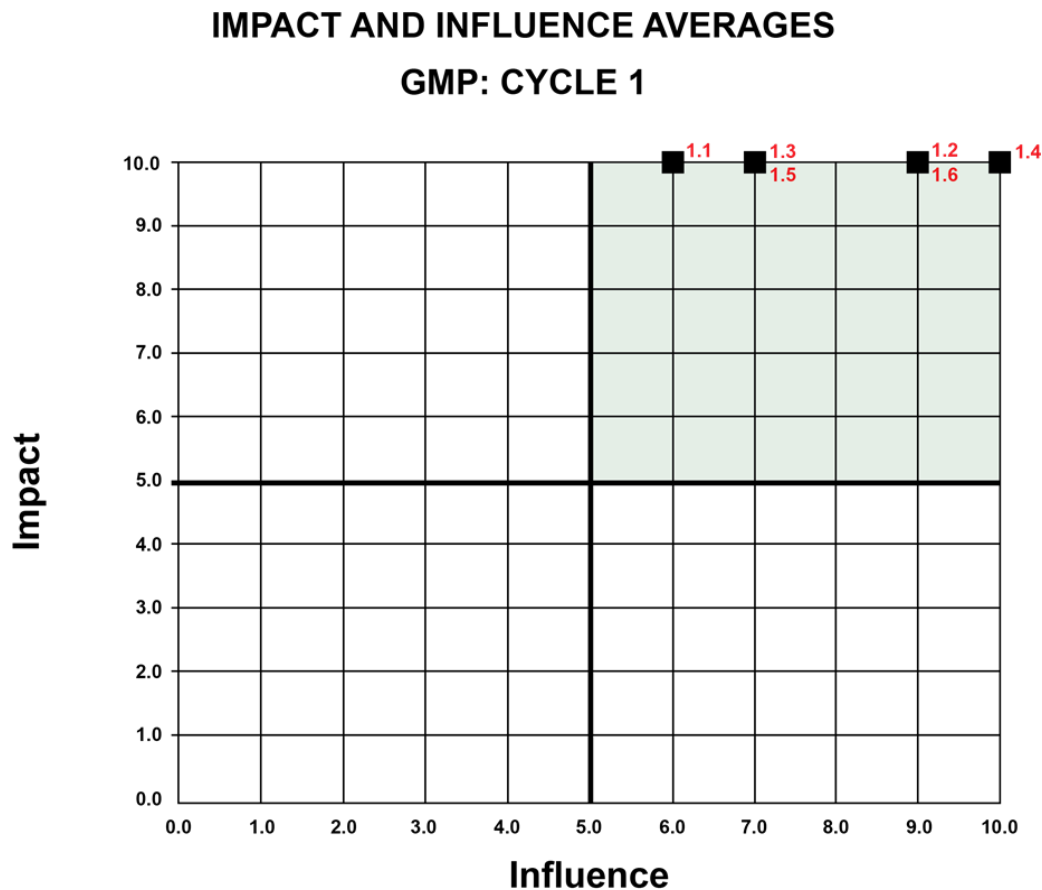


Figure 7.49. The scores of impact and influence tool employed to assess opportunities in Gotswameetsing GMP project

Eight Dimensions Criteria: Gotswameetsing Project (GMP)

The selected opportunities were assessed on the eight dimension criteria from 1-10. Benefit obtained highest score of 10 in the opportunity of obtaining diesel, market access and improving technical skills. Cost of not doing also achieved highest score of 10 in all the three opportunities. Ease scored highest score 10 in obtaining diesel, followed by market access with the first highest score of 9 and the fifth highest score 5 in improving technical skills. Partners were highly motivated to implement opportunity of obtaining diesel and improving technical skills with the highest score 10, while market access achieved second highest score of 8. Total score for positive dimension was 40/40 in obtaining diesel; 35/40 in technical skills and 27/40 in market access.

The cost of obtaining diesel was very high with a score of 10, while market access obtained lowest score of 1 and first lowest score 2 for technical skills. Time to implement was in the middle with a score of 5 in all opportunities. Term to see the benefits were also in the middle with a score of 5. Total score for negative dimension was 30/40 for obtaining diesel; 13/40 for technical skills and 12/40 for market access (see Table 7.35).

Table 7.35: Scores of selected opportunities from Eight Dimension Criteria for Gotswameetsing GMP project cycle 1

Criteria	Opportunity 1.2: Obtain diesel	Opportunity 1.4: Market access	Opportunity 1.6: Technical skills
Benefit	10	10	10
Cost of not doing	10	10	10
Ease	10	9	5
Motivation	10	8	10
Positive Total	40	27	35
Cost	10	1	1
Risk	10	1	2
Time	5	5	5
Term	5	5	5
Negative Total	30	12	13

Eight Dimensions Pinwheel Version: *Gotswameetsing Project (GMP)*

The scores from eight dimension table were further plotted on the pinwheel version. On the right hand side, the bell shape was big in obtaining diesel (1.2) and also bigger on the left hand side. The bell shape for opportunity of market access (1.4) was bigger on the right and smaller on the left. Improve technical skills also had bigger bell shape on the right and smaller on the left. All the opportunities were taken further to the next step (Figure 7.50).

EIGHT DIMENSIONS PINWHEEL VERSION

GMP: CYCLE 1

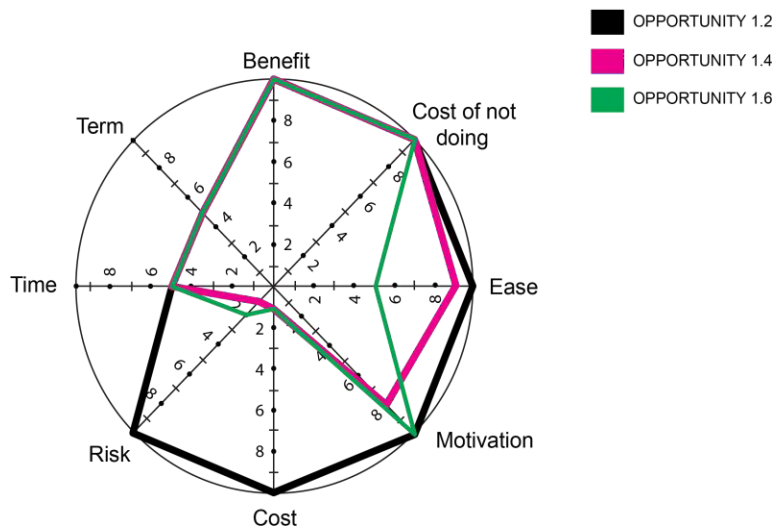


Figure 7.50. Scores for diesel, market access and technical skills on Eight Dimension Pinwheel Version for Gotswameetsing GMP project

Impact and Influence tool: Lephoi (LP) Project

The developed opportunities from the previous step were assessed for level of impact and influence on a scale of 1-10. Opportunity to improve fish growth (1.1) achieved highest impact and influence score 10. Opportunity to install solar (1.2) achieved highest impact score 10 and second lowest influence score 3. Opportunity of water access (1.3) achieved first highest impact score 9 and fifth highest influence score 5. Opportunity of market access (1.4) obtained highest impact score 10 and first highest influence score 9. Opportunity to obtain fish (1.5) obtained second highest impact score 8 and third highest influence score 7. Opportunity to obtain transport (1.6) and boat (1.6) obtained fifth highest impact and influence score 5. Opportunity to resume abattoir construction (1.7) obtained first highest impact 9 and fourth highest influence 6. Opportunity to improve technical skills (1.8) scored first highest impact score 9 and second highest influence score 8. The scores were plotted on the impact and influence electronic spreadsheet (see Figure 7.51).

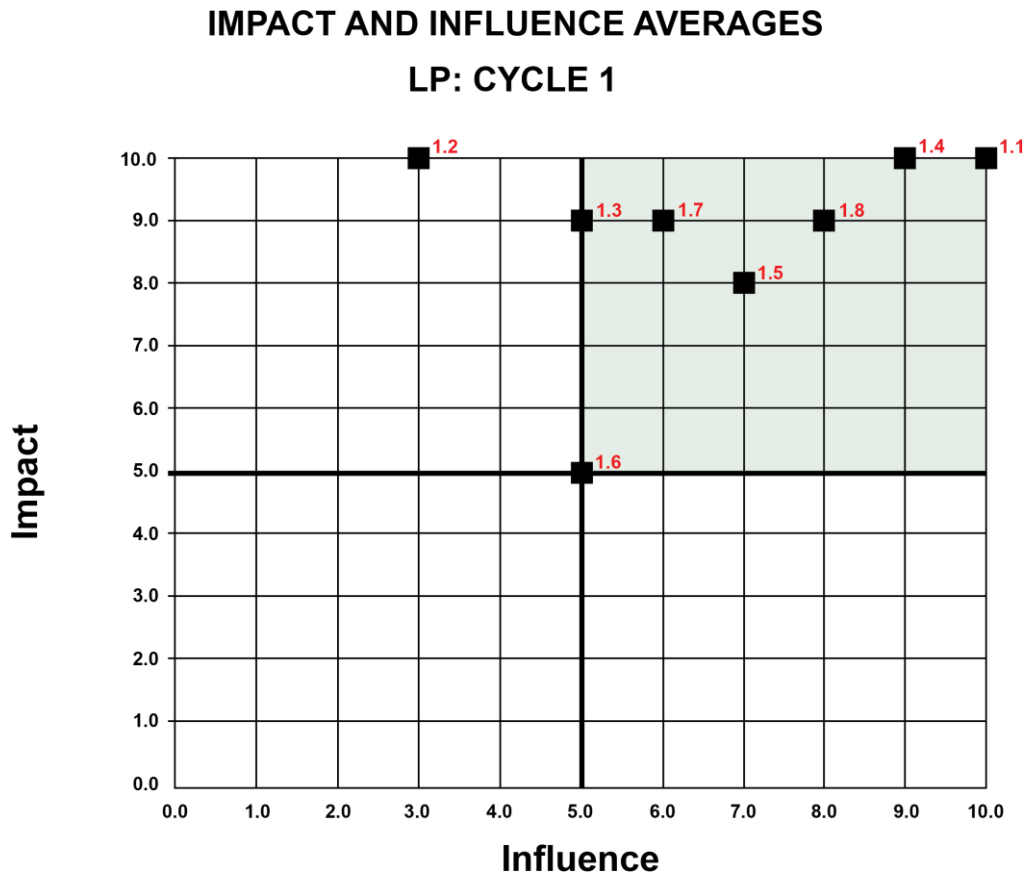


Figure 7.51. The scores of impact and influence tool employed to assess opportunities in Lephoi LP project

Eight Dimension Criteria: *Lephoi (LP) Project*

The selected opportunities were assessed on the eight dimension criteria from 1-10. Benefit obtained highest score 10 in fish growth (1.1). Cost of not doing also achieved highest score 10 in fish growth and market access (1.4). Ease obtained second highest score 8 in fish growth and fifth highest score 5 in market access. Motivation obtained highest score 10 in both opportunities. Total score for positive dimension was high in fish growth 38/40 and lower in market access 34/40.

Cost achieved fifth highest score 5 in fish growth (1.1) and first highest score 9 in market access (1.4). Risk achieved the lowest score 1 in fish growth and first lowest score 2 in market access. Times achieved a score of 5 in fish growth and a score of 6 in market access. Term also achieved fifth highest score 5 in fish growth and fourth highest score 6 in market access. Total negative score was high in market access 20/40 and lower in fish food 16/40 (Table 7.36).

Table 7.36: Scores of selected opportunities from Eight Dimension Criteria for Lephoi LP project

Criteria	Opportunity 1.1: Fish growth	Opportunity 1.4: Market access
Benefit	10	10
Cost of not doing	10	10
Ease	8	5
Motivation	10	10
Positive Total	38	34
Cost	5	9
Risk	1	2
Time	5	6
Term	5	6
Negative Total	16	20

Eight Dimension Pinwheel Version: *Lephoi (LP) Project*

The scores from eight dimension table were further plotted on eight dimension pinwheel version. According to the pinwheel, opportunity of fish growth (1.1) had a bigger bell shape on the right hand side and smaller bell shape in market access (1.4). On the left hand side, the bell shape was bigger in market access and smaller in fish food. Opportunity 1.1 fish growth was the best option to be taken to the next step (Figure 7.52).

EIGHT DIMENSIONS PINWHEEL VERSION

LP: CYCLE 1

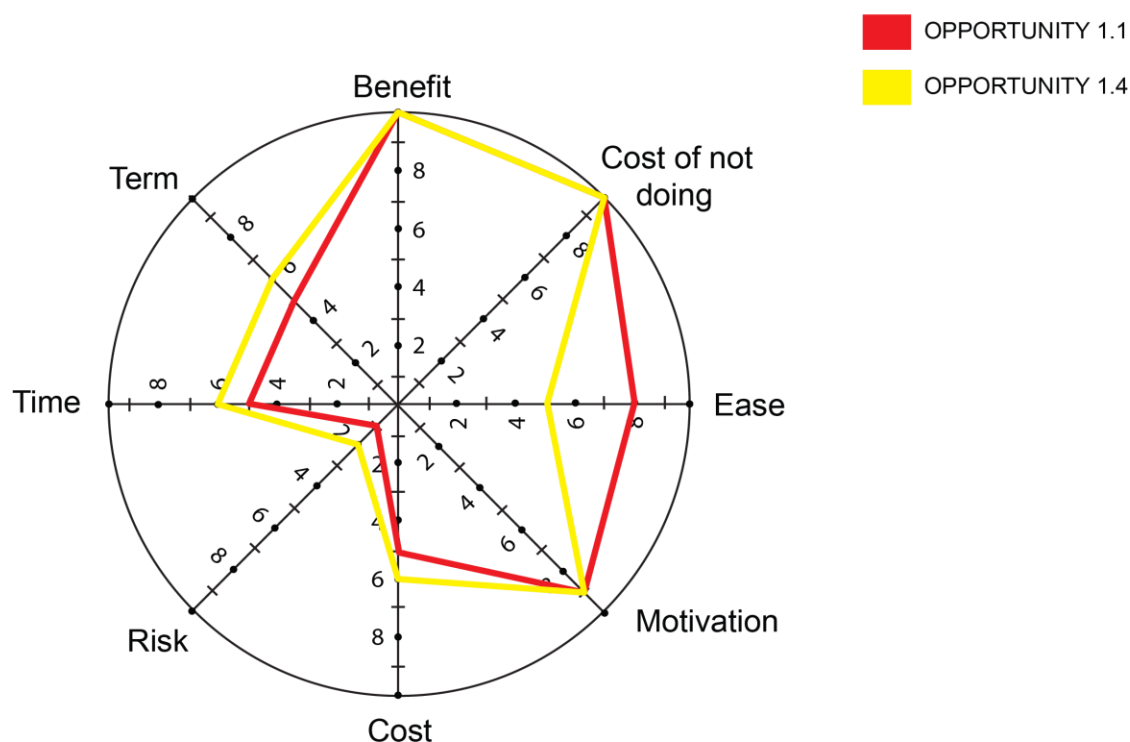


Figure 7.52. Scores for fish growth and market access on Eight Dimension Pinwheel Version for Lephoi LP project

Impact and Influence: Ludlow (LL) Project

The opportunity to improve electricity connection (1.1) achieved the highest impact score 10 and fourth highest influence score of 6. Opportunity to increase product knowledge (1.2) achieved the highest impact score 10 and the second highest influence score of 8. Opportunity of improving transparency (1.3) between farmers and implementers achieved highest score of 10 and medium influence score of 5. Opportunity of market access (1.4) achieved highest impact score 10 and third highest influence score 7. Opportunity to establish processing facility (1.5) achieved highest impact score 10 and medium influence score 5. Opportunity to obtain funding (1.6) achieved impact score 10 and influence score 5. Opportunity of improving communication (1.7) from government obtained highest impact score 10 and fourth highest influence score 6. Opportunity 1.8 improve partner involvement (1.8) obtained highest impact score 10 and fourth highest influence score 6. The scores were plotted on the electronic spreadsheet of impact and influence tool (see Figure 7.53).

IMPACT AND INFLUENCE AVERAGES

LL: CYCLE 1

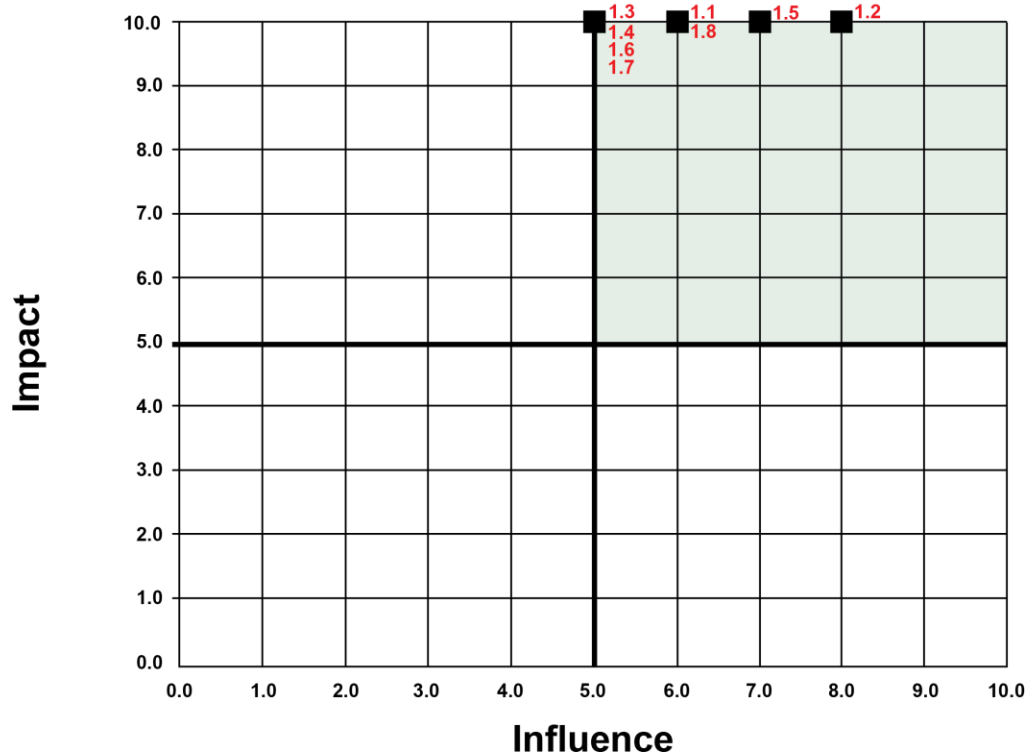


Figure 7.53. The scores of impact and influence tool employed to assess opportunities in Ludlow LL project

Eight Dimension Criteria: Ludlow (LL) Project

The selected opportunities from the previous step were assessed on a scale from 1-10 employing eight dimension bar graph. Benefit achieved the highest score 10 in opportunity electricity (1.1); product knowledge (1.2) and processing facility (1.5). Cost of not doing obtained highest score 10 in all the opportunities. Ease of implementation achieved the second highest score 8 in electricity and fifth highest score 5 in both product knowledge and processing facility. Motivation of partners to implement was the highest with a score 10 in electricity and processing facility and third highest score 7 in improving product knowledge. Total score for positive dimension was high in electricity 38/40; followed by 35/40 in processing facility and 32/40 in product knowledge.

Cost obtained fifth highest score 5 in product knowledge and processing facility and lowest score 1 in electricity. Risk obtained first lowest score 2 in processing facility and lowest score 1 in both electricity and improving product knowledge. Time to implement was very long in processing facility with the highest score 10. Product knowledge obtained fourth highest score 6 and fifth highest score 5 in product knowledge. Term was lengthy in processing facility with highest score 10; fourth highest score 6 in product knowledge and fifth highest

score 5 in electricity. Total score for negative dimension was high in processing facility 27/40; 17/40 in product knowledge and 12/40 in electricity (Table 7.37).

Table 7.37: Scores of selected opportunities from Eight Dimension Criteria for Ludlow LL project

Criteria	Opportunity 1.1: Electricity	Opportunity 1.2: Product knowledge	Opportunity 1.5: Processing facility
Benefit	10	10	10
Cost of not doing	10	10	10
Ease	8	5	5
Motivation	10	7	10
Positive Total	38	32	35
Cost	1	5	5
Risk	1	1	2
Time	5	5	10
Term	5	6	10
Negative Total	12	17	27

Eight Dimensions Pinwheel Version: *Ludlow (LL) Project*

The opportunity to install electricity (1.1) had a bigger bell shape on the right indicating high positives and smaller bell shape on the left indicating low negatives. This was followed by processing facility (1.5) with a second bigger bell shape on the right and smaller on the left. Improve product knowledge (1.2) had a smaller bell shape on the right hand side and a bigger bell shape on the left. Opportunity of installing electricity was taken further to the next step (Figure 7.54).

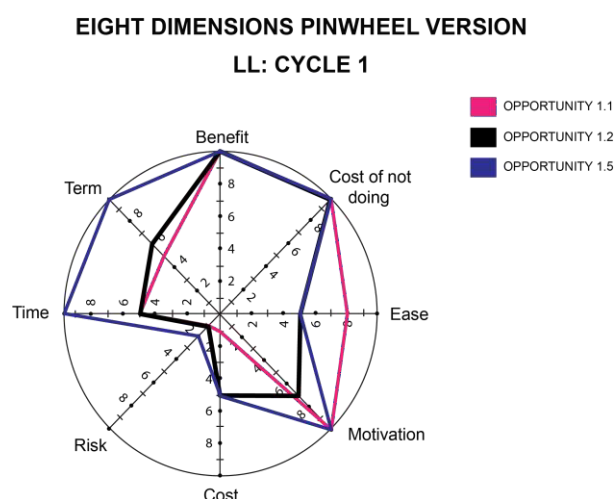


Figure 7.54. Scores for electricity, product knowledge and processing facility on Eight Dimension Pinwheel Version for Ludlow LL project

7.5.4. Action Design Step

Lephoi (LP) Project; partners in this project were committed to improve their skills in aquaculture or catfish farming. The action to be implemented was organizing the trainers from local training center, securing a date, ensuring that the training manual and equipments were organized. Partners would hold a meeting and finance the trip. The activities were displayed in the table below (Table 7.38).

Boiteko Fisheries (BF) project; partners selected to increase number of tools. The designed action was for partners to obtain project bank statement, apply for funding and search for quotations from the stores. Obtain bank statement and also check availability of funds.

One Vision (OV) project; partners designed action on the opportunity of increasing market access by approaching restaurants, wholesalers, feeding schemes, prisons; military and administer a questionnaire in their local community. Partners would improve technical skills through training and advertise their project on billboards.

Gariep Dam (GD) project; a survey was designed to ask community about fish consumption and partners would also approach their local supermarkets and retailers to find markets.

Partners would also organize with the training center to find out when they could be trained on aquaculture. Partners would also search quotation of tools and make a follow-up on project registration process.

Gotswametsing Project (GMP); in this project the opportunity in which the action was designed was to improve technical skill in catfish farming and also purchase diesel for backup generator. Partners would request for aquaculture training, food, transport and accommodation from the training center, and hold a meeting to allocate available project funds. *Ludlow (LL) project*; this project has selected to make their aquaculture system operational again by engaging minister of Agriculture. Partner also wanted to acquire proper name and description of the business and compile a letter that would be forwarded to management.

Table 7.38: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Free State Province

Project number	Opportunity	CSFs	KPIs	KAs
LP project	Improve technical skills	Trainer	Report that has details of the trainer, email confirmation	Contact training center manager to organize training
		Fish for practical	Email confirmation	Confirm with the training center if the fish was available for training
		Training equipment and manual	Email confirmation	Confirm if training equipment would be available
		Money to call the trainer	Donation agreement	Donation would come from the project to buy airtime and stationery
		Accommodation and meals	Email confirmation	Confirm with the training manager

(Full version Appendix 5)

7.5.5. Action Implementation Step

Lephoi (LP) Project

During action implementation partners went to the field to implement all the activities and also taking into consideration the time frames. After 30 - day's action monitoring to support action session was conducted. Partner mentioned that on the issue of training they managed to discuss with their Agriculture manager and the respond was that they were already fully trained by the Chinese partners; however, she could try to look for other types of training. At this stage, consumer survey was designed with partners and submitted to the University's ethics committee for approval. Most of the partners missed this session therefore training on how to administer the survey was not conducted (Table 4.32).

Partners were requested to give feedback on liaising with extension officer to design pamphlets to advertise their project in local shops and restaurants. A partner mentioned that the cooperative failed to meet but their fish breeding center promised them another breed of fish valued by their community.

'We didn't do it yet, we never met as a cooperative but what we have to do on the pamphlets of the shop, the community already know about the fish and we were promised by training center this red fish that are normally being bought by white people, our community love them very much so the center promised us (Lephoi LP51).'

On the activity of advertising their project on billboard a partner mentioned that the initial service provider was supposed to have erected sign boards and billboards and they were already paid to render this service but they left without doing it.

'They were supposed to have done it long time ago, I will make follow-up with my extension officer because they came here last week (Lephoi LP51).'

On the issue of transport a partner indicated that Agriculture extension office mentioned that they will only provide one transport for all the six farms in the area to pick up the fish and deliver to the processing plant.

'You see this one for transport when we asked the person who is in charge of Agriculture; he told us that they will not be in a position to buy each one transport for all the six plants. What they will do, there will be one transport with a cooler that will be picking up fish from each plant starting from one farm to deliver at new processing plant they are building for us, and we agree with that, that is only right (Lephoi LP51).'

The researcher asked if the processing plant is completed already. *'It is quite we are waiting for hand over but is very quiet and there are machines. I last visited the processing plant when the contractors finished with the work and leaving behind security guard so that when they do handover their security company should be the one guarding the place (LP51).'*

On the issue of training, a partner reported that they were already trained on aquaculture and practicals including fish dissection, all of them as a cooperative. *'Chinese from training*

center are the ones who trained us on how to handle the fish when they have stress they don't eat a lot and they stay at the bottom, they showed them to me. Even other beneficiaries were trained all of them are all trained (LP51)'.

Boiteko Fisheries (BF) Project

Action monitoring session in this project was conducted. Members did not implement all the activities agreed in the previous step. They were unable to meet as a cooperative and they have issues of being included in the cooperative certificate.

Feedback on obtaining bank statement and withdrawing the money to purchase equipments, partners mentioned they were not able to implement anything due to the difficulty in getting the chairperson and the treasurer to attend the meetings. *'We 'didn't go; we didn't do all of them, no progress (Boiteko Fisheries BF63). The people didn't come since you left we haven't met and we informed them of the meeting (Boiteko Fisheries BF66).*

The researcher asked the partners how the other beneficiaries were invited to the meeting. The partner explained that they were invited verbally when they accidentally met around their home and they agreed to arrange a meeting but it was never done. *'I have explained to them face to face, we stay in the same place and they said we will arrange a date but since you came here we never met. You see even today this one comes and next time the other comes, we never come here all of us (BF67)'.*

The researcher asked the partners how the cooperative was formulated. The partner mentioned that they were asked by the chairperson who was their friend to come and assist her with fish harvesting as the other beneficiaries were no longer coming to the project.

'We are used to the chairperson; she is our friend at the location. So she approached us to help her in 2015. There was nothing happening in the project it was just sitting but there were fish. The other people were not active, so she was the only one doing up and down. So some of the fish were dying and we decided to slaughter and sell at the location and the money we deposited into the project's account (BF67)'.

One Vision (OV) Project

Action monitoring in this project partners indicated that feeding schemes and restaurants they prefer hake and tilapia over catfish. Prisons offer contracts to supply fish. Some partners also marketed their project through word of mouth around their community. On the issue of training nothing was implemented yet. For the survey the researcher is awaiting approval from University's ethics committee. Billboard advertising partners have approached graphic designers to design the poster.

One Vision (OV) Project: Observation, Questions, Ideas, Opportunities (OQIO)

With Observation, Questions, Ideas, Opportunities (OQIO) tool partners questioned

themselves about the steps they can take to make restaurants members about catfish, how will they improve skills of cooperative members, if word of mouth marketing was done in the form of a questionnaire, if prisons can accept catfish. Partners thought of an idea to contact the service provider who upgraded their system to also offer technical training and also put a lot of effort during implementation. For opportunities three projects out of six will be able to obtain incentives.

Gariep Dam (GD) Project: Action Monitoring

A questionnaire was designed for this project waiting approval by ethics committee. Partners managed to visit local town to market their fish to wholesalers and restaurants and they showed interest in purchasing fish between 50 - 70 grams. Partners manage to discuss with the centre manager to assist them with transport to seek for market and make quotations for equipments. Some of the quotation on equipments was obtained from their local town. With training, the scientist did not organize the training for the guys in their own center and no feedback was given. Project registration nothing was implemented.

Gariep Dam (GD) Project: Observations, Questions, Ideas and Opportunities (OQIO)

Partners had a difficulty in coming up with observations of their implemented actions and questions. For ideas partners thought they approach other Do It Yourself (DIY) stores to get cheaper quotation and they wanted to slaughter the fish and sell to raise capital.

Gotswametsing Project (GMP): Action Monitoring

Action monitoring in Gotswametsing Project GMP project, partners did not manage to implement any of the Critical Success factors (CSFs) and also indicated that they required no further support to keep implementing.

Ludlow (LL) Project: Action Monitoring

Action monitoring in Ludlow (LL) project indicated that partners did not implement any of the agreed Critical success Factors (CSFs) and it was also indicated that no support was needed to keep implementing.

7.5.6. Performance Assessment Step

Results Assessment: *Lephoi (LP) Project*

Partners assessed performance of the action they implemented and feedback on organizing a training center was that, it was completed due to the manager saying partners have been already trained.

'When we talked the manager, the manager told us that, that training we have done it at the training center because we told her that you were here and when we were doing this course we identified that there are other things that we must learn like training of fish. She said we have done that training and we must look for funding if we want to be retrained (Lephoi LP52).'

Researcher also continued to ask if the practicals of fish dissection were completed and partners responded by saying this type of training was also attended in 2014.

'We also did it the one of cutting and opening the fish in 2014 (Lephoi LP51). We thought it will be different, it will not be similar to the one we did, we thought they will teach us more because they only taught us how to open a fish, eggs and only how to make it breed and they only taught us verbally they didn't show us because that white man took an egg and injected the fish at night, we were not there (LP52).'

On the training manuals, partners mentioned that they were also been given in the year 2017. *'We have a manual given by Chinese and they brought them in 2017 (Lephoi LP52).'*

The researcher asked if the action of purchasing stationery was completed and partners said it was left when they heard the manager saying they will not be trained.

'But we said we will make a donation and we heard the manager saying that we will not be trained and we left it (Lephoi LP52).'

The researcher probed by asking the partners to give a reason why they selected training as a goal to pursue if they knew they were trained. Partners mentioned that the training was done long time ago and they wanted to engage in refresher course.

'Because we said it's long time ago, we wanted to refresh our minds because we sat for a long time (Lephoi LP52). They are supposed to refresh because it has been a long time ago not working with fish, they have to do it. They are increasing fish, in fact the fish that are there are ours, they are just growing them for us to a certain size and they will bring them back. So if the fish are here people must be trained again because they forgot it's been long (Lephoi LP51).'

Another partner mentioned that perfect time to ask for refresher training is when they bring the fish to stock in tanks.

'I think the time they are bringing the fish the manager must also be there and we have to ask her at that time to bring trainers here to train us on fish, water, everything because we were trained long time ago (Lephoi LP52).'

On market access partners were sure of their product off-takes to places such as processing plant, school feeding schemes and retail stores.

'Another thing on market, marketing will help us if we have found a place where we can sell our fish, like guesthouse and Shoprite store, those are places that we are sure they will buy our fish even in schools, old days where old age people stay. I am definitely sure that they will want our fish because our people like fish (Lephoi LP53). But we don't have an assurance that is written down; we are relying on processing plant because it will require lots of fish (Lephoi LP53).'

The researcher probes by asking partners to elaborate on their understanding of a processing plant and the manner in which it should be managed. Partner explained that processing plant will process all the fish supplied by project so that they do not struggle with market.

'Processing plant was built under Agriculture to help our projects of fish, that's why they did processing plant for us so that we do not struggle with market, that is where our fish will be processed and they will take also from all the other plants here in training centre. Processing plant will do fish canning (Lephoi LP53), they will process and do canning by Agripark and from Agripark they will take it to other places (Lephoi LP51).'

Furthermore, another partner mentioned that the processing plant was built on loans by using the names of the projects. *'It is under Agriculture the things bought inside they were bought with our name, it was loaned money with names of all the projects so that they can buy material (Lephoi LP52).'*

It was not clarified who will own the processing plant because when constructors run out equipment they approached the project for a signature in order to release the money and purchase materials. Furthermore, the keys of the processing plant are sitting with Agriculture and they are not given the project.

'We don't know if it belongs to Agriculture or even us we are involved because when sponsors came to me they said there are some material that are lacking you must sign so that we can withdraw money and buy. So I don't know if it's Agriculture that answers or even projects will also answer. Because Agriculture and projects when I look properly they help each other because last month an inspector of contractors came and handed over keys to them, the contractor gave keys to Agriculture and they left, they are no longer there, so they didn't come Agriculture here to give us the keys (Lephoi LP51).'

Creating a pamphlet to advertise the project, partners mentioned that they did not take any action on this one. The reason that was given was that the project does not have fish at the moment and they will advertise and then not be in a position to supply the fish.

'The thing that made us to leave the matter of pamphlets was that we will advertise that we have fish when in reality we don't have fish, people will come looking for fish and they will not find it. The time when the fish is there then we will make the pamphlets and advertise them in stores so that people will know that fish is there (Lephoi LP52).'

On the activity of advertising on billboards partners mentioned that they were given fish in

the beginning to sell around the community carrying them in a wheelbarrow. From there the stock run out and people started looking for more fish and the project was never in a position to have more stock since the breeding station was not breeding any fish.

'The thing that has happened when the fish was here given by the training center to sell so that people must know that we are selling fish, we were selling them in a wheelbarrow, so now what is happening people are still looking for them and they say where are your fish, we just sold them until they are finished and it took long to come back again. Others were coming from nearby towns, they came here looking for fish and we told them we don't have fish. We have to buy the fish from the training center, this thing of buying from Limpopo its far and there is no transport, we must buy from the training center, and sometimes training center might say we don't have fish and other times they will have, business doesn't want something like that, it needs something when you order now you must get it now (Lephoi LP51).'

Achievement Stacker: Lephoi (LP) Project

In this tool partners were asked to mention the critical success factors that they think are completed to achieve the goal. Partners mentioned market access to supply their fish to be the one achieved better.

'I think achievements that we got are right all of them because we will be able to meet all of us to discuss and be able to have motivation on our own. Inside all of them the most important one is marketing because when you do marketing you will be able to get many suppliers (Lephoi LP53). I think marketing is the one that succeeded because training we did not reach it properly (Lephoi LP52). Even me it's marketing, it is the one that will make us succeed (Lephoi LP53).'

Results Assessment: One Vision (OV) Project

The partner gave feedback on advertising on billboards and designing pamphlets and he mentioned that he managed to find the graphic designer to design a fish logo, look for funding for company's banners and print leaflets for door to door marketing. For market the partner mentioned that they have a good support from owners in the community and feeding schemes and they don't have military bases locally and he requires financial support.

'For advertising, the results of action, what results did I achieve, the results that I achieved I managed to approach the graphic designer to design me a fish logo for the fish plant and also I tried to look for funding for outside banners and indoors banners for the company and to print leaflets so that we can do door to door for marketing. Critical Success Factors (CSFs) are the target market, Key Performance Indicator (KPI) is the report and Key Actions (KA) was to search for possible restaurants, wholesalers, retailers, feeding schemes, prisons, military bases and hospitals. The good results because of the support of the

business owners from restaurants and whole sales, the retailers and also the support from cooperative, the feeding schemes from schools, the military base, we don't have the military base here because it is in Kimberly and one is in Bloemfontein so, so transport, lack of money is a problem and right now I also got a challenge for the transport for hospital in nearest town because this one is not working like before. The support that I needed that's financial support for both of them (One Vision OV60). One Vision (OV) Project: Achievement Stacker Tool

The researcher asked the listeners to mention what were the achievements from the presentation. The respond was nothing much was achieved and the advice was that the presenter could have went to the library and design the fish logo by himself instead of approaching a graphic designer. The partner agreed that the presenter required financial support.

'He hasn't achieved anything, I wrote there when he was talking about advertising that he went to a graphic designer, I wrote that instead of going to a graphic designer he could have gone to a library and try to do things for himself on his own time while he is there. And on market I agree with him he does need financial support because without funds we can't do anything (One Vision OV57)'. Another partner did not comment because she mentioned that she was lost.

The second presenter also gave feedback on the results of action and it was mentioned that the partner managed to liaise with community members and they have an interest in buying and consuming fish. Support needed is finances.

'The target market was report, Key Performance Indication (KPI) is report and Key Action (KA) was restaurants, wholesalers, feeding schemes and prison. Action implemented we need to speak to the community members and other neighboring towns, the results that I achieved was that I did speak to the community members and other neighboring towns and I received positive response from them, they did say they are interested in buying fish, eating fish because they don't eat it every day, the support I need I think it is finance (One Vision OV60).

The researcher asked the presenter why she required financial support and the partner mentioned that they will have to obtain the fish and transport to the community.

'Because I need to get the fish and I have to transport it to the community so I am going to need transport and I had to pay for all those things so without funds you can't do anything (One Vision OV60)'.

The presenter also did not manage to organize the training at training center due to lack of interest from project members because they mentioned they wanted the fish so that something can happen in the project.

'On the skills and organize for training, on that one I did nothing really, I don't want to lie because the other guys had no interest in it when I talked to them and I said let's organize

maybe we can go to training center and go for lessons there, they were saying no we don't want lessons, we want products, we want to see something, we are tired of just attending, attending classes and not achieving anything (One Vision OV61)'.

With compiling a letter to the Member of the Executive Committee (MEC) and searching for contact details on the internet and nothing happened because the counselor once promised to organize funders for them to visit their project and they are still waiting.

'The money thing we were supposed to write a letter to the Member of the Executive Committee (MEC) and contact details and internet. On that one I kind of got stuck because one, there was a point whereby our counselor organized a meeting and told us about that, he is going to organize people who are going to come to us and tell us about funds, who are willing to give us funds, so I was still waiting for that so I guess, that's is why I didn't do anything, I was hoping that it will come but it never came, nothing came out of it really (One Vision OV61).

On the achievement stacker the partners mentioned that the presenter mentioned financial support for the transport and nothing much happened on the advertising. *'From me what I see they did achieved was especially for the target market was the financial support for the transport, the second one I just wrote disappointed because she didn't do nothing for advertising (One Vision OV60)'.*

Another feedback was that the presenter managed to talk to the community and the response was positive and the reason for searching for funding was to be able to transport the product and sell to the community. *'I wrote the results she has achieved, she spoke to the community members and they are positive about buying the fish and interested and the reason why she needs the funds is because of the transport to buy the fish and to sell it to the community (One Vision OV62)'.*

Results Assessment: Gariep Dam (GD) Project

On the action of approaching restaurants, wholesalers and school feeding schemes the partners managed to approach one wholesaler who was interested to buy fish and foreign nationals from hair salons.

'We sold our fish and managed to go to town and spoken to Chinese wholesalers and they promised to buy our fish but nothing was in writing, it was verbal. We also went to talk to foreigners in the hair salons and they love to buy our fish (Gariep Dam GD57)'.

The researcher designed a questionnaire for market survey and asked the partners what were the results. Partners mentioned that youth was not interested in filling in the questionnaire due to non-payment and they mentioned that they will only complete a job application.

'Most of the youth were not interested on these questions that we have, asking them by

saying there isn't pay so the only way they want forms to fill in forms is to get some jobs (Gariep Dam GD57)'. Researcher asked the partners the type of support they need to keep going was to obtain funding and create employment opportunities; they even mentioned this during an interview of Closed-circuit Television (CCTV).

'If our project in the future can go far, we spoke me and my colleague, I tell the people from CCTV when we get more funded and our project is growing, we will be able to provide more jobs for the youth, so we can push back to our community because why this is our community project, that's what I spoke about (Gariep Dam GD57)'.

Achievement Stacker Tool: Gariep Dam (GD) Project

Partners mentioned other achievements of been able to sell their fish to a client assisted by their extension support.

'What we managed to do last week the other guy was calling extension to buy fingerlings from the center and we already have fingerlings from carp, so this guy was actually in contact with extension person, who asked us, do you have this much fingerlings and we decided we going to go to our pond and get some fingerlings and count them, he wanted 40 but we managed to harvest 50, that guy is from Bloemfontein, so he came last week and he bought 50 from that fingerlings and also to include he said to us he also want to buy the juveniles, that is what I've achieved now (Gariep Dam GD57)'.

The researcher asked the partners how much where the fingerlings selling for. Partners mentioned that they sold them for R5 each and managed to make R250 which they used to purchase fuel for pond cleaning and grass cutting.

'We sold them for R5 and we managed to make R250. The R250 we managed to buy some petrol to use for our grass cutters to clean our ponds in the inside and the outside. So we spoke me and my colleague we can't expect from our government to give us so we have to push so that they can see we are moving forward with this project, we know it's a little bit but that is a start (Gariep Dam GD57)'.

The researcher asked for the type of the support that the partners needed. The partners mentioned working hard and fast. They also managed to mention on the CCTV interview that they would like to be assisted with funding and their lack of business account to save money.

'We have to put ourselves in a hurry to work very hard and I think what was good for us when the people from CCTV came and I said to them and I talk about the funding when we can get more funded, we can open our business account, we will be able to open a business account to put some money in there, if we need something during winter, we going to go there straight to the business account and draw some money out and put it in writing that I bought tools and knives (GD57)'.

Results Assessment: *Gotswametsing Project (GMP)*:

The researcher asked the partner to give feedback regarding making application for finances in Agriculture. The partner's response was that, there was a conflict between members of the project and they are avoiding by all means being in the same meeting with each other. One member resigned as a chairperson and came back to the project to claim his position and that is where the conflict arose from.

'To be honest there are no results. The last time we had a meeting, Agriculture had a meeting with us as a group but it didn't come together because the two members are fighting too much and I told them about this meeting last week and this morning I went to their house and asked and he said no, he is going to the dam to go fishing he forgot about the meeting. He does not want to be in the same room with the other member. He is going to go out of the project but suddenly he comes back and say he cannot go and for that he don't want to accept that he changed his mind and the interim chairperson says no it does not go like that and everytime when we have meetings he comes and interim chairperson don't want, but I told him he must leave him but he don't want to (GMP64).'

The researcher probed the partner by asking if she managed to go and visit Agriculture. The partner's response was that he went there several times but did not succeed in finding the extension officer. Then at some point they met during weekend and secured a day to meet with him and she did not manage to go due to personal commitments.

'Yes, I was there two times but I didn't find extension officer, everytime when I come there then extension officer is out somewhere after that I didn't go again but I met him there by the shops but it was on Saturday and I asked him can I come and see him on Monday he said yes, then on Monday I didn't go because of the funeral so I didn't have a chance to go there (GMP64).'

The researcher asked if the project will need intervention from Agriculture to solve the conflict. The partner mentioned that Agriculture once intervened and failed because the resignation of the chairperson was on paper and he went away with this paper and there was no copy and now they can't proof that there was a resignation.

'We did that with the extension officer but extension officer I don't know what went wrong but then he don't understand what the chairperson say or what deputy chairperson say. The resigning of chairperson on the project we put it on paper and the he signed on this book, after that he took the paper and then he go to town and then we didn't take a copy we don't have something to show, we can't show anything that chairperson was doing that, so that why chairperson says no he didn't say that (GMP64).'

The partner further added that the chairperson resigned because he got employed in the construction company and when the contract ended he came back to the project, claimed his position as a chairperson and also denied that he submitted the resignation letter.

'Long time ago we had this project on the road, after that, he asked us to go along with the

contract from the road and then he asked us to give him that contract and then he resigned and then he go there. After that then he goes with the road construction, I don't know what was going wrong there is still on or what I don't know. After that, he then come back and now we sit with this problem, where he says no he didn't resign (Gotswametsing GMP 64)'.

7.5.7. Creation and Synthesis Step

Six thinking hat tool was applied by partners to generate new ideas. In the performance assessment step partners mentioned funding as support needed to achieve their goal.

Black Hat: Lephoi (LP) Project

The researcher asked the partners to think about things that have made them not to be able to obtain funding in their business. Partners mentioned that their business did not have proof of address, tax clearance, business plan and business banking account. *'We don't have address of the project and secondly we don't have tax clearance. Even business plan, our business plan is very small, one page (Lephoi LP52). We don't have project account (Lephoi LP53)'.*

Another partner mentioned lack of information and communication from Department of Agriculture regarding implementation plans in the project and also occasional site visits were constraints that hindered them from obtaining funding.

'Lack of information, they can't update us that on this day this will happen. To make an effort of meeting with us and inform us of what will be happening in the project, the Agriculture people. They were supposed to each and every month pay us a visit twice in a month and brief us regularly so that you know that your project will go forward and you are still waiting for this type of material (Lephoi LP53)'.

Furthermore, the major hindrance also was when Agriculture acted as a sponsor of building a Recirculating Aquaculture System (RAS) only and did not ensure that the basic business administrative requirements were met. The partner mentioned the issue of not having a registered physical address of the project and lost lots of investor interest.

'You see one thing that defeated us was that Agriculture came here as a sponsor because when they started helping us, they asked us what is missing in the project so that they can help us. And then we told them that we sold our fish from our houses and they said they will help us with the building. When they finished building they were supposed to put us on their database as pensioners so that they can pay water and electricity and in that time there was no address, so I pushed municipality to give us address because when many sponsors wanted to help us they noticed that this place is not been noticed, it is just a place that was given and they will not assist a project put in a place without address because it can also be

belonging to municipality. So the sponsors did not manage to assist us. So now we have the address, so tax letter and other things are the ones that we need to do (LP51)'.

Yellow Hat: Lephoi (LP) Project

The researcher asked partners to list the positives things about having funding. Partners mentioned job creation, purchasing a vehicle and a boat to be able to fish from the nearest dam to sell locally and nearby towns.

'We will be able to create jobs for young people in our community because we want to buy our own boat and transport our fish in our community and the nearby towns. When we have money we can buy transport, we can buy boat and net the fish at the river while waiting for the system, and we can go and net and sell (Lephoi LP53)'.

Another partner also mentioned having funding can create jobs for local community and they will be able to pay for business plan designing services.

'It will create jobs for us and for other people. When we have money we can be able to make a business plan, because you have to pay for it and when you don't have money you can't make a business plan (Lephoi LP52)'.

Other materials that partners mentioned they will be able to pay for fishing license and being able to create a small photocopying business for local community to raise some funds.

'You can't be able to net the fish without a license, so we have to buy a license (Lephoi LP52). We can be able to buy ink for the photocopy machine so that you can make copies for people and make money (Lephoi LP51)'.

White Hat: Lephoi (LP) Project

Researcher asked partners to list the facts about funding. Partner mentioned that without funding their project was struggling to achieve lot of things, however, if they can have funding they can implement lot of things and reduce unemployment rate in South Africa.

'We are struggling, we can't achieve many things, so if we have funding it will be able to achieve lot of things that we've been wishing, we will be able to feed other families, and here in South Africa rate of unemployment will be reduced (Lephoi LP53)'.

Red Hat: Lephoi (LP) Project

The researcher asked partners to think about what will be their emotions regarding funding. Partner mentioned that young people are reluctant to work, they are just looking for free money, however, having funding can create jobs in the project.

'Young people are lazy, they are lazy to work they just only need money. Unemployment has to be reduced so if we have money we will be able to hire other people to work in the project (Lephoi LP53)'.

Another partner mentioned that service providers demand payment upfront for their services and in many occasions they fail to pay.

'People demand money from us that we don't have, when a person is looking for funding he wants to be paid (Lephoi LP52)'. Another partner supported the statement by giving an example whereby a service provider was paid money and failed to deliver services to them. 'Like Samson from Gauteng, he was helping us with tax clearance and business plan and he has ran away with our one thousand eight hundred (Lephoi LP53).'

The researcher probed partners to explain more on how they got to be in contact with this service provider. The partner's response was that the service provider was asking local people for their contacts until he managed to find them.

'He was the one who came here and asked about us, there is bakery up there and he was constantly asking who the owners of this project are. He went to social development and asked that who owns that building and social development gave him our number and he called and said he wanted to meet with us and then he came. He has been asking the owner of the bakery about us (LP52).'

Another partner added by saying that the service provider once worked with the bakery owner and many projects lodged complaints to his employer regarding his behavior of robbing people their money and promised to take necessary steps against him.

'The owner of the bakery knows him and he confirmed that he is a hardworker but he robs people because he called the company that this man works for in Gauteng and there are lot of people who are also crying about him, they have been receiving lot of calls. The company gave him the job of helping project so that they can get funding, so he also wants money from projects but they said they will deal with him (Lephoi LP51).'

Green Hat: Lephoi (LP) Project

The researcher asked partners to think about new ideas they can come up with to obtain funding easier and quicker. Partners mentioned advertising project on social media platforms. Others suggested making funding application to National Department of Agriculture (NDA) and Department of Social Development.

'We can advertise on social media with the name of the project and create pamphlets and put them in shops so that we can attract funding (LP53). We can apply somewhere like National Department of Agriculture (NDA) (LP52). We can go to social development to assist us to get funding (LP53).'

The researcher probed by asking if Department of Social Development can fund fish farming businesses and partner responded by saying they can link them to funders.

'They help those who are looking for funding, they can take you to people they know (LP53).'

Blue Hat: *Lephoi (LP) Project*

Partners we asked to summarize all the things they mentioned in the other hats together. Partner mentioned that lack of physical address, tax clearance, business plan will make them struggle to obtain funding and due to this they might meet unreliable people who rob them of their money

'When you are looking for funding we said something that made us not to get funding was because we did not have address of this place, we didn't have tax clearance; we didn't have business plan that is why we struggled to get funding. This one for Simon, when we look for funding we will meet people who are crooks (LP52).'

Another partner added by saying that chances of always been robbed of money are high from all angles and the partner struggled to comprehend the reason behind government being unable to assist them with administrative issues so that they can have a proper business. They just built a system and washed their hands from it and now they have to be vulnerable to robbers.

'You see now you meet problems and your money will be eaten even when someone can fund they will still demand money from you because Agriculture is a big thing of government, they can say ok we have built a building so the people we will start with them from the beginning by making them company and look for funding for them, we can sponsor this people so that they can start their business. They just build a system and leave you like that and say you will see for yourself. So others they can see that we are hungry and tired and they can use us, not see it for yourself, look for yourself, look now we meet with people who ran away with one thousand seven hundred, you see things like that, it is fraud from Agriculture, I blame Agriculture, you give a person a farm and then you say the person must work it out himself on that farm (LP51).'

Black Hat: *One Vision (OV) Project*

The researcher asked partners to list black hats of not having funding and partner mentioned the project will not be in a position to move and generate income; they are just in need of small amount of funding just to start their business.

'The project cannot start, cannot generate money, cannot move, we are just without a little, we just need a little cash / money so that we can just start (One Vision OV57).'

Another partner also mentioned that lack of funding will prevent them from generating income and they will not have any motivation to stand up each morning to go and work. If funding is there it will be evident in the well bodily performance and weight gain.

'I think I will also say the generating of income and then secondly you know when there is no money, we don't stand up your body, it doesn't talk to you in the morning to say hmm... let me stand up and go to that fish plant, I think that's the negative, body talks and your life is

continuing you see with your body and your heart, my body within three months you will be getting a small belly to show that there is something in the bag (OV60)'.

Yellow Hat: One Vision (OV) Project

The researcher asked partners to think about the positives funding can bring to their projects and the partner mentioned that funding will assist in kick starting the business and it will be in a position to generate income and reduce unemployment.

'The project will start and it will start generating income and you will be able to produce products and decrease the rate of unemployment (OV61)'.

Another partner also mentioned they will achieve their goal of improving rural livelihood and develop fish production and be in a position to eradicate youth unemployment and drug abuse by children.

'I will say we are going to achieve our objectives because it is to improve the livelihood or improve rural livelihoods especially particularly in those of rural communities and enhance fish production in Gariep District and also determine the yield and availability of fish production in Gariep District and also be a vehicle of employment there for our community especially, to eradicate youth unemployment and also eradicate the drugs that our kids are now using (OV60)'.

White Hat: One Vision (OV) Project

The researcher asked partners to think about the facts of having funding. Partner's response was they will be able to conduct all their planned activities and make a good impact.

'The fact of having funds is, we will be able to do all things that we wanted to do that we need to do in order to make a good impact on our project (OV61)'. Another partner also added by saying without finances you will not be able to achieve anything. *'Hmm, without money you can't do anything that is a fact (OV60)'.*

Red Hat: One Vision (OV) Project

Partners were asked to list the emotional feelings they have about lacking funding access. The partner mentioned the slow implementation of funds and there is not even an example of a sustainable project. They are always giving you impressions that your business is supported and later on you realize officials were just speaking for the sake of compiling monthly reports.

'From my point of view the Free State government is very slow especially when we talk about funds because there is no sustainable project in Gariep District which I can point that there is one project in Gariep district that is sustainable, there is nothing and what frustrates me more they will come to you and they will put you for that 30 minutes and they will put you

in that good mood as though something is happening but after you realize they just there to make their monthly reports and send them to the Member of the Executive Committee (MEC) (One Vision OV61)'.

Another partner mentioned the issue of not being able to obtain a straight answer when you request for funding and you will be just waiting for long periods.

'Is when we go to the people, when you ask for funds that is when they are not giving you straight answer, they will say no we will get back to you, but you don't know when that is going to be and what you should be doing in the meantime, should you wait for them or should you just move on (OV61)'.

Green Hat: One Vision (OV) Project

The researcher asked partners to think about new ideas that will assist them in getting funding. Partner responded by saying monitoring and evaluation of all the small scale projects must be done hand in hand with the office of the MEC in order to have sustainable projects because funding from other institutions is not easily accessible.

'From my point of you if we talk about in terms of monitoring and evaluation, I think we must work with the office of the Member of the Executive Committee (MEC), things will move forward because while the funding is being provided by other institutions we don't get it, I think that MEC's office must run all this projects and monitor them and evaluate them so that we can have sustainable projects also in the districts (OV60)'.

Another partner made a suggestion of making donations as small as R5 and sell snacks to be in a position to fund their business.

'I think we should start funding ourselves like donating a little maybe R5 from each member asking friends and family members, maybe can we even start by selling something selling like sweets or something or snacks anything so that we can fund ourselves (One Vision OV61)'.

Blue Hat: One Vision (OV) Project

The researcher asked the partners to summarize all the hats together. The partner mentioned that the office of MEC and minister of Agriculture are working hard in removing nepotism and corruption by the roots and taking the mandate of monitoring and evaluation of projects upon themselves.

'MEC and minister are taking over from the Department of Agriculture to root out nepotism and hmm corruption and taking over for monitoring and evaluation (One Vision OV61)'.

Another partner mentioned that lack of funds you cannot implement anything, however, with funding you can be able to contribute to job creation and changing the lives of people.

'Without funds we cannot do anything but with funds we will be able to research, decrease

the rate of unemployment and make changes in the project and lives of other people while coming up with funding ourselves, it will also help to generate money much faster (One Vision OV61)'.

Black Hat: Gariep Dam (GD) Project

Partners mentioned lack of employment as something that can hinder them from obtaining funding. *'Lack of work (Gariep Dam GD54)'.* Another partner mentioned that it takes time to obtain funding because they will wait for long periods.

'Waiting, waiting, you get some promise maybe we get another guy from the North West who says he is going to put some funding into our account in August, months go and months go and is already November, there is the frustration or negative things (Gariep Dam GD57)'.

The partner also mentioned that they also have to wait for the fish to grow and sell before they realize revenue. *'The fish you can't take it now as a fingerling and tomorrow is bigger and then you go sell and get funded, so you have to wait for a certain time and that's another bad thing (Gariep Dam GD58)'.*

The researcher probed the partners by asking them, if I were to ask you to go and look for funding where will you begin? Partners responded by saying that they will approach retailers and hotels and liaise with the managers about funding.

'We will go to markets like Ok store (GD58), we will go to Forever Resorts to the offices and speak to the manager, this is what we put on the table, we need funding for our project to go forward, then they can give us results back, the one that will be able to get us funded (Gariep Dam GD57)'.

Yellow Hat: Gariep Dam (GD) Project

The partners were asked to list the good things that can happen if they were to obtain funding for their project. Partners mentioned that their project will be successful and they will be able to create employment. *'The work will go forward and we will be able to hire other young people (GD54)'.* Another partner also mentioned that they will be able to demonstrate to other local people about fish farming. *'They can also come and learn what we do in the fish project (GD57)'.*

White Hat: Gariep Dam (GD) Project

Partners were asked to think about what the facts will be about funding. Partner's response was that they can make some investments and purchase equipments. *'We can invest and buy more equipment (Gariep Dam GD58)'.* Additionally, it was mentioned that they will be able to pay salaries and purchase their own vehicle. *'To be able to pay to our employees and also get our own transport (Gariep Dam GD57)'.* The researcher probed and asked if

they don't have funding what will happen and the partner mentioned that the business will be very slow and it takes them longer to succeed. *'It will take years and years, business will be very slow (Gariep Dam GD57).'*

Red Hat: Gariep Dam (GD) Project

Partners were asked to list frustrations they may think of about not having funding. Partner mention that the conceptualization of the project was in 2017 and if they were obtained funding, they could have been far and created employment.

'We started our project 2017 February and we could have been far by now if things were going the right way, if we are having funds we would have already created jobs (Gariep Dam GD57).'

The other partner mentioned different emotion by highlighting the negative work impact caused by having many visitors and students coming to check the fish.

'The other thing work will be slow especially when every week we get visitors here and now ponds are dirty we can't clean them, the students are going down to the ponds and we talk to them (Gariep Dam GD58).'

Green Hat: Gariep Dam (GD) Project

Partners were asked to think about new ideas that will assist them to have access to funding. Partners mentioned project registration, having a business account and market uptake of their fish. *'Get our project registered; open a business account and selling fish (GD58).'* It was also mentioned that they will also knock at doors of business looking for funding and having their project registered will assist in obtaining funding. *'Knock on doors that are business, to have some proof that we are registered and it will be easier for us to get funded (GD57).'*

Blue Hat: Gariep Dam (GD) Project

Partners were asked to summarize all the hats together. Partners mentioned that funding will assist in purchasing equipments and create employment. They don't want employees who are absent from work and if they can pitch to work drunk and they rather employ people who will show understanding of their work.

'If we getting funded, positive things can happen, we going to buy new things, we going to buy some more items we going to use, we going to create jobs so that the job can grow. Other things is the negative things, if we are employed you tell them you must work three times a week and they only come once a week that's more frustration, that's bad negative things, we don't want in our project. When we are employed our workers and they see, they are not getting every month a salary, they don't come to work at the end of the month, and we know

we depend on those guys so that work can go forward, if they come drunk here is frustration, its emotions, we don't want that in our project (Gariep Dam GD57). To be funded you hire those people that will be much easier, so the work will be going forward, so everything will be alright when you are funded (Gariep Dam GD58)'.

Black Hat: Gotswametsing Project (GMP) Project

The partner mentioned the black hat as lack of cooperation amongst project members to an extend of not being able to meet and discuss matters of raising funds. *'We don't have a relationship we as the members so we can't come together and talk and put something on the table, so that we can see what we can do to put money on the table (Gotswametsing Project GMP64)'.*

Yellow Hat: Gotswametsing Project (GMP) Project

The researcher asked what will be the positives of having good working relationships and funding. The partner explained that if they can work together they will be able to brainstorm and share ideas.

'For us, it is working together, if we work together, we can put our heads together, our thoughts and ideas, we can share some ideas and we can contribute towards ourselves (Gotswametsing Project GMP64)'.

White Hat: Gotswametsing Project (GMP) Project

The researcher asked for facts about having funding and the partner mentioned that the project lacked funding and they must act upon this challenge to build the project.

'For now, guys we don't have money and we must accept that we don't have money so we must do something. To help us build the project (Gotswametsing Project GMP64)'.

Red Hat: Gotswametsing Project (GMP) Project

The researcher asked partners about their emotional feeling regarding infighting and lack of funding. The partner mentioned that she sometimes felt like resigning and some other times she felt that maybe it will be for the best if both the guys could resign from the project and at the same time feel that they are both assisting the project a lot.

'I am honest now, sometimes I get that feeling that I must resign from the project and some other times I wish that the chairperson and the vice must leave the project, some other time, I think both of them are a help for us in the project. Like chairperson when he is here at the project he is here with everything he can do everything like now for instance the project the stealing that was happening there, the break ins, he can offer himself to sleep there. The

vice-chairperson is helpful; we can send him, go to the mine and ask this and that there for me (Gotswametsing Project GMP64)'.

Green Hat: Gotswametsing Project (GMP) Project

The researcher asked the partner for new ideas that will assist the project to move forward. The partner mentioned that she has faith that prayer can solve everything and when the conflict is solved they can plant vegetables and sell. They can even buy fish from the shops, bake it and sell to generate income in the project.

'I can go to the farm every day, sit there cleaning and me I have that faith in me the prayer can solve everything, so I can sit there and pray for the Lord to help us for this issue of the chairperson and his vice. And then we can do something like when this problem is solved we can do something like planting vegetables there and sell everytime when is payday to help with the money issues with little things. We can even buy some fish at the shops there in town and sell hake fish, me, I bake it and sell it (Gotswametsing Project GMP64)'.

Blue Hat: Gotswametsing Project (GMP) Project

The partner was asked to summarize all the hats together according to her understanding. The partner mentioned that the conflicts in the projects needs to prioritized in order to be able to work effectively together. Sometimes I have mind of resigning or making the chairperson and the vice to resign, however, at the same time they are both contributing to the project in a positive manner. Assistance can be sought from Agriculture and once the conflict is solved they can plant vegetables and bake fish to sell and raise capital.

'For me to solve the issue of the project is important because it is not taking the project anywhere and then working together is important to share ideas and solve our problems but sometimes I feel I can resign from the project or both the chairperson and the vice resign but we need them, I feel If we can approach Agriculture to help make both of them work together then we can plant veggies or buy fish to sell in order to make the project go forward (Gotswametsing Project GMP64).

7.6. Mpumalanga Province

7.6.1. Focus Step

Masibambisane (MB) project: the draft goal was to achieve high fish performance and generate income, *'to see our fish grow well and to make money (MB16, 17, 18); to grow the business, 'achievable goal, to move forward the project (MB10, 11) and to be a well-known business person, we want to be successfully and be recognized (MB14, 15)'*.

Money that would be made from fish would be measured and there was a need to make fish farming viable in their community within a year. The developed SMARTT goal was to achieve 2% profit improvement in MB project within 12 months (Table 7.39).

Mthaiza (MT) project; the draft goal was to make fish farming to grow and create jobs. Partners specified that they needed to improve technical skills in catfish farming and create employment. Partners would measure profit and the goal of fish farming was relevant because there were no fish projects in their area. Partners would achieve 2% profit within 12 months and the developed SMARTT goal was to achieve improvement in profit within a year.

Gilmo (GM) project; draft goal for this business was to improve lives and generate business income. In specific, partners indicated income generation and become profitable and income could be counted and measured. Partners indicated that this goal was achievable in spite of the challenges it would bring. Partners also indicated that fish farming was a new thing in their community and it would improve lives. The goal would be attained within a year by acquiring 2% profit. The developed SMARTT goal was to improve lives of people by feeding them with white meat and generating income.

Hangweni Trading (HT) project; the developed draft goal for this business was to increase profit. Partner specified the goal as selling catfish to community and further innovation as having processing equipments.

'Producing Africa catfish for sale directly to the public. Innovation entails acquiring equipment for processing catfish into fillets (Hangweni Trading HT64)'. Partner expressed measurable as, *'sales figures to be compared with the previous financial year and expenses for the two periods also compared (HT64)'*, and the scale of improvement was achievable. Partner indicated that *'the goal is related to a need, to improve the profitability of catfish business (HT64)'*. The business targeted 2% within one year and the SMARTT goal was to achieve increase in profit of catfish farming within 12 months.

Master Denzel (MD) project; Partners wanted to grow their business and employ more people as their initial goal. When specific was applied partners indicated making profit from fish farming. Partners would be able to measure generated profit and this goal was achievable. When relevant was applied, partners indicated the need in the community to farm with fish. Partners aimed 2% profit as a target within 12 months as time-frame. The

developed SMARTT goal was to improve profit of catfish farming by 2% within 12 months.

Khumbula Trust (KT) project; income generation and feeding the community with white meat was the initial goal. Specific was applied to the draft goal and partners indicated successful at catfish farming and owning a profitable business. When measurable was applied partners indicated they could measure income and this type of a goal was achievable. People in the community prefers catfish more than any type of meat, therefore, there was a need to develop this kind of a business. Targeted was 2% profit within a time-frame of 12 months. SMARTT goal was to develop a profit making business with catfish that supply the community with white meat and create employment opportunities.

Jubelly (JB) project; the draft goal for this business was to make money from fish farming business. The goal was specified as to run a profit making business from fish. Money, skills and number of fish sold could be measured. The goal was achievable and there was an opportunity of growing fish in the community since no one was doing it and the people preferred fish. Money that would be made from fish was the target within 12 months. The SMARTT goal was to achieve 2% profit and job creation and improve technical skills within 12 months.

Table 7.39: Outcome of draft and SMARTT goal developed in Mpumalanga projects

Research Partner	Draft Goal	SMARTT Goal
MB 10, 11,12,13,14,15,16,17 & 18	To make money from our projects	To make money from fish farming business, create employment for our community within 12 month
MT 23, 24 & 25	To make our project achieved and create job opportunities	To achieve 2% improvement in profit in MT fish farming project within 12 months
GM 19, 20 & 21	To improve lives by making money	To improve lives by feeding them white meat and make money to achieve 2% profit of catfish farming in GM project Mpumalanga within 12 months
HT 64	Increase profit	To achieve the 2% increase in profit of HT African Catfish farming business within 12 months
MD 22	To grow the business and employ more people	To achieve 2% improvement in the catfish farming at MD business in 12 months and create jobs.
JB 26, 27, 28 & 29	To make money and improve training skills	To achieve 2% profit in fish farming, and create jobs and improve technical skills within a year

Masibambisane (MB); Mthaiza (MT); Gilmo (GM); Hungweni (HT); Master Denzel (MD); Khumbula Trust (KT) and Jubelly (JB)

7.6.2. Situation Analysis Step

Masibambisane MB, Jubelly JB, Mthaiza MT, Hungweni Trading HT, Master Denzel MD, Khumbula Trust KT

In Mpumalanga group partners mentioned water as the main constraint and it appeared 9 times (see Figure 7.55).

'Lack of water (MB14, 15), Lack of quality water (HT64) we need water (MB10, 11); we don't have water (MB12; 13), shortage of water during drought season and water loss i.e. no pond liners (MD22), shortage of water (MT23).'

Lack of equipment to utilize during fish harvest and slaughter was discussed three times: 'Equipment costs such as nets and air pump (Hungweni Trading HT64); lack of equipment for harvesting and slaughter (HT72)'.



Figure 7.55. Outcome of brainstorming tool for step 2 situation analysis cycle 1 in Mpumalanga projects adapted from Atlas.ti 8

7.6.3. Impact Analysis Step

Impact and Influence: *Jubelly (JB) Project*

The opportunities developed from the previous step were assessed from a scale of 1 - 10 for the level of impact and influence. Opportunity to increase number of nets (1.1) achieved highest impact score 10 and third highest influence score 7. Opportunity to increase fish food (1.2) achieved second highest impact score 8 and third highest influence score 7. Opportunity to obtain protective clothing (1.3) achieved third highest score 7 and third lowest influence score 4. Opportunity to obtain equipments (1.4) achieved third highest impact score 7 and fifth highest influence score 5. Opportunity to market access (1.5) achieved fourth highest impact score 6 and third highest influence score 7. Opportunity of training (1.6) obtained third highest impact and influence score 7 (Figure 7.56).

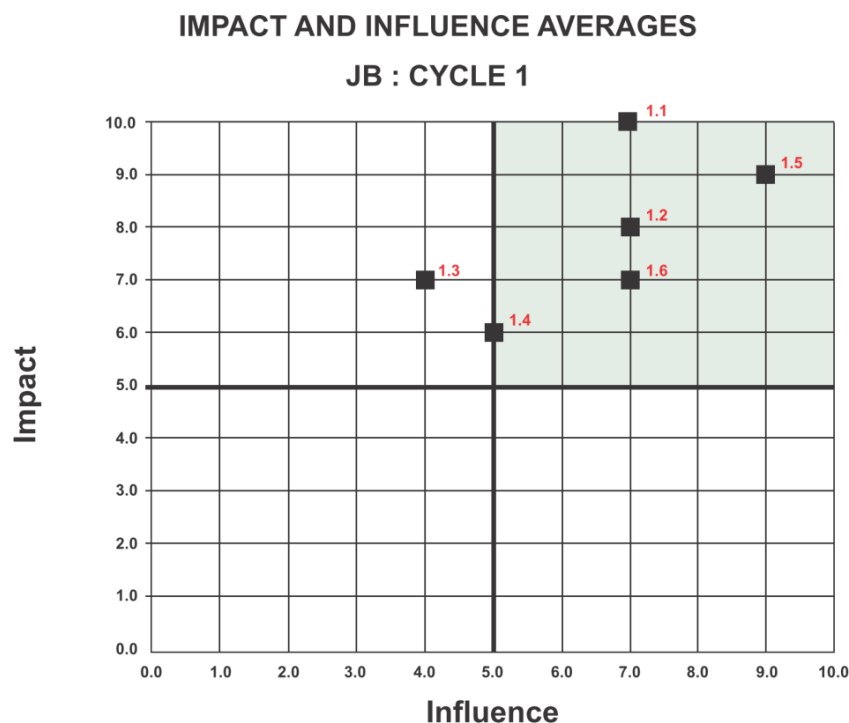


Figure 7.56. The scores of impact and influence tool employed to assess opportunities in Jubelly JB project

Eight Dimensions Criteria: *Jubelly (JB) Project*

The benefit of implementing opportunity of increasing number of nets achieved higher score 10 and also first highest score 9 in market access. Cost of not doing scored fourth highest score 6 in nets and third highest score 7 in market access. Ease achieved second highest score of 8 in both opportunities. Motivation achieved first highest score 9 in increasing number of nets and third highest score 7 in market access. Total score for positive dimension was 33/40 in nets and 31/40 in market access.

Cost achieved second highest score 8 in nets and third highest score 7 in market access. Risk was scored second lowest score 3 in nets and third lowest score 4 in market access. Length of time to implement was very long in both opportunities, 10. Term achieved second highest score 8 in both opportunities. Total score for negative dimension was 29/40 in both nets and market access (Table 7.40).

Table 7.40: Scores of selected opportunities from Eight Dimension Criteria for Jubelly JB project

Criteria	Opportunity 1.1: Nets	Opportunity 1.5: Market access
Benefit	10	9
Cost of not doing	6	7
Ease	8	8
Motivation	9	7
Positive Total	33	31
Cost	8	7
Risk	3	4
Time	10	10
Term	8	8
Negative Total	29	29

Eight Dimension Pinwheel Version: *Jubelly (JB) Project*

Opportunity of increasing number of nets (1.1) had a bigger bell shape on the right hand side than in market access. On the left hand side the bell shape was bigger and similar in both increasing number of nets and market access. Both of the opportunities were taken to the next step (Figure 7.57).

EIGHT DIMENSIONS PINWHEEL VERSION

JB : CYCLE 1

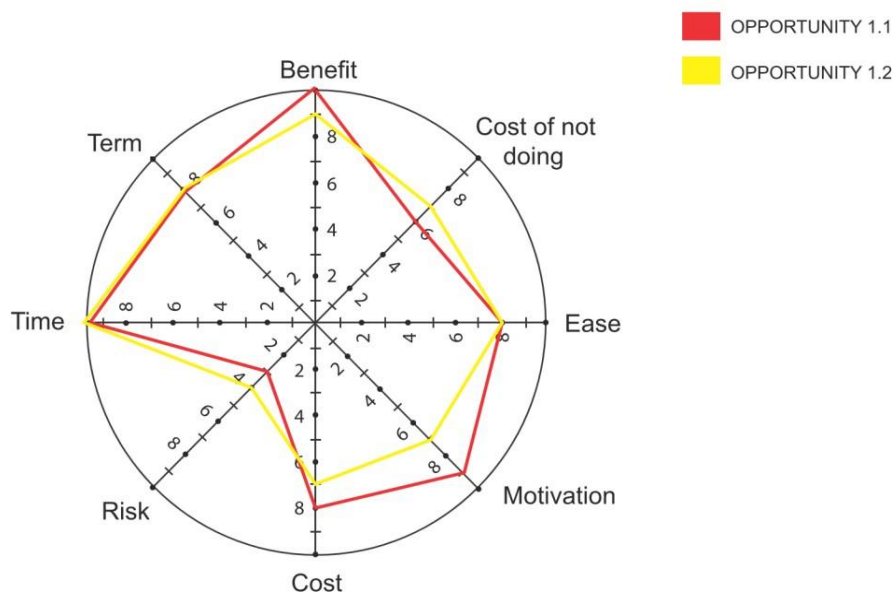


Figure 7.57. Scores for nets and market access on Eight Dimension Pinwheel Version for Jubelly JB project

Impact and Influence Tool: Hungweni Trading (HT) Project

Opportunity to prevent theft (1.1) achieved the highest impact score 10 and fourth highest influence score 6. Opportunity to prevent predation (1.2) achieved third highest impact score 7 and highest influence score 10. Reduce nitrogenous substances (1.3) obtained fifth highest impact score 5 and fourth highest influence score 6. Opportunity 1.4 improve technical skills obtained 7 impact and influence of 8. Opportunity to reduce feed waste (1.5) achieved highest impact 10 and fourth highest influence 6. Opportunity improvise (1.6) achieved third lowest score 4 and second highest influence score 8. Opportunity to destroy invader plants (1.7) achieved third highest impact score 4 and first highest influence score 9. Opportunity to improve water quality (1.8) achieved second highest impact score 8 and highest influence score 10 (Figure 7.58).

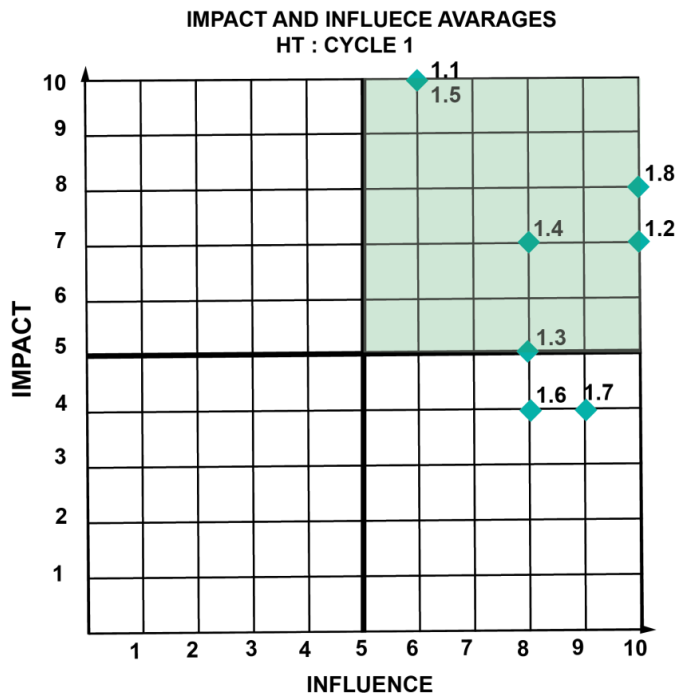


Figure 7.58. The scores of impact and influence tool employed to assess opportunities in Hungweni Trading HT project

Eight Dimension Criteria: Hungweni Trading HT Project

The benefit of preventing theft and market access both obtained highest score 10. Cost of not doing obtained highest score 10 in preventing theft and first highest score 9 in market access. Ease obtained fifth highest score 5 in preventing theft and fourth highest score 6 in market access. Motivation achieved highest score 10 in both opportunities. Total score for positive dimension 36/40 in market access and 35/40 in preventing theft.

Cost achieved highest score 10 in theft and first lowest score 2 in market access. Risk was scored lowest score 1 in theft and third lowest 4 in market access. Time to implement obtained fifth highest score 5 in theft and second highest score 8. Term achieved second lowest score 2 in theft and third lowest score 3 in market. Total score for negative dimension was 18/40 in preventing theft and 15/40 in market access (Table 7.41).

Table 7.41: Scores of selected opportunities from Eight Dimension Criteria for Hungweni Trading HT project

Criteria	Opportunity 1.1: Prevent theft	Opportunity 1.5: Market access
Benefit	10	10
Cost of not doing	10	9
Ease	5	6
Motivation	10	10
Positive Total	35	36
Cost	10	2
Risk	1	2
Time	5	8
Term	2	3
Negative Total	18	15

Eight Dimension Pinwheel Version: Hungweni Trading (HT) Project

Prevent theft (1.1) and market access (1.5) had similar and bigger bell shapes on the right hand side with a caution that they would not be easy to implement. On the left hand side, the bell shape was bigger in preventing theft indicating higher negative results and smaller in market access indicating lower negatives. Preventing theft was taken further to the next step (Figure 7.59).

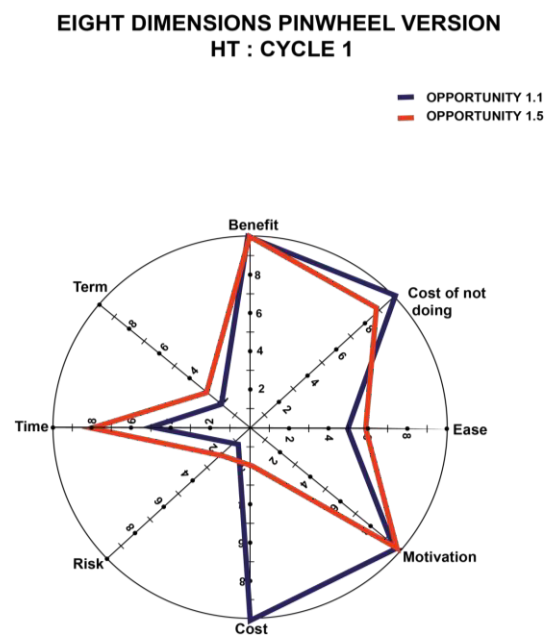


Figure 7.59. Scores for theft and market access on Eight Dimension Pinwheel Version for Hungweni Trading HT project

Impact and Influence: *Gilmo (GM) Project*

The opportunities that partners developed in the previous step were assessed on a scale from 1-10 for the level of impact and influence. Opportunity of water access (1.1) achieved highest impact and influence score 10. Opportunity to increase number of ponds (1.2) achieved third highest impact and influence score 7. Opportunity to prepare additional ponds (1.3) achieved highest impact and influence score 10. Opportunity of having more equipment (1.4) had second highest impact and influence score. Opportunity to kick start the business (1.5) achieved highest impact and influence score 9. Covering ponds with liners (1.6) achieved first highest impact and influence score 9. Opportunity to obtain protective clothing (1.7) achieved highest impact and influence 10. Opportunity to obtain fish food (1.8) achieved third highest impact and influence score 7. Opportunity to hire security personnel (1.9) achieved second highest impact and influence score 8. The scores were plotted on the impact and influence electronic spread sheet (Figure 7.60).

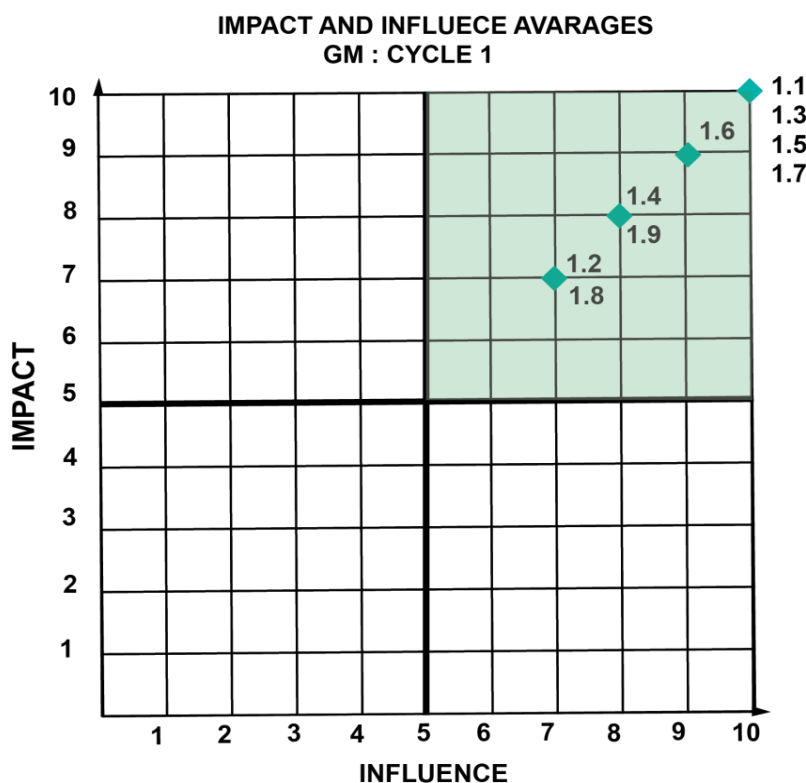


Figure 7.60. The scores of impact and influence tool employed to assess opportunities in *Gilmo GM project*

Eight Dimensions Criteria: *Gilmo (GM) Project*

The benefit of water access (1.1) and additional ponds (1.5) both obtained highest score of 10. Cost of not doing achieved highest score 10 in water access and first highest score 9 in additional ponds. Ease obtained fourth highest score 6 in water access and fifth highest

score in additional ponds. Motivation obtained highest score 10 in both opportunities. Total score for positive dimension was 34/40 in water access and 33/40 in additional ponds.

Cost was extremely high in water access with highest score 10 and lower in additional ponds with first lowest score 2. Risk obtained first lowest score 2 in additional ponds and lowest score 1 in water access. Time obtained second highest score 8 in additional ponds and fifth highest score 5 in water access. Term obtained second lowest score 3 in ponds and first lowest score 2 in water access. Total score for negative dimension was 18/40 in water access and 15/40 in ponds (Table 7.42).

Table 7.42: Scores of selected opportunities from Eight Dimension Criteria for Gilmo GM project

Criteria	Opportunity 1.1: Water access	Opportunity 1.5: Additional ponds
Benefit	10	10
Cost of not doing	10	9
Ease	5	6
Motivation	10	10
Positive Total	35	36
Cost	10	2
Risk	1	2
Time	5	8
Term	2	3
Negative Total	18	15

Eight Dimensions Pinwheel Version: *Gilmo GM Project*

The scores from the previous step of eight dimensions criteria were plotted on the pinwheel version. Water access (1.1) and additional pond (1.5) had bigger and similar bell shape on the right hand side of the pinwheel. On the left hand side of the pinwheel, the bell shape of both opportunities was small and similar. Both opportunities were taken to the next step (Figure 7.61).

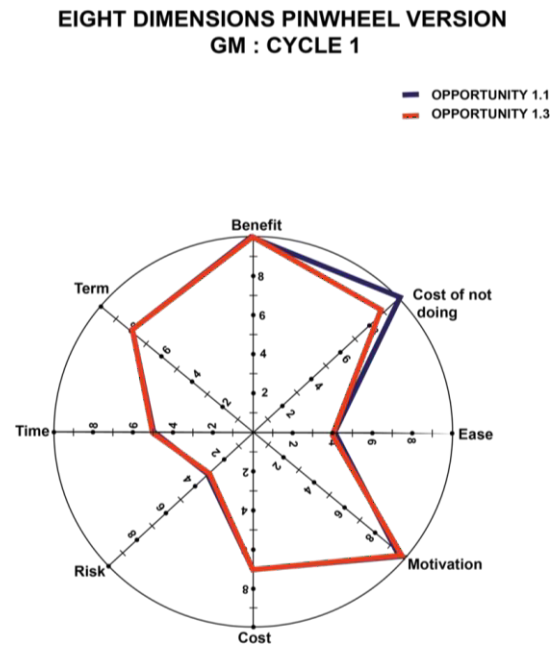


Figure 7.61. Scores for water access and additional ponds on Eight Dimension Pinwheel Version for Gilmo GM project

Impact and Influence: Master Denzel (MD) Project

Opportunity of water access (1.1) obtained highest impact score 10 and third highest influence score 7. Opportunity to improve capital (1.2) achieved fifth highest impact score 5 and third highest influence score 7. Opportunity to improve security (1.3) achieved third highest impact 7 and highest influence 10. Opportunity to install ponds with liners (1.4) achieved second highest impact 8 and highest influence 10. Prepare additional ponds (1.5) achieved third highest impact and influence score 7. Obtain more implements (1.6) achieved third highest impact score 7 and second highest influence score 8. Increase fish food (1.7) achieved highest impact score 10 and first highest influence 9. The scores were plotted on impact and influence electronic spreadsheet (See Figure 7.62).

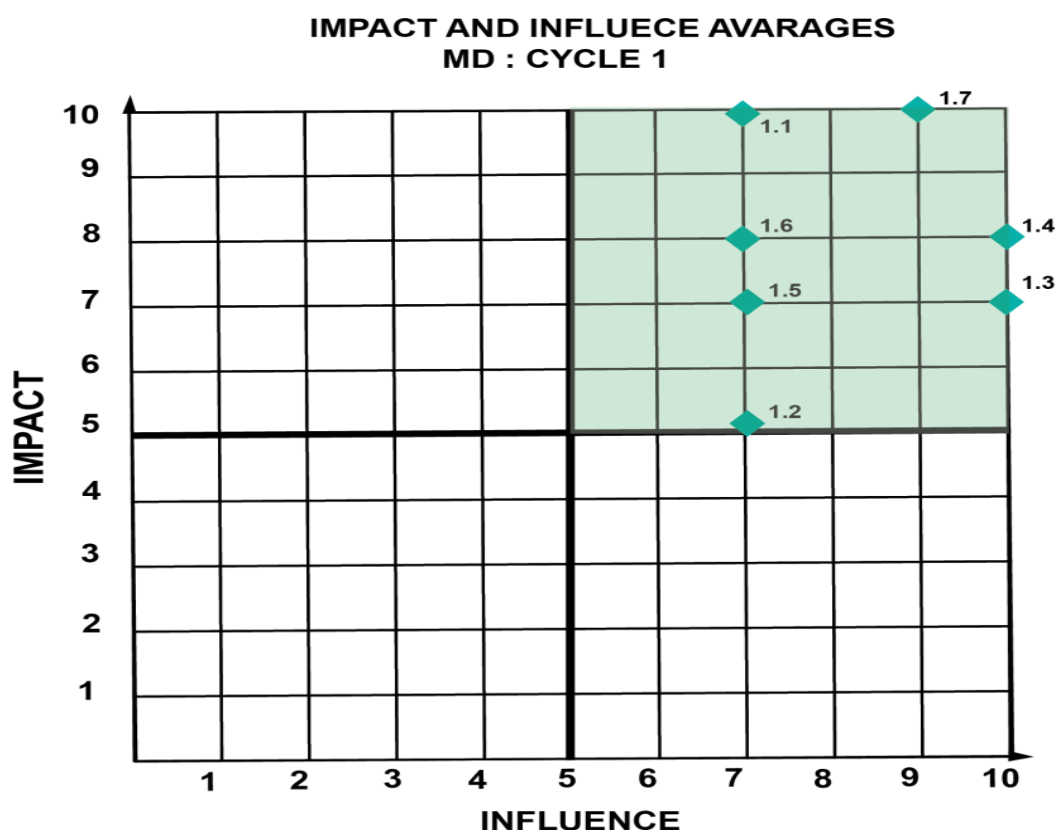


Figure 7.62. The scores of impact and influence tool employed to assess opportunities in Master Denzel MD project

Eight dimension Criteria: Master Denzel (MD) Project

The selected opportunities were assessed from eight dimensions criteria on a scale of 1-10. Benefit obtained highest score 10 in water access (1.1); second highest score 8 in both security (1.3) and implements (1.6) and third highest score 7 in pond liners (1.4). Cost of not doing achieved the first highest score 9 in implements; followed by second highest score 8 in security; third highest score 7 in water access and fifth highest score 5 in pond liners. Ease achieved first highest score 9 in implements; followed by second highest score 8 in improving security and third highest score 7 in both water access and pond liners. Motivation achieved the highest score 10 in implements; followed by second highest score of 8 in pond liners and third highest score 7 in both water access and security. Total score for positive dimension was 31/40 in improving security; 30/40 in more implements; 27/40 in water access and 26/40 in stalling pond liners.

Cost was scored first highest score 9 in water access; second highest score 8 in security and fourth highest score 6 in both pond liners and implements. Risk achieved third lowest score 4 in both security and pond liners and second lowest score 3 in implements and water access. Time and term achieved fourth highest score 6 in all the opportunities. Total score

for negative dimension was 24/40 in both water access; 22/40 in improving security and 21/40 in more implements (Table 7.43).

Table 7.43: Scores of selected opportunities from Eight Dimension Criteria for Master Denzel MD project

Criteria	Opportunity 1.1: Water access	Opportunity 1.3: Improve security	Opportunity 1.4: Install pond liners	Opportunity 1.6: More implements
Benefit	10	8	7	8
Cost of not doing	7	8	4	4
Ease	7	8	7	9
Motivation	7	7	8	10
Positive Total	27	31	26	30
Cost	9	8	6	6
Risk	3	4	4	3
Time	6	6	6	6
Term	6	6	6	6
Negative Total	24	24	22	21

Eight Dimension Pinwheel Version: *Master Denzel (MD) Project*

Opportunity of improving security (1.3) had the bigger bell shape on the right hand indicating high positives; followed by more implements (1.6); water access (1.1) and then a smaller bell shape was found in installing pond liners (1.4).

On the left hand side of the pinwheel the bigger bell shape with high negatives was found in water access and improves security; followed by pond liners and a smaller bell shape was in more implements (see Figure 7.63).

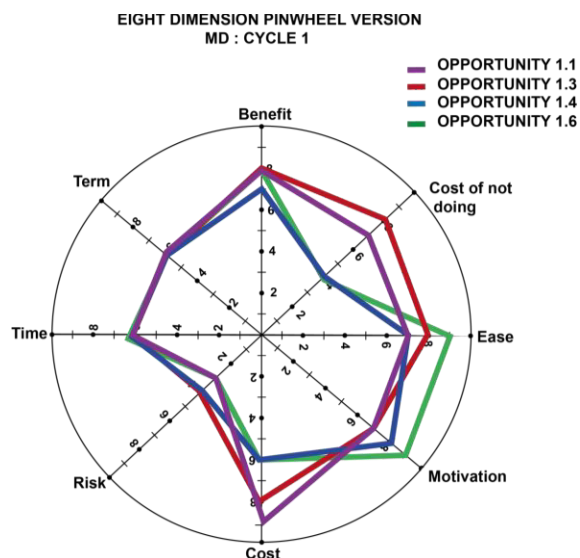


Figure 7.63. Scores for water access, security; pond liners and implements on Eight Dimension Pinwheel Version for Master Denzel MD project

Impact and Influence: Masibambisane (MB) Project

The developed opportunities were assessed further on eight dimension criteria. Water access (1.1) obtained the highest impact score 10 and third highest influence score 7. Increase fish farming (1.2) achieved first highest impact score 9 and second highest influence score 8. Market access (1.3) obtained highest impact score 10 and fifth highest influence score 5. Increase fish (1.4) and increase availability of fish food (1.5) had the highest impact score 10 and fifth highest influence score 5 (Figure 7.64).

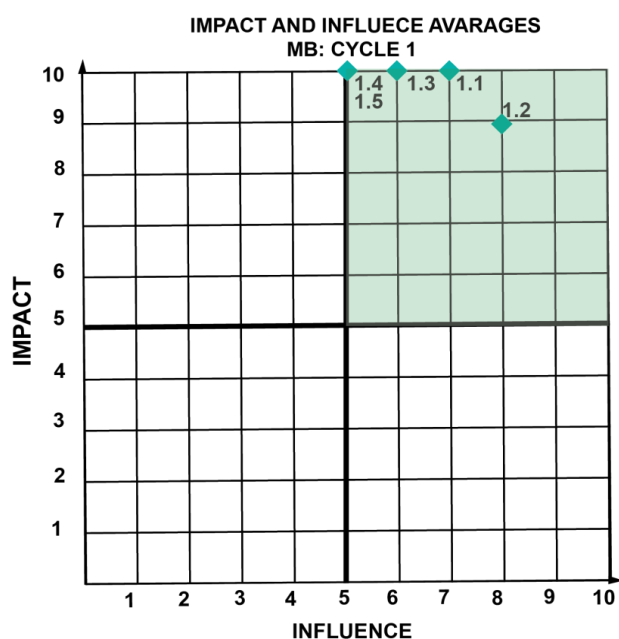


Figure 7.64. The scores of impact and influence tool employed to assess opportunities in Masibambisane MB Project

Eight Dimension Criteria: *Masibambisane (MB) Project*

The selected opportunities were assessed on a scale of 1-10 on eight dimension criteria. Benefit obtained the highest score 10 in both water access (1.1) and market access (1.3), and first highest score 9 in increasing fish farming (1.2). Cost of not doing obtained highest score 10 in water access, third highest score 7 in increasing fish farming and fifth highest score 5 in market access. Ease obtained the highest score 10 in water access; second highest score 8 in market access and fifth middle score 5 in fish farming. Motivation achieved highest score 10 in water access and market access and third highest score 7 in fish farming. Total score for positive dimension was high 40/40 in water access; 33/40 in market access and 28/40 in increasing fish farming.

Cost obtained highest score 10 in water access; followed by first highest score 9 in market access and second highest score 8 in fish farming. Risk obtained fifth highest score 5 in fish farming; followed by second lowest score 3 for water access and first highest score 2 for market access. Time obtained third highest score 7 in fish farming; followed by fifth highest score 5 in market access and third lowest score 4 in water access. Term obtained third highest score 7 in fish farming and fifth highest score 5 in both water access and market access. Total score for negative dimension was high in increasing fish farming 27/40; followed by both water access and market access with 22/40 (Table 7.44).

Table 7.44: Scores of selected opportunities from Eight Dimension Criteria for Masibambisane MB project

Criteria	Opportunity 1.1: Water access	Opportunity 1.2: Increase fish farming	Opportunity 1.3: Market access
Benefit	10	9	10
Cost of not doing	10	7	5
Ease	10	5	8
Motivation	10	7	10
Positive Total	40	28	33
Cost	10	8	9
Risk	3	5	2
Time	4	7	5
Term	5	7	5
Negative Total	22	27	22

Eight Dimension Pinwheel Version: *Masibambisane (MB) Project*

Opportunity of water access (1.1) had bigger bell shape on the right hand side of the pinwheel indicating higher positives, followed by opportunity of market access (1.3) with second biggest bell shape and the third biggest bell shape was found in increasing fish farming. On the left hand side of the pinwheel the biggest bell shape was found in increasing fish farming; second highest was found in both water and market access (Figure 7.65).

EIGHT DIMENSIONS PINWHEEL VERSION MB: CYCLE 1

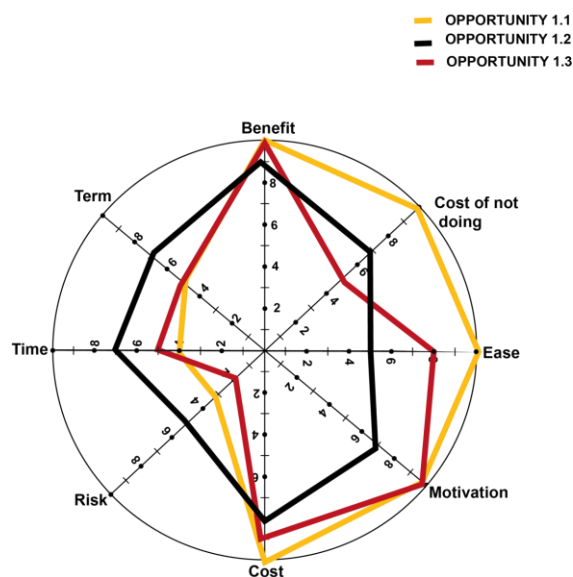


Figure 7.65. Scores for water access, fish farming and market access on Eight Dimension Pinwheel Version for Masibambisane MB project

Impact and Influence: *Mthaiza (MT) Project*

The opportunity of water access (1.1) achieved the highest impact and influence score 10. Opportunity to improve fish food supply (1.2) achieved first highest impact and influence score 9. Improve security (1.3) achieved the highest impact and influence score 10. Opportunity to improve market access (1.4) achieved the highest impact and influence score 10. Additional ponds (1.5) obtained first highest impact and influence score 9. Water access and market access were taken further to the next step (Figure 7.66).

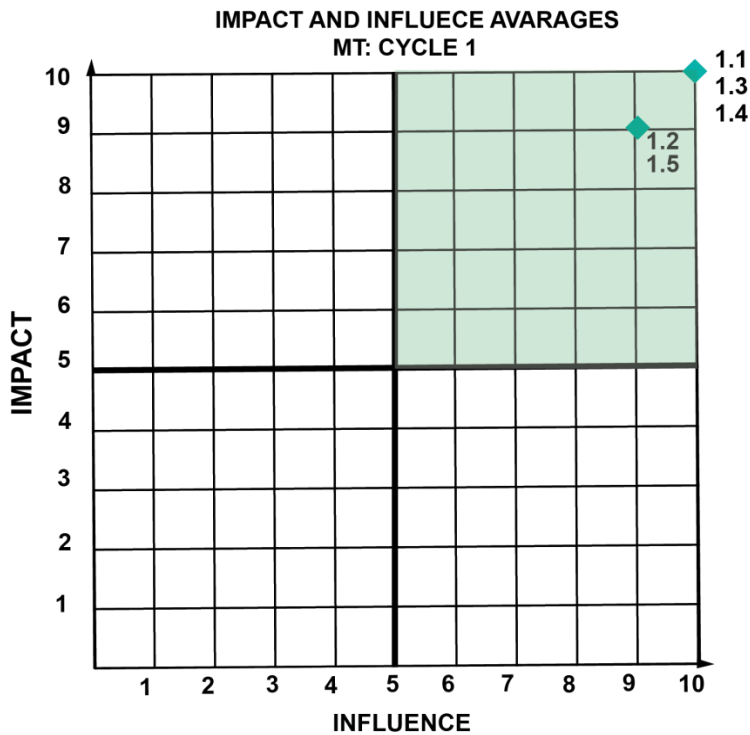


Figure 7.66. The scores of impact and influence tool employed to assess opportunities in Mthaiza MT Project

Eight Dimension Criteria: Mthaiza (MT) Project

Water access (1.1) and market access (1.4) were assessed further on the eight dimension criteria on a scale from 1-10 (1=low; 10=high). Benefit of water access obtained highest score 10 and first highest score 9 was in market access. Cost of not doing achieved the highest score 10 in water access and first highest score 9 in market access. Ease achieved the highest score 10 in water access and third highest score 7 in market access. Motivation achieved the highest score 10 in both water access and market access. Total score for positive dimension 40/40 in water access and 37/40 in market access.

Cost achieved the third highest score 7 and water access and second highest score 8 in market access. Risk achieved a score of 4 in both opportunities. Time achieved a score of 2 in both opportunities. Term achieved a score of 6 in water access and a score of 5 in market access (see Table 7.45). Total score for negative dimension was 24/40 in market access and 11/40 in water access.

Table 7.45: Scores of selected opportunities from Eight Dimension Criteria for Mthaiza MT project

Criteria	Opportunity 1.1: Water access	Opportunity 1.4: Market access
Benefit	10	9
Cost of not doing	10	9
Ease	10	7
Motivation	10	10
Positive Total	40	37
Cost	7	8
Risk	4	4
Time	2	2
Term	6	5
Negative Total	11	24

Eight Dimension Pinwheel Version: *Mthaiza (MT) Project*

The scores achieved on the eight dimensions criteria were further plotted on eight dimensions pinwheel version. The bell shape on the right hand side was bigger in water access (1.1), followed by market access (1.4) indicating high positives. On the left hand side the bell shape was bigger in market access indicating high negatives, followed by water access with lower negatives (Figure 7.67).

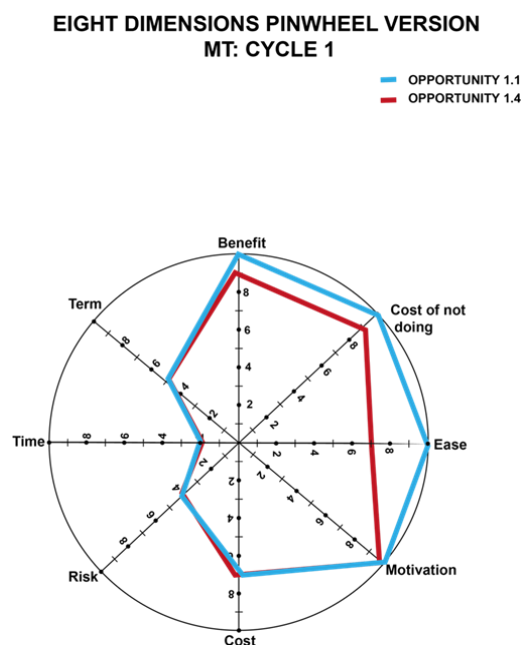


Figure 7.67. Scores for water access and market access on Eight Dimension Pinwheel Version for Mthaiza MT project

7.6.4. Action Design Step

Gilmo (GM), Masibambisane (MB) and Mthaiza (MT) Projects; partners selected to improve water access by looking for a water driller, obtain quotation for water pumps, install pipes and tanks, and obtain water license from department of water affairs.

Hungweni Trading (HT) and Master Denzel (MD) Project; partners selected to design action for preventing feed wastage from fish ponds. Partners would search for training from Department of Agriculture on how to reduce feed wastage and other general technical training. Action was designed for preventing theft, partners would erect fencing around their project, advertise to hire overnight security guard, and install alarms systems and night lights. Employment adverts would be circulated in search of a suitable candidate to be a security guard. Partners would look for quotations for harvesting equipments.

Khumbula Trust (KT) Project; in this project, partners selected an opportunity to prevent fish escape and purchase equipment to design action. In preventing fish escape partner would seek assistance from Department of Agriculture Engineering Unit and also private engineers to fix fish ponds. In the opportunity of purchasing equipment, partner would request quotations from stores for building materials to construct fish ponds.

Masibambisane (MB) Project; partners wanted to raise capital in their project by applying for funding from Small Enterprise Development Agency (SEDA), Agriculture and Banks (Table 7.46).

Table 7.46: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Mpumalanga projects

Project number	Opportunities	CSFs	KPIs	KAs
GM, MB & MT project	Improve water availability	Drilling machine and driller	Quotations, Delivery note	Contact the driller and obtain quotation for equipments
		Water pump	Quotation, cash slip, deliverynote	Obtain quotation from hardware stores
		Pipe and installation tank	Quotation, cash slip, deliverynote	Obtain quotation from hardware stores
		Water assessment	Report	Conduct water assessment
		Water license	Water license certificate	Liaise with Department of Water Affairs

Gilmo (GM), Masibambisane (MB) and Mthaiza (MT) (Full version Appendix 7)

7.6.5. Action Implementation Step

In this step partners were implementing their designed action from the previous step and after 30 days, action monitoring session was conducted to check how far partners were in their activities. This step required members to give feedback on the specific action taken in order to achieve their goals.

Action Monitoring: *Mthaiza (MT) Project*

The presenter MT23 gave feedback of the action implemented in his project. It was reported that the pond was constructed with inlet and outlet draining pipes. The pond did not have water because of the water pump problem and they were waiting for installation by an expert. Partner mentioned that they did not obtain water license from department of Water Affairs because they already had one for Agricultural purposes acquired long ago. Partner also mentioned that their farm also owned a fresh produce shop in town and their fish products would also be marketed there. Furthermore, they managed to approach one retail shop for product take-offs and no conclusion was reached yet due to unavailability of fish on site. As for alternative fish food they own chickens, cows and pigs, so their waste was readily available. The electricity was already installed and utilized for daily operations of the farm.

'I can start with pond construction, we did one pond, the average ponds that we are having

now is 17.5 m in length and breadth of the ponds, the ponds have two drainages, the first one is inside drainage, the other one is outside drainage. For us to put drainage we take water from the big dam and we build the ponds beneath. The outside drainage is made through the lowest point in the ponds. The thing that hindered us, we did the ponds but we did not put water because we waiting for the expert of water pump to come and install them for us. So we didn't put water in because of that water pump. We had a problem that the water pump we get are not the type we want because we have our own farm. Water there is no need to go to department of water for applying any license of water because the place we are farming from is ours; we made an application for that because we started long time ago, so we were busy with Agriculture only. Hmm when we come to marketing, marketing we have a store in Male lane that's where we take all our vegetable produce. So we went to Spar for marketing and discussed with them about fish and we did not come to an agreement yet because we are looking at we haven't put the fish yet in the ponds. The question of fish food, we have poultry farming, we don't have a problem with obtaining chicken livers, chicken intestines, cow dung, and we don't have a problem with fish food. The only problem we have is with the water pump because we are still waiting for experts. Electricity we don't have a problem with it because we are having our own place so we don't have any problem with electricity (Mthaiza MT23)'.

Observations, Questions, Ideas, Opportunities (OQIO): Mthaiza (MT) Project

Partner asked for the reason the presenter said their water was not in a good condition to raise fish. *'You said water you have but it is not in the condition you want (Masibambisane MB11)'.* Presenter responded by saying they did have water and they just lacked water pump to pump water from reservoir to the fish pond. *'No, we have dams and the only problem is we want water pumps to pump water from the big dam to small ponds (Mthaiza MT23)'.*

Another partner asked for clarity of the description of inlet and outlet pipes. *'Inner pipe and outer pipe, can you please explain it again (Jubelly JB25)'.* Presenter's response was that inlet was an inner pipe placed at the bottom of the pond and the pipe must be covered with a screen to prevent fish escape. Outlet was an outer pipe located on top of the fish pond and both pipes should have valves to close and open the water.

'Inner pipe in the ponds is the inside drain, most of them are turn down pipe and you can modify it yourself and outlet is located at the lowest point. Outside pipe is installed on top to put in the water, the water comes from the dam so it is on top. So the inside one is placed at the bottom of the pond. And there must be something like when you clean the dam for the fish not to escape. The inside one has a valve to close the water on the valve and then you clean. From there you have cleaned the pond the outside one you use it to drain the water, there must something like a small mesh fence to cover to prevent fish escaping and drain only water

not the fish (Mthaiza MT23)'.

Another question was about lack of electricity in the farm and how they manage their daily farm operations. *'You said you have a problem with electricity so are you working without it (Gilmo GM20)'.* Presenter's response was they did have electricity supplied by Eskom in their farm. *'We have electricity from Eskom that we are using full time in the farm (Mthaiza MT23)'.* The partner made follow - up asking if the project had water license. *'Did you apply for having water license (Gilmo GM20)'.* Presenter mentioned that the water license was acquired long ago. *'We have from long time ago that water license (MT23)'.* Furthermore, another partner supported ad hoc the manner in which their project also covered outlet pipe with a screen to prevent fish escape. *'We used to use a small fence and put on the pipe and when you open the water the fish will jump against the small fence, you tie it tightly (Masibambisane MB11)'.*

Action Monitoring: *Gilmo (GM) Project*

Presenter *Gilmo GM20* gave feedback on the action implemented in their project and support needed. The report given was that they managed to contact the water driller and he visited the project to survey and he promised to give feedback. Support needed on this activity was to obtain assistance from government; however, partner doubted if they would be assisted as the project achieved most of the things solely on their own. Water pump required to be fixed and they do have ponds that were in a good condition. Their fish feeds on poultry feed, droppings and intestines, bread crumbs, cow dung and saw dust. The project already acquired water license since they were mainly farming with poultry.

'Under Critical Success Factor (CSF) number one, we have drilling machine, so we contacted the driller and he came and they checked what was happening, after checking they said they come back to us and inform us what we can do and not do. On support we want government to help us but I don't think they will help us a lot because most of the things we do them on our own. Government just come and checks and says did you do this on your own. So number two water pumps, we have water pump. We want our chairperson to fix it so that we can continue working with the water pump but we are not sure if it is available or not. Pipe installation, we are not sure, we asked government to assist us. On the ponds, we do have ponds and they are 100 % and they are in a good condition, we fixed them. I can show you on the phone, ponds we have and they are in a good condition, they are 20 x 20 in a 7 ha farm. Our fish eat poultry feed and poultry waste, they eat bread crumbs, they eat chicken intestines after slaughter. And they know which side they are eating from and the time they eat, we also give them cow dung but we don't use it a lot, we use sawdust and we have lots of fish. With water license we don't have to have it, chairperson has done the water license because we own the poultry farm is ours (GM20)'.

Observations, Questions, Ideas, Opportunities (OQIO): *Gilmo (GM) Project*

Partner asked if the presenter said their water pump was not well functioning. *'You mentioned something about water pump, you said it has a problem or something (Jubelly JB20).* Presenter responded by saying the challenge with water pump was that it pumped mud out, however, they normally do not have a problem with water. They used a machine to clean their ponds and the waste water they used it to irrigate vegetables.

'Water pump once had a problem of when water is not there, it pumped mud from the borehole, it pump mud so we have that kind of a problem but a lot of time we are not suffering with water pump and when we clean the ponds, we have a machine to clean the ponds, there is pipe that goes inside with a screen and fish cannot escape even the small ones cannot escape. We normally use the water a lot for irrigation of vegetables (Gilmo GM20).'

Another partner wanted to know if their pond was lined with concrete or soil at the bottom. *'How are the ponds at the bottom, did they use concrete or is soil (Mthaiza MT23).'* The response was that the one is soil and the other one is concrete and they have taken measures of constructing two steps up to prevent frog invasion into the pond as it is their major constraint.

'The first pond is muddy and the side is green grass and the second pond we used concrete and it has two steps to prevent frogs come in, we are being troubled a lot by frogs (Gilmo GM20).'

A follow-up question was asked regarding the condition of water with muddy bottom. *'How is water in the pond made of mud (Masibambisane MB11).'* The response was that the water get spoiled and dirty water is normally been drained out and fresh water poured in. The partner further mentioned that fish prefers muddy water, clean water and the one in between. *'They get spoiled, we drain the dirty water and we put fresh water, fresh water we are able to see the soil at the bottom and can also see the fish. Most of the time the fish loves mud and we put grass at the corners and it quickly spread all over the pond and fish loves clean water or water that is in between (Gilmo, GM20).'*

Partner asked the type of flower planted in the fish pond. *'I wanted to know the type of flower they plant in the pond (Masibambisane MB11).'* The response was she does not know their type but they were beautiful and small and they could be obtained from the river. *'I don't know them, you can only get them from the river and they were beautiful and they were small (Gilmo GM20).'* Researcher probed by asking the purpose of the flowers in the fish pond and the presenter said they change color of the water. *'They change the water and make them green for production of food for fish (Gilmo GM20).'*

Another partner cautioned the presenter about knowing the type of flowers they planted in fish ponds since some consumes lot of water and department of Water Affairs was in a process of eradicating them. Partner further added that their ponds must also be fenced to prevent theft. *'An idea on flowers, flowers waste water, they drink lot of water that is why department of Water Affairs is trying to eradicate them. In your farm where you are farming with fish you must try to put up a fence to prevent people from stealing fish (Mthaiza MT24).'*

Action Monitoring: Jubelly (JB) Project:

On market research partners were still waiting for approval of market survey or questionnaire from the University's approval. The support partners need was funding to conduct an awareness campaign and showcase the various fish products. For branding, partners made business cards and advertisement stickers. Partner made an example of stickers as those similar to the ones found on packaged apples and vegetables indicating which company they came from. Support needed the partner mentioned money and also billboards also needed money. Partners also managed to make an appointment with radio station manager to secure broadcasting time slot for their project. Support needed was money to pay for broadcasting fee. The project also needed smart devise like iPod to advertise their project on social networks.

'Our goal is to improve market access in Jubelly JB project in order to achieve 2% profit in catfish farming, Critical Success Factor (CSF) market research, Key Performance Indicator (KPI) market report, Key Action (KA) is mouth to mouth and door to door to create leads, action implemented, we are waiting for our template of survey so that when we go to people and tell them about our project and what it does, it sells fish there must be a template of questions and put their names and file it as a survey to say we did one, two, three. Support needed, we need funding to be able to create standing points to demonstrate our processed and unprocessed products of fish, like walking in villages we will be having cut fish and a whole fish so that when we make key points, advertising the fish we will show them that finished product is like this, and our product before it is finished is like this so that we can be able to educate people about the things we are doing in our project. And another thing is branding, key performance indicators, we wrote business card, billboard and posters, key action was to get a graphic designer to design those things and obviously money to pay him to design these things. Action implemented so far we made business card, there are advertisement stickers that we made, just like with apples and vegetables that you buy from the shops, they put sticker to show which farm they come from to advertise your business. So far we made business cards and we made advertisement stickers. Support needed, we want more money to be able to spread all this things, billboard; we need money to make billboards to be able to advertise to people so that when people see them they will know it is our business. Another Critical Success Factor (CSF) radio, to advertise our business on radio and

social network, key performance is radio and social network. We have approached radio Bushbuckridge which is our local radio station and met with manager and she is fine with it. So she is waiting for us to schedule date to be able to see them to try to explain what is it that we are doing in the project to advertise to Bushbuckridge people what we are doing. Support needed, we need money and find time on their slot because we are not a Non- government Organization (NGO) we are business and they are also business, they need money for us to explain what we are doing to advertise our business. Another important thing social networks, we will need smart device for us to be able to capture photos, create networks, social networks, Facebook account, we can be able to take our important photo we capture from the project we can be able to post them on the networks, let's say iPod, pad any pad with a Microsoft office, more like a laptop or computer to be able to store those things, yes to be able to store our information and create social network on Facebook etc. we can be able to do it from our own device (Jubelly JB26)'.

Observations, Questions, Ideas, Opportunities (OQIO): Jubelly (JB) Project

Partner Hungweni Trading HT64 commented that the presentation was good. A question was asked finding out where the stickers were made. 'Can I ask, there is something when you want to sell something is wanted, where did you do it (Masibambisane MB11)'. The response was the presenter approached a graphic designer to design the stickers with the logo of the company and also chose a round shape.

'I went to the graphic designer and he designed it for me according to how I wanted the sticker, round shape, four corner shape, I went to the graphic designer, I gave him my company's logo and said logo of my company our stickers will be round, can you take this logo and put it in a round shape and after I went to Jetline printers and said I have a design, they designed for me and its round, can you take this design and print out as stickers and you just tick them (Jubelly JB26)'.

Another partner Gilmo, GM20 asked how they would advertise their fish. The response was going door to door, administering a questionnaire which would assist in creating leads and it was market in small magnitude. When funding was secured they would create standing points in malls and make people taste the fish, the way white people do.

'One of the things I mentioned we will go house to house for market research to create leads, it is when a person asks what is that I am doing, you tell someone one what I am doing, it means it creates leads, still it is marketing but at a smaller magnet. Money is the one that can make most things work. When you have money you can advertise and make people know your business. So we are still doing it on a small magnet like mouth to mouth. One of the things we want to make is to create the standing points where there is market, like stores because you can sell fish, white people's way of advertising something like wors or whatever

on the stores and saying taste it. Another thing we want to make let's say catfish we process on our own, open it and show them it is like this and put it at stages, if we have a budget ,we can cook small simple for them take in pieces and know what catfish is, it creates leads, they are going to tell someone else, and that person will tell another person and then they will come to the farm (Jubelly JB26)'.

Researcher explained about how the questionnaire would be administered in this community to build data on marketing. The presenter mentioned that the survey was essential for establishing what kind of fish they preferred and they would know which strategy to apply to change their behavior.

'Survey creates awareness for us to know what people are dealing with, and market within our community, are they fish people or what kind of people, how are we supposed to approach them to change tactics (Jubelly JB26)'.

Masibambisane (MB) Project: Action Monitoring

A presentation was made regarding the action implemented in this project. The partner mentioned that they have ponds that were prepared manually and one was holding fish. The water comes from the spring in the project and fish were never sold after farming with them for three years. They were excelling in poultry farming and they have people who buy the chickens. As for fish the partner mentioned that they lacked technical skills and shortage of water could be solved by drilling a borehole and by hiring the water surveyors.

'We have ponds that we prepared with our bare hands and they are 16 m, we have others that we also prepared but they are not properly done. And one of them has fish inside and can be two times that 16 m. That's where I can say our fish is good there. Water comes from the spring, we don't have water properly and we never sold any fish yet and I don't now marketing of fish well. One thing that we excel in is poultry farming and we are producing and selling well. We don't know fish very well we still need to improve technical skills. As we were discussing then I thought about it to say we still need to be trained on fish farming and the fish are not growing well. They are not growing well because we never sold any and for three years those fish are sitting in the ponds. We can only get lots of water from a borehole and survey the project to obtain perfect spot because it is water that we extremely need. I will not say a lot because I can see we are still behind, we are still growing (Masibambisane MB11)'.

Masibambisane (MB) Project: Observations, Questions, Ideas, Opportunities (OQIO) a question was asked to find out how the ponds were cleaned while water comes from a spring. 'I am having a question to say I understand that water is coming from the spring, so my question is I want to know how you clean your ponds while water is coming from the bottom (MT23)'. The response was the ponds were cleaned by draining the water out of the ponds for

irrigation. The pond is sealed with cement because initially they lined it with plastic and it failed.

'We clean the ponds by draining the water and we put a screen on the pipe, we have put a pipe at the bottom of the pond so that we can irrigate our vegetables because we also farm with vegetables. So we put a screen and drain out the water and we always remove also weeds growing round the pipe. We also put cement in one of the pond as well. We started with covering the pond with plastic and it was torn by the sun and we removed it and started to plaster it with cement (Masibambisane MB12).'

Researcher probed by asking what happened to the activity of finding a water driller. The partners mentioned that they costed R20, 000 and their cooperative although is made of 15 members they would not be in a position to raise this amount, they might ask for donation from their community or search for a sponsor.

'They costed us R20, 000 to make a borehole, and R20, 000 at our cooperative of 15 members we will not be able to contribute it, and it means we have to go out ask for donation from our community or get a sponsor to come and make the borehole for us (Masibambisane MB15).'

Another partner mentioned that it would not be easy to obtain a sponsor who would give funding free of charge. Instead partners would embark on a journey to search for funding from organizations such as Small Enterprise Development Agency (SEDA).

'I want to give advice, it is not easy to just ask for a sponsor and they give you because it is not Non-government Organization (NGO) there. I think you must quickly search for funding from government, to fund a borehole in your project. A person will not give you just free and they are always wants to receive something back, he will not invest his money free of charge unless you don't profit anything you. They must go to Small Enterprise Development Agency (SEDA) and other organizations to ask for funding maybe they will succeed (Mthaiza MT24).'

Another partner also mentioned that Department of Agriculture Forestry and Fisheries (DAFF) had application forms for a borehole installation for small scale farmers. Their project completed the application and they were on a waiting list and the procedure was to submit application forms this year and the department would put their project in the financial year for next year and it would be free of charge.

'And another thing Department of Agriculture, DAFF there are application forms I filled them last year, hmm government said any small scale farmer can fill the document, next year they put you in a new financial year, they put your company to do a borehole, it is free of charge. Agriculture was doing rounds last year to meet farmers and explain this, to say if you want a borehole how do you do it, you complete the application and submit it locally. We have filled in

the application last year, this year they were supposed to start to drill borehole for us but you know government's things are always slow but they drill the borehole free of charge (Jubelly JB26)'.

Another partner also alluded that most of the time government services were very slow and made an example of a project in their community assisted with a borehole but the activity was left abandoned although water was available but it was not completed.

'But government things are slow, there is another project where they came to drill and they stopped along the way, they didn't complete it, but they came to drill and they got water but they stopped along the way (Masibambisane MB15)'.

Action Monitoring: *Hungweni Trading (HT) Project:*

A presentation was made from *Hungweni Trading (HT) project* regarding preventing theft in the project. The partner begun by giving brief description of his project situated on 1.8 ha with one pond of 7 x 5 m and water was coming from a canal and the partner found it unnecessary to obtain water right license. A fence was constructed in the project and work force to have the right attitude and not steal the fish, the partner approached officials from Agriculture and also Agriculture Sector Education Training Authority (AgriSETA) for training and they were still on a planning stage. Employment contract for security guard was also drawn and the position not advertised due to lack of finances. Night light quotation was not implemented due to budget constraints.

'Goal is to prevent theft of the fish, we chose this one because the other opportunities are all there and the project is about 1.8 ha of farming vegetables. I am starting with fish farming now and I have one dam 7 x 5 m and I am taking water from the canal that is passing by, it means it is not necessary for me to have water rights because they say there are agrarian water rights for those who farm nearer to the river. There are Critical Success Factors (CSFs) to prevent theft of fish, I saw it necessary to have a proper fencing and even the workers must be trained on attitude so that they are not the ones who are stealing because a training like that, it is number 3 that those who steal must come from outside, we must have a security guard at night and if it possible put an alarm system and spotlight that shines at night. I have five Critical Success Factors (CSFs), so number one proper fencing, Key Performance Indicators (KPIs), we will obtain quotations for fencing and pay slips. Fence is being put in of 2.5 m and added to the one that was there which was 1.8 m. Support needed is, I have to have razor wire because the farm is big, even if I can put around the fish ponds only because I still want to add another four ponds. The one of training workforce to have a good attitude and not steal, I must obtain registered trainers from AgriSETA and also get division of Agriculture for aquaculture. I did that I met with Agriculture; they are still planning on how to assist me. I still need to have training manuals so that even though they are not there I can study on my

own. For watchman Key Performance Indicators (KPIs) is that I must have employment contract; I have drawn it, it is there, advertise a post, I didn't advertise because of budget. Alarm system; I was supposed to obtain quotations from security companies. They are not being installed because they are expensive and I have no budget for it yet. Night light also needs a quotation and they will give me proof that they have installed. I didn't implement this action due to budget constraints. So Critical Success Factors (CSFs) one, two, three it was because of budget constraints (Hungweni Trading HT64).

Observations, Questions, Ideas, Opportunities (OQIO): Hungweni Trading (HT) Project

Partner (MB16) complemented the presenter on a good presentation and asked the number of ponds he owned and if fish survived in the ponds. Partner responded by saying he had one pond that he used to utilize to offer farmers Agriculture Sector Education Training Authority (AgriSETA) training on Agriculture farming. His plan was to convert that into fish farming. The partner also explained the process of breeding catfish from his own understanding.

'I have one pond I still want to increase them and farm with catfish. I was teaching people Agriculture for AgriSETA and I want to change and stock fish. When you want to breed catfish, you inject them with a hormone, you sacrifice one fish and cut it and take pituitary gland and put in an injection and then inject somewhere and eggs become ripe quickly, and then you squeeze the eggs out and take the older catfish and remove sperms and mix with eggs. They will hatch and release small catfish up to thirty thousands and you must separate them according to their size and people can steal even the small ones and this is the reason why I want to talk about security (Hungweni Trading HT64).'

Result Assessment: Masibambisane (MB) Project

A presentation was given by the partner from MB project regarding the results achieved. The partner mentioned that they bought cement to plaster one pond to avoid water seepage. The pond is completed and they put in water and stocked the fish. Partner also mentioned that they managed to get contact details of the water surveyor and gave a quotation.

'For our project we once mentioned that we bought cement and we fixed our pond because we once put a plastic and that plastic cracked and water was leaking and we saw it proper to buy cement and plaster the pond on the inside and we put our fish and the fish are right and we have put in water. So we will continue asking who can assist us to buy more cement to fix the other ones. We have to also ask for a borehole because relying on the water from spring is not enough we need a borehole, we found someone who works with drilling the water and he promised to come and look and give us a quotation and another thing we want catfish because we have tilapia and is not growing (MB15).'

Achievement Stacker: Masibambisane (MB) Project

Other partners after listening to the presentation they had to note the achievements from the speaker. It was mentioned that the presenter achieved fixed pond and also found someone who specializes in water and also managed to obtain contact details.

'She said their pond was having plastic and it cracked and what they have achieved they managed to fix their pond until it was good and even water to say they went to someone who works with water and discussed with him and he gave them his number phone and they are waiting for him to come (Jubelly JB28).'

Result Assessment: Jubelly (JB) Project

The presentation from JB partners was conducted and they mentioned that they managed to go door to door to inform the community that they have catfish in their project. They managed to make a list of thirty people interested in buying their fish from the community and they filled in the questionnaire of market research.

'Our Critical Success Factor (CSF) is marketing research, key action is mouth to mouth and we managed to do it and our results we managed to inform the community that we have catfish and people were happy about the fish and it was about thirty people that we will be selling fish to and they managed to fill in the survey. So on support we want government to come and assist us to harvest fish to see how big they are so that people can come and buy them. Support is to be able to harvest the fish from our dam so that we can weigh them (Jubelly JB26).'

Achievement Stacker: Jubelly (JB) Project

Other partners gave feedback of the presentation made by the partner. They mentioned that the project achieved the one to be able to approach the community and inform them about fish sales. *'I think she achieved the one to be able to approach and inform people that she is selling the fish (MB15).'*

Result Assessment: Mthaiza (MT) Project:

The partner gave a presentation of the results achieved from MT project. The partner mentioned that they managed to approach stores that sell fish to compare prices and come up with a fixed price for their fish. Support they need was the stores to inform of any price change and the fish must be in a good quantity. The partner managed to approach Mpumalanga newspaper to advertise their fish.

'I went to the nearest supermarket to get the exact price and we asked to sell our fish we made sure that Spar and Shoprite they sell fish and we approached them and we found the exact price and which price do they charge. So for support that I need is to back to the nearest supermarket to find someone otherwise and inform him of the price changes and they said

they will be able to inform us on time. Then when we come on size within three to four months it would have grown and we will be able to sell. On quantity the results achieved was to make sure that the fish is in proper quantity so that when you sell to a person he must come back and say this fish of yours is not in a good quantity. When we come to advertisement I go straight to the results, station, hmm Mpumalanga news so that we can be able to say we are busy with this and that in or project and then to support that need (Mthaiza MT23)'.

Achievement Stacker: Mthaiza (MT) Project

The partners gave a report of what they heard the presenter has achieved and majority mentioned that he achieved approaching the market to look for fixed prices and also to know how much they weigh per kilogram selling.

'He achieved going to market to talk to them about how much he sell his fish and they also know how much they must weigh (Masibambisane MB15)'.

7.6.7. Creation and Synthesis Step

Black Hat: Masibambisane MB Project

Partners were requested to think about negative things that prevents them from obtaining funding. One partner mentioned lack of knowledge about the process of applying for funding. *'You find that sometimes we don't have the knowledge of how to get funding (Jubelly JB27)'.* Another partner added by mentioning that they do not where to knock and who to liaise with. *'For us not get funding was because we didn't know where to go and who to talk to (Masibambisane MB10)'.*

Another partner brought in a different perspective saying that funding in his area can be raised via car wash business and sometimes hosting beauty contest.

'Where I stay, we are able to get funding. I am having a business that I own of car wash where I stay. I am the owner of that car wash. We are able to hire women to be the ones that wash cars because when is ladies washing the car wash becomes full of clients, something like that. Another way to get funding, we normally host beauty contest and raise funds through entrance fees (Masibambisane MB13)'.

Yellow Hat: Masibambisane MB Project

The researcher requested partners to think about positive things funding can bring to their projects. One partner mentioned being to have a market to sell the products and be able to purchase other materials.

'We will be able to sell, marketing. You can be able to buy materials like pest control and you can be able to have market of fish (Jubelly JB27)'. Another partner mentioned being able to advertise their business. *'You can be able to advertise (Jubelly JB26)'.*

White Hat: Masibambisane MB Project

Partners were asked to give the fact about funding. Partner mentioned that funding will assist on having effective exit strategy of retiring temporary workers in their business. *'Funding is the one that will help the temporary workers who are already over sixty years, when they retire from Extended Public Works Programme (EPWP), it will be very good because you will be having funding, when they go out of there they will go into here. And when EPWP is giving young people those old ones will train the young ones, only if you can get funding (Jubelly JB27).'*

Red Hat: Masibambisane MB Project

Partners were requested to give emotional feelings or frustrations regarding funding. Partner expressed happiness knowing that goals will be reached. *'I feel good because I will be able to reach all my goals with the funding (Jubelly JB28).'* On the contrary another partner mentioned that she does not feel good if fish die due to lack of water and predation. *'Sometimes you don't feel good because when there is no water the fish dies; even birds are eating them, so it means if I obtain funding I will make nets so that the birds don't eat the fish (Jubelly JB27).'*

Green Hat: Masibambisane MB Project

Partners were asked to give ideas that can assist them in obtain funding. They mentioned having business plan and tax clearance will assist on obtain the funding.

'For you to get funding you must do business plan, everything, tax clearance and have them with you (Jubelly JB27).'

Another partner also added by mentioning tax clearance and business plan are required to get funding. *'You have to have tax clearance, business plan to be able to be funded, if you don't have a business plan you will not get anything (Masibambisane MB10).'*

It was also added that awareness campaign can also assist to raise capital in project. *'I still say the one for demonstrating to people and give them a taste, awareness campaign, and also fish and chips, we make them taste all of them (Jubelly JB27).'*

Blue Hat: Masibambisane MB Project

Partners were asked to give a summary of all the hats together in a paragraph. Partners managed to mention that for them to obtain funding they must meet all the requirements and also know the organizations that offer funding. *'For us to get the funding we must get the right information and the right places and we must know the requirements (Mthaiza MT23).'*

Profit Driver Tree in Catfish Farming Industry

The profit driver tree was developed and expanded by partners to focus on the selected goals. To realize profit, price and throughput should be increased and costs lowered. Throughput in the profit equation developed from beef industry was affected by growth, reproduction and mortalities; price was affected by management and costs were affected by marketing.

Marketing in catfish industry was broken down into products required to be fitted to market (i.e. formal or informal market); secure product off-takes; branding/packaging and advertising. To achieve improvement in genetics partners selected genetic selection improvement. Nutrition was affected by costly pellets; feeding with alternative food; feeding with expired pellets and poor storage facilities

Management was broken down into operational such as shortage of technical skills, lack of water, poor communication, poor record keeping skills, poor performing indoor system and no electricity/ high costs. Management was broken down into Human Resource and Development (HR & D) such as lack of Recirculating Aquaculture System (RAS) expertise/ consultants/; lack of aquaculture trainers and lack of dedicated aquaculture extension support. Management was in the form of quality referring to accredited processing facilities and product handling. Management was also in the form of financial management such as lack of funding and some partners lacked the skills to expropriate available funding (seeFigure 7.68).

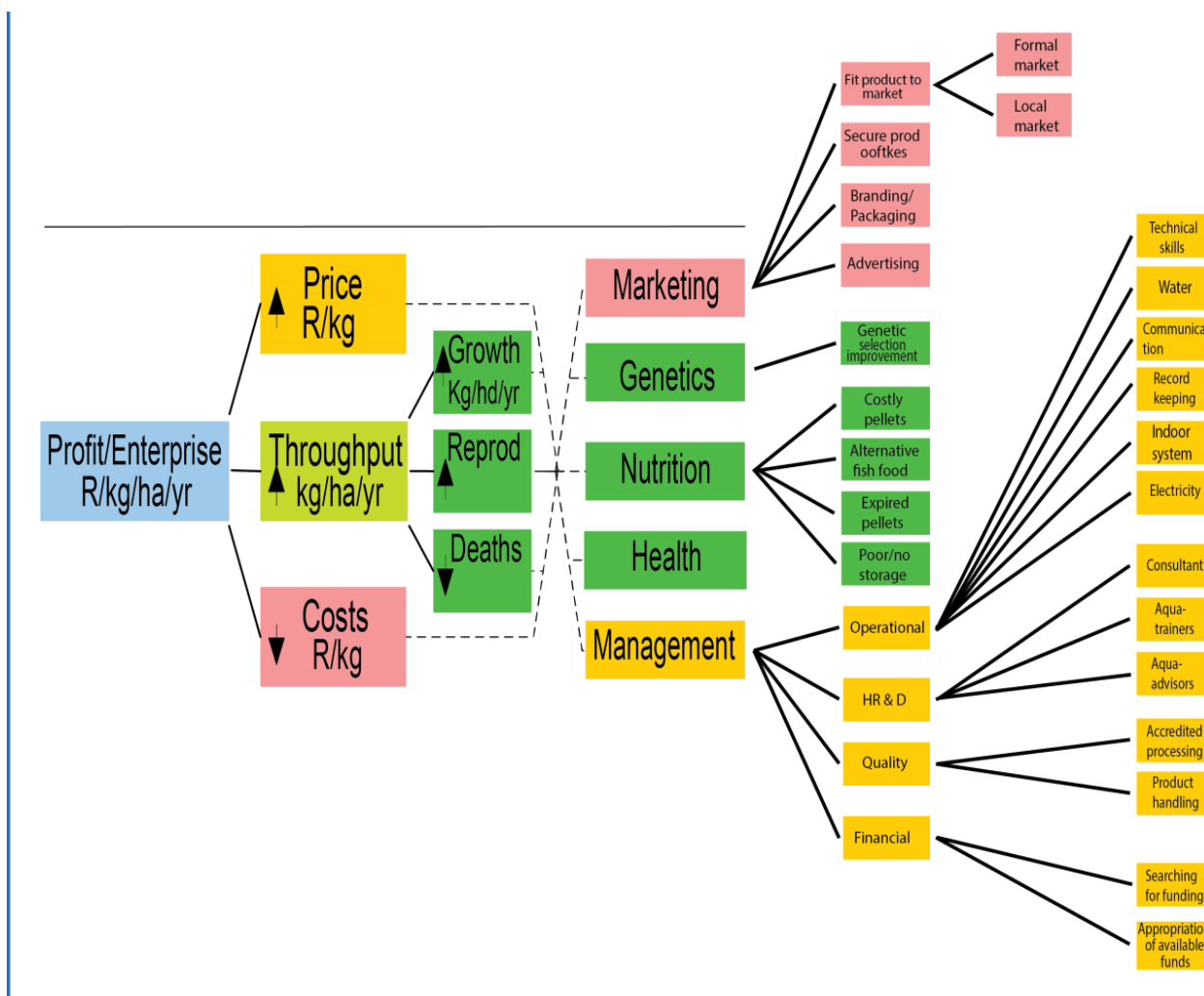


Figure 7.68. Profit Driver Tree displaying high impact strategy for improving profit in the beef industry further expanded into catfish industry

7.7. Tools Assessment Outcomes

Specific, Measurable, Achievable, Relevant, Targeted and Time-framed (SMARTT) Goal Tool Assessment for Cycle 1

Partners were asked if they liked SMARTT goal tool and they all highly liked the tool with the first highest mean score 9 and highest median score 10. The tool elicited 87% of partners to have specific goal and also know the direction in which it would be achieved.

'We are learning that next time if we have something that we want to discuss at the farm we must have an idea, and then we decide which direction we are going take, it is teaching us that when you have an idea and you want to make money and the idea is not specific, so we have to say we want to make money, how are we going to make it (Tladinga TD05).'

Ease was scored second highest mean 8 and highest median score 10. Thinking enhanced scored first highest mean 9 and highest median 10. Time obtained fourth highest mean score 6 and first highest median score 9. Cost of not doing obtained second highest mean 8 and first highest median 9. Partners found value in the tool with second highest mean 8 and

first highest median 9. Motivation obtained first highest mean and median score 9 (Figure 7.69).

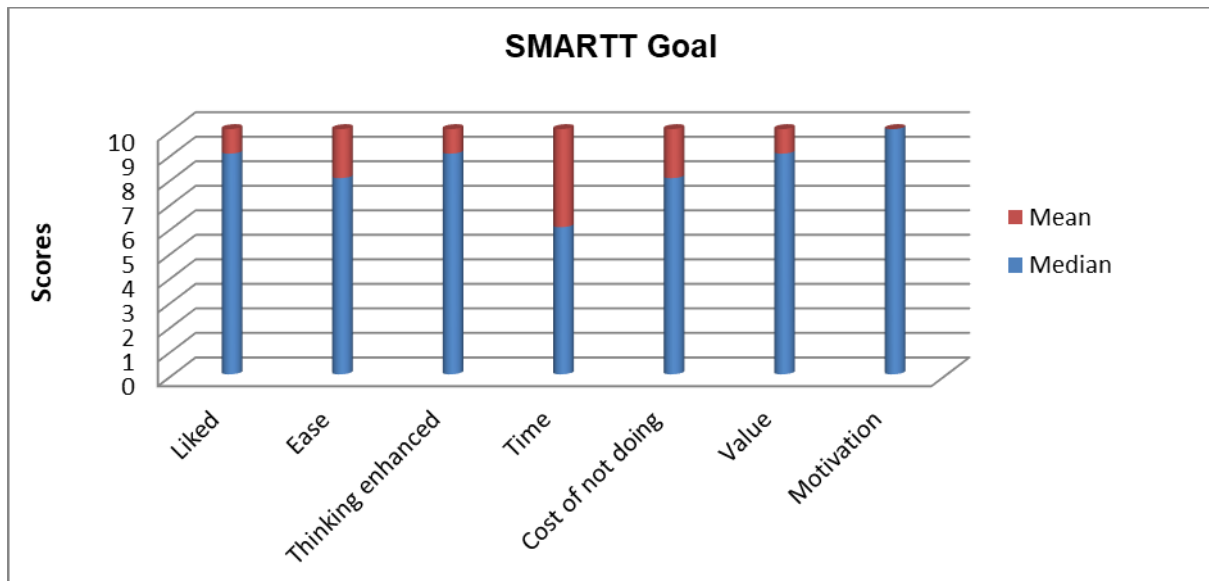


Figure 7.69. Scores of SMARTT goal tool assessment

Assessment of Brainstorming Tool

Partners were asked to score (1=low; 10=high) the variables liked; ease of use; thinking enhanced; time; cost of not doing; value and motivation. Liked and ease of use scored the first highest mean score of 9 and the highest median of 10 from 80% of partners. Thinking enhanced also scored the first highest mean 9 and median of 10. Time scored the middle mean score of 4 and median of 5. Cost of not doing scored the second highest mean 8 and a mean of 10. Value scored a mean 9 and median 10 and motivation scored highest mean 10 and median 10 (Figure 7.70).

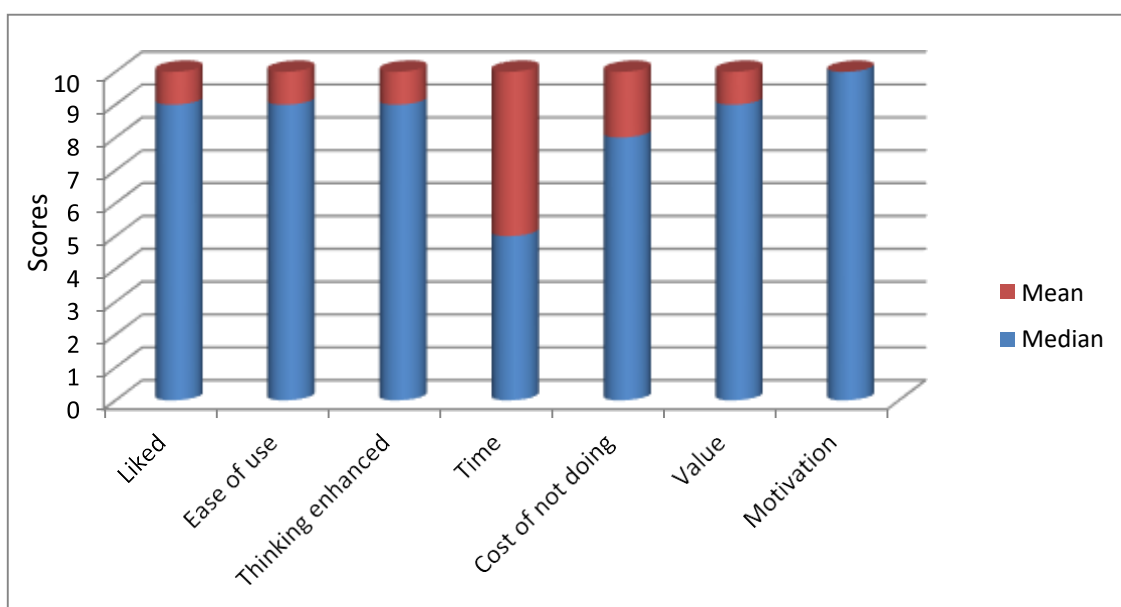


Figure 7.70. Brainstorming tool assessment scores for all partners in cycle 1
Impact Analysis Tool Assessment

Impact and Influence Tool Assessment

Partners in all the businesses were also asked to assess out of ten the value of impact and influence tool in supporting them in the achievement of their outcomes. The impact and influence tool showed that partners liked the tool and it had first high mean and median value 9. Ease of use had highest median and mean 8. Thinking enhanced scored second highest median and mean 8. It took partners a medium time with fourth highest mean and median 6 to apply the tool. Cost of not doing the tool was also high with second highest mean 8 and first highest median 9. The tool had high value, with first highest mean and median 9 and partners were highly motivated to apply the tool again with the first highest mean 9 and highest median 10 as displayed in Figure 7.71.

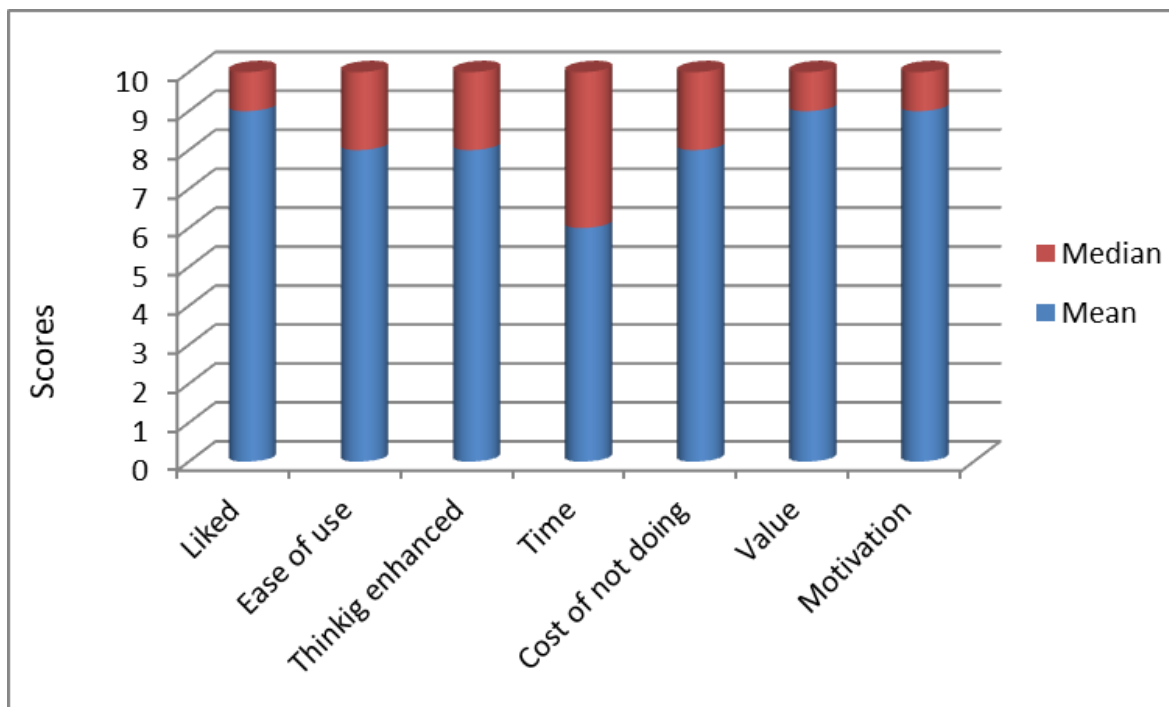


Figure 7.71. Impact and Influence tool assessment scores for all partners in cycle 1

Eight Dimension Bar Graph Tool

The eight-dimension bar graph variable liked was scored first highest mean and median 9. Ease was scored second highest mean and median 8. Partners also indicated that the tool enhanced their thinking with the second highest mean and median 8. It took partners medium time to apply the tool with fifth highest mean and median 5. Cost of not doing the tool was high with second highest mean and median scoring 8. The value of the tool was high first highest mean 9 and second highest median 8. Motivation of partners to use the tool in future was high with mean 9 and medium 10 (Figure 7.72).

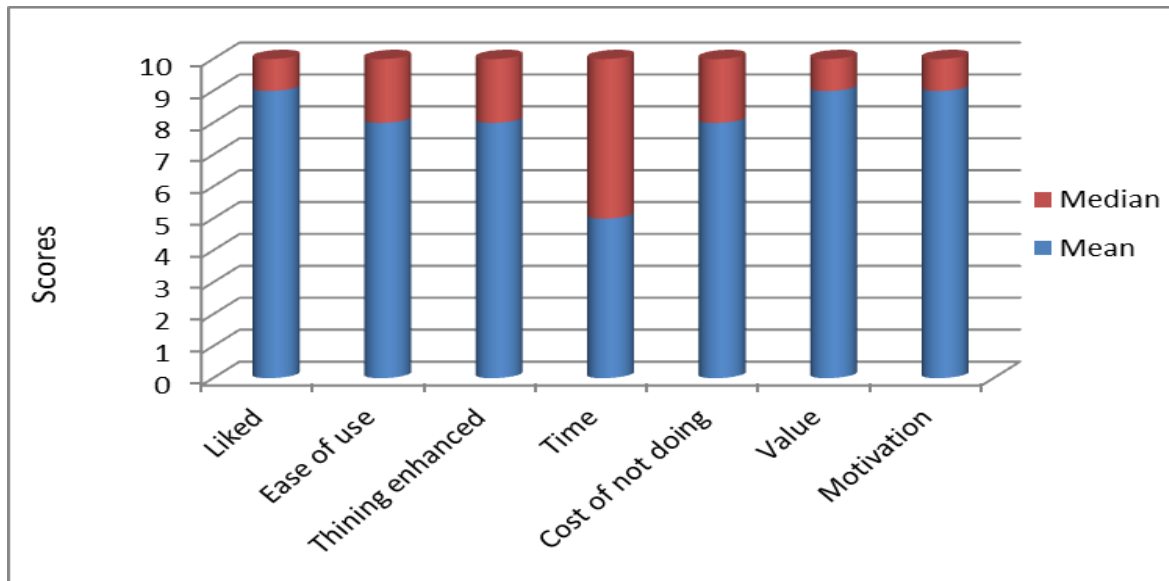


Figure 7.72. Eight Dimension Bar Graph Tool assessment scores for all partners in cycle 1

Eight Dimension Pinwheel Version Tool Assessment

Partners liked the pinwheel version tool with the first highest mean 9 and highest median 10. Ease of use obtained the first highest mean and median 9. The tool enhanced the partners thinking with first highest mean and median 9. It took partners a longer time to apply the tool, with fourth highest mean 6 and third highest median 7. Cost of not doing this tool was high with second highest mean 8 and first highest median 9. The value of the tool was high with the first highest mean and median 9. Motivation was high to apply the tool again with first highest mean 9 and highest median 10 (see Figure 7.73).

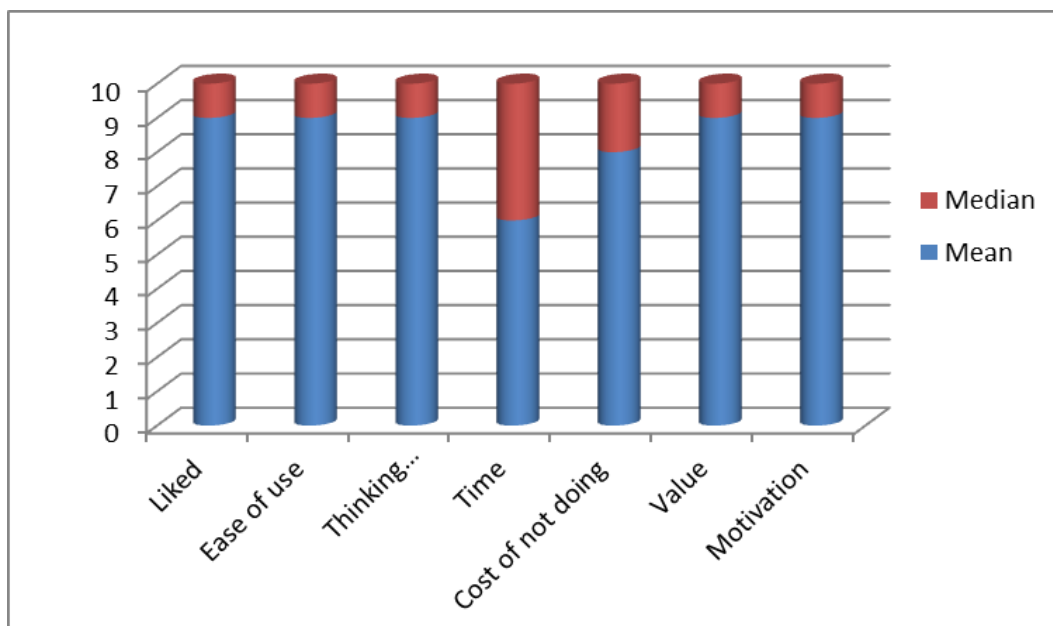


Figure 7.73. Eight Dimension Pinwheel Version Tool assessment scores for all partners in cycle 1

Action Design Tool Assessment

Liked obtained the first highest score of 9 and a median of 9. Ease of use achieved second highest mean 8 and median 8. The tool enhanced the thinking of partners and achieved first highest score of mean 9 and median 9. Time it took partners to apply the tool achieved a middle score of 6. Cost of not doing the tool obtained second highest mean of 8 and median of 8. Value achieved second highest mean score of 8 and a median of 8. Motivation achieved the first highest score of 9 and median of 9 (see Figure 7.74).

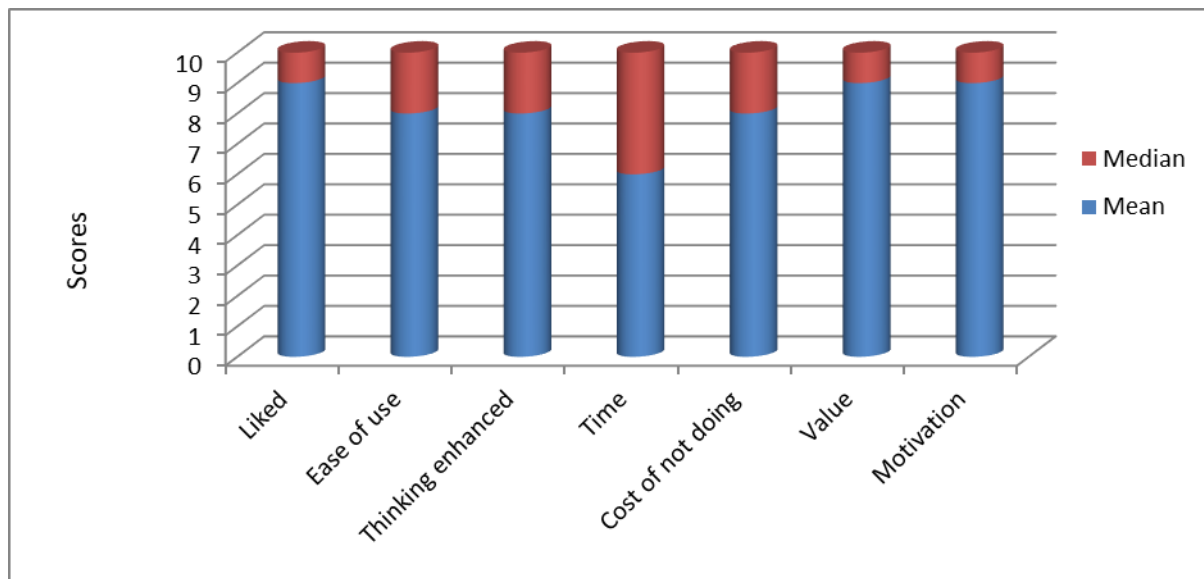


Figure 7.74. Action Design Tool assessment scores for all partners in cycle 1

Performance Assessment Tool

Partners were asked to evaluate the Performance Assessment Tool on a scale from 1-10. Liked achieved the second highest mean score of 8 and median of 9. Ease of use achieved the second highest score of 8 for mean and first highest score 9 for median. Thinking enhanced achieved first highest mean score 9 and median score of also 9. Time to implement achieved a mean score of 5 and a median score of 5. Cost of not doing obtained a mean score of 8 and a median score of 8. Value obtained first highest score 9 and highest median score of 10. Motivation obtained the highest mean score 10 and median score 10 (Figure 7.75).

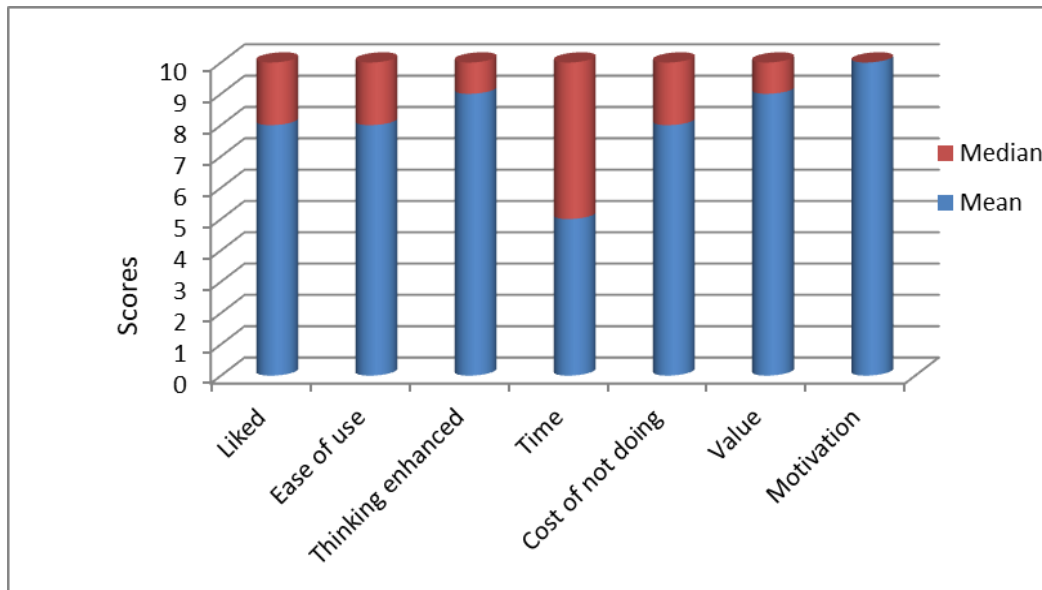


Figure 7.75. Scores for evaluation of Performance Assessment step for all projects cycle 1

Achievement Stacker Tool Assessment

Partners also assessed the Achievement Stacker Tool on a scale from 1 - 10. Like achieved the first highest mean score 9 and median score 9. Ease of use obtained a score of 8 for mean and 9 median score. Thinking enhanced achieved a mean score of 8 and median 9. Time achieved a mean score 5 and median score 4. Cost of not doing achieved a mean score 8 and median score 9. Value obtained a mean score of 9 and a median score of 10. Motivation scored a mean score 9 and a median score of 10 (Figure 7.76).

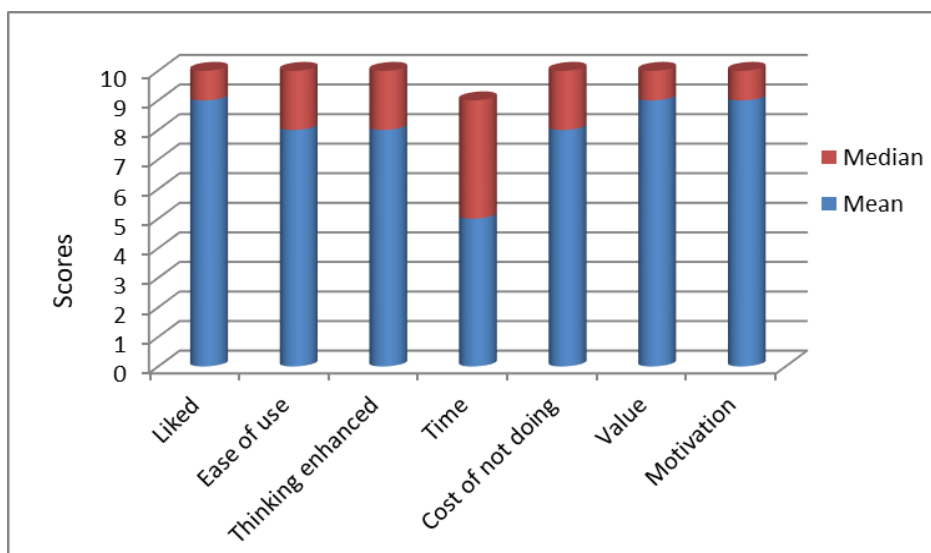


Figure 7.76. Scores for evaluation of achievement stacker step for all projects cycle 1

Creation and Synthesis Assessment

Partners evaluated the Six Thinking Hat Tool on a scale from 1 - 10. Liked achieved the highest mean score of 10 and the highest median score of 10. Ease of use achieved the second highest mean score of 8 and the first highest median score of 9. Thinking enhanced achieved the first highest score of 9 for both the mean and the median. The length of time to apply the tool achieved the fourth highest mean score of 6 and the third highest median score of 7. Cost of not doing the tool achieved the first highest score of 9 for both the mean and the median. Value achieved the first score of 9 for both the mean and the median. Motivation to apply the tool again was extremely high with a score of 10 for both mean and median (Figure 7.77).

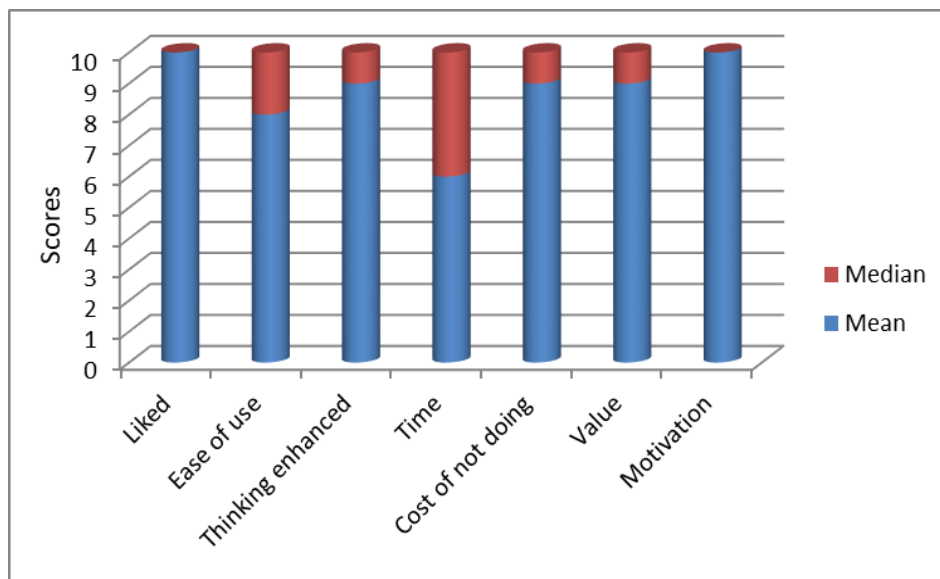


Figure 7.77. Scores for Six Thinking Hat Tool Assessment

CHAPTER 8: Discussion

8.1. Descriptive Statics

There were 30 projects that agreed and were interested in what the study had to offer, achieving improvement and innovation in their businesses that impacted on profit. Only one commercial project was actively farming with catfish and 29 were subsistence farmers. This number of projects increased from the 10 catfish project registered in the database from DAFF, where 1 project was actively farming at commercial level (Britz *et al.*, 2009; DAFF, 2016b). Inaccurate, incomplete and outdated database were the challenges that were also cautioned to researchers in the work of Edwards *et al.* (2007). The need for reliable aquaculture production statistics remains dire in South Africa and reliable statistics are critical for the establishment and growth of the sector (Britz *et al.*, 2009). There is no obligation for freshwater producers to report on production and performance of aquaculture cannot be accurately gauged (Britz, 2014). This study managed to provide additional accurate information of the number of catfish farming project in South Africa.

Enterprise Development

The study revealed that the types of projects involved were sole traders and cooperatives and few closed cooperation, Pty and trusts. The Aquaculture Institute of South Africa (AISA) benchmark survey in 2009 also found that in freshwater aquaculture the majority of registered businesses were sole traders and closed cooperation and few cooperatives (Britz *et al.*, 2009). The study found that there was emergent of cooperatives in the catfish farming aquaculture sector. The projects operated for less than five years. This agreed with report given that most freshwater aquaculture businesses were fairly young and had operated less than 5 years in South Africa (Britz *et al.*, 2009, AgriSETA, 2020).

There was the highest number of men than women involved in the study. Gray (2013) also worked with more males and a few females in her CI & I study. AgriSETA (2020) also reported more males than female in aquaculture. Since fish farming is male dominated, Boto *et al.* (2013) encouraged participation of women in aquaculture. However, participation of youth, women and black people in the industry was identified as a concern in South Africa (Laboratory Report, 2014). Olasunkanmi (2012) further reiterated that women were highly motivated and adapted faster to newly introduced technology and the notion has to change were fish farming was observed males been more actively involved than females (Mbozi, 1991). The results showed that the mean age group was between 51 - 60 years and older and young people were a few in the study. The results were concurrent with the study that found average fish farmer age to be 43 in Egypt (El-Naggar *et al.*, 2010); 44 in Nigeria (Abiona *et al.*, 2013); 53 in Guangdong and 50 in Zhejiang China (Jia *et al.*, 2016). Yunusa (1999) reported that the age group 31 - 50 was self-driven, innovative and adaptive individuals in fish farming. (Olasunkanmi *et al.*, 2012) also alleged that this age group was still active and more productive fish farmers in Nigeria. Therefore, majority of participants aged between (51- 60) years in this study was not alarming.

Participants held primary education and some matriculated and others had tertiary education. Olasunkanmi (2012) also determined that the majority of fish growers in Nigeria had tertiary education, 54% completed matric and 11% had postgraduate degree in South Africa (Britz *et al.*, 2009). Good education was a basic requirement in fish farming to ignite innovation and keep accurate record at project level (Olasunkanmi *et al.*, 2012). In South Africa, government encourages modules in aquaculture to be offered in both basic and higher education sectors (AgriSETA, 2020).

Majority of the projects were utilizing borehole as the main source of water, followed by streams/river/dam and a few used municipal and stream. Water that was available on site was not often free of charge and most projects neglected this critical part of planning for its water use and obtain water permissions (Rouhani, 2010).

The type of production systems owned by participants was ponds and Recirculating Aquaculture System (RAS), and a few farmed inside concrete ponds. People who engaged in aquaculture mostly utilized either high-tech indoor system to simple-systems such as family ponds responsible for 60% of aquaculture production in 2008 globally (Boto *et al.*, 2013). If ponds were not properly planned, then farmers would not improve productivity (AgriSETA, 2020).

Participants were involved in mixing farming catfish/tilapia in their majority, followed by catfish only. A few had catfish, bass, tilapia and catfish, carp and tilapia. Majority did not indicate their reason for polyculture. However, a few projects indicated that customers preferred those types of fish species, others indicated that the fish came into the ponds through floods and while others reported to improve income generation streams. Culturing of tilapia and catfish species in the same space with different diet and habitat was a common practice in aquaculture and maximize production (Rouhani, 2010). Consumption of wild caught species has shifted enormously to aquaculture produce sold at an affordable price and it was an important source of animal proteins to many Africans (Boto *et al.*, 2013). Polyculture has the potential to maximize production in freshwater aquaculture; however, Britz (2014) encouraged this for pond farming rather than indoor systems. Tilapia farmers in the study were willing to switch to catfish or to be involved in polyculture (tilapia/catfish farming). After lot of research, a business in Eastern Cape switched from tilapia to catfish given its attractive benefits to increase production and generate income (Hancock, 2015).

The majority of interested projects were community project/ cooperatives types, followed by small-scale commercial smallholding with <R5 million turn-over per annum. The results were similar with those reported by Britz *et al.* (2009) that enterprises of aquaculture were subsistence farmers with a revenue of less than R5 million. AgriSETA (2020) articulated that 1/3 of aquaculture farmers were regarded as under resourced and cooperatives were viable with no potential of converting to commercial level.

In this study majority of the businesses sourced funding privately, government assistance

and loans. 75% of fish farmers in Nigeria were capable to increase capital from their own investments and others qualified for personal credits (Olasunkanmi *et al.*, 2010). The results were supported by a report that indicated fish farmers should join existing aquaculture associations to strengthen their access to funding (Olasunkanmi, 2012). Access to funding was found to be the major obstacle to growth of aquaculture in South Africa (Britz *et al.* 2009, AgriSETA, 2020).

Most of the businesses in the study were involved in the grow-out while a few were involved in other business activities such as packaging, processing, distribution, spawning and fry rearing. Most fish producers were operating hatcheries, raising fry or fingerlings in benchmarking survey (Britz *et al.*, 2009).

Most of the projects in the study were operating under 10% capacity, others were between 40-60% and only one project was at 100% capacity. At least 51% aquaculture businesses in South Africa were operating below 50% capacity (Britz *et al.*, 2009), supporting that aquaculture was still a young industry (Britz *et al.*, 2009; AgriSETA, 2020).

The market channels used by majority of the businesses in the study were direct to consumers, followed by supermarkets and restaurants, hotels and wholesalers. In Britz *et al.* (2009), the most market channel used was wholesalers with 26% sold direct to consumers. The type of fishes sold was mostly live or whole freshly killed, some projects were involved in some of value adding and processing. There were some projects that did not sell fish before. Fish were also sold live or freshly killed in 2008 (Britz *et al.*, 2009). Freshwater fish has never made it to the formal outlet shelves; consumption was limited to subsistence informal sales (McCafferty *et al.*, 2012). However, (Lombardi and Anderson, 2008) found that in Germany, African catfish was mostly purchased in a fillet form at a larger size of between 0.5-1kg fish (fresh and frozen).

Most of the projects determined product pricing on their own and others used a method of negotiating with the buyer during sales. Few projects used market price and estimation by head to determine the price of the fish. However, South African subsistence farmers have small power to bargain their products and often compete against organized marketing organizations and are forced to search for external marketing opportunities (Boto *et al.*, 2013). Improvement of bargaining power was hindered by fisherman not being able to formalize themselves (Omwega, 2006). The constraints were heavy on entry of small businesses into aquaculture in South Africa and small businesses were the backbone of establishment and growth of the sector (Britz *et al.*, 2009).

Majority of the businesses did not take marketing activities to increase sales and there were others that took commercial market activities. Markets and foods did not differ significantly ($P>0.05$) between the 30 projects. Marketing activities were door to door, street vending and commercial marketing. Other activities were done less frequently such as value adding, public gathering and local marketing. Consumers were not willing to purchase fish product at

a price that covered production costs and the fish had a negative image (Britz, 2014), commercial businesses secured off-takes of product to the formal market (Hancock, 2015). Majority of the projects in the study indicated that government did not play any role in linking them to markets; however, others did agree that government participated in linking them to markets. The type of role played by government was providing the projects with fish pellets; others indicated construction of processing plant, a few indicated training via workshops and linking them to feeding school programmes. Olasunkanmi (2012) also found the most significant problem was the cost of feed which made 66.7% of total aquaculture production. In the current study freshwater aquaculture catfish production created 37 permanent jobs in 2016, which reduced to 10 in 2015 and slightly increased to 12 in both 2013 and 2012. Majority of the workers were middle service, semi-skilled and unskilled mainly black and colored. However, there were also a few professional skilled and unskilled Whites and Indians. Temporary work was high in 2015 with 45 jobs created, followed by 41 in 2016, 29 in 2013 and 32 in 2012. Majority of the workers were semi-skilled and unskilled mainly black and only one was Indian in 2016. Professional skills in aquaculture were dominated by whites, while semi-skilled and unskilled were blacks between 2005-2008 (Britz *et al.*, 2009). AgriSETA (2020) highlighted that issue of compliance to food safety standards was gaining momentum in aquaculture recently than in the past. However, aquaculture jobs were dominated by black people followed by colored (AgriSETA, 2020). This was further added that in 2014 aquaculture created 15 000 direct and full time jobs and this were quality jobs that improved livelihoods in rural communities (Laboratory Report, 2014).

8.2. Focus

There is scanty of literature of CI & I in aquaculture, however the results were discussed. Similar themes on draft and SMARTT goal from all the participants were grouped together, counted and percentages were determined. The results showed that 87% of participants reported their draft goal as to create viable and sustainable businesses that generated income and created employment. 1% reported improving fish growth to meet demand and supply and also additional 1% reported access to market, permits and obtaining funding transparency. These types of goals were regarded as “un - SMARTT” and required further action. Un - SMARTT goals were described as “make money from our farm” and “buy less feed” (Department of Primary Industries and Regional Development, 2017). Furthermore, un-SMARTT goal was highlighted as “to enhance the well-being of rural families” in Timms and Clark (2014). The aspirations of partners was of essence because aquaculture was becoming rapidly leading animal production, outpacing beef and buffalo production and currently at par with poultry production (Human, 2019). FAO (2018) further indicated an enormous growth in aquaculture in 2014 offering fish for human consumption. The South African government also prioritized the development and growth of aquaculture due to its potential of contributing to national food supply and boosting economic growth (Britz, 2014).

Partners applied SMARTT goal tool and the results showed that specific was articulated as generating income and running profitable businesses, improving aquaculture technical skills, access to import permits and job creation. Here partners did not indicate in which area they wanted to generate income and improve skills. Several examples of specific were reported as the goal applied to canola operations and not the other crops (Department of Primary Industries and Regional Development, 2017), coastal provinces, farmers with beef herd and their target capacity (Timms and Clark, 2014). Australian agricultural research economists also found it difficult to articulate SMARTT goal during CI & I application (Griffith and Mullen, 2016).

In measurable, most of the partners indicated they could measure jobs, income, skills, obtaining permits, having fully functional systems and building ponds with brick wall. Others reported that gross margins and amount of hay fed could be measured (Department of Primary Industries and Regional Development, 2017), while number of farmers, profit and increase in capacity were all measurable (Timms and Clark, 2014).

In achievable, partners found their goals to be within reach and reasonable. Partners with commercial background indicated that their financial model was the one that forecasted that their goal was achievable. Others indicated that their goal was within the capacity and scope of the company. However, there was one group that found it challenging to articulate achievable because they have not sold any fish yet. It was key for people to think and indicate if their goals would be within reach to be able to know what to expect (Timms and Clark, 2014) and know exactly what their aspirations were before action taking (Department of Primary Industries and Regional Development, 2017).

In relevant, the results showed that all partners indicated that there was high demand of fish in communities and it improved lives due to its nutritional benefits. The results were in agreement with reports that indicated that aquaculture products had high nutritional benefits, improved livelihoods and created employment in South Africa (AgriSETA, 2020; Laboratory Report, 2014). Another important element to consider was that most citizens and indigenous communities in the country do not consume much fish (Britz, 2014). Most of the household budget (30%) was spent on red meat, compared to only 4% on fish (Yakob *et al.*, 2006). Department of Primary Industries and Regional Development (2017) expressed relevant as gross margins contributes to improving profit. (Timms and Clark, 2014) indicated relevant as a need to improve well-being of rural families. One project with commercial background indicated that their goal was relevant because if their business was not sustainable then there would be no development. These partners were having a lot of experience in the field of aquaculture and their thinking was highly ordered and effective because they had better heuristics than novices (Plsek, 1997 cite Gray 2013). Heuristics were “rule of thumb derived from experience” (Gray, 2013). Some partners found it difficult to express this part and left the

space blank.

Targeted, majority of partners indicated 2% profit and only one with commercial background indicated 5%. One partner indicated that his target was to reach previous level of production before production was stopped by land claim. Time-frame was within 12 months and one project placed an ambitious time of 9 months. (Timms and Clark, 2014) indicated 20% of farmers and 5% profit were the targets and 5% increase was the target (Department of Primary Industries and Regional Development, 2017).

The SMARTT goal, majority of partners had a focus of improving profit and making sustainable businesses. Partners in the study of Gray (2013) described their focus on increasing profit, business sustainability and develop livelihoods. Using focus was critical to ensure a better appreciation of people's existing conditions since people were often overwhelmed by too many things happening in their lives (Gray, 2013, Timms and Clark, 2014). Others indicated improvement of technical skills as a focus; others job creation and upgrade of the aquaculture indoor systems. (Rouhani, 2010) cautioned that fish farmers have to possess more skills compared to other sectors to succeed, they must be skilled in construction, fixing equipments, fixing water pumps and fish harvesting equipments, fish husbandry, understand fish biology, manage an organization, manage staff recruitment process and market the end produce. AgriSETA (2020) also emphasized that without correct planning and focused interventions the small scale farmers would continue to struggle. Having a focus would assist people in concentrating on things that would make a real difference, it would be clear what needs to be achieved, when would it be achieved and how would outcomes be measured (Timms and Clark, 2014). When engaging with other people, SMARTT goal made it easier for everyone to be clear about what needs to be achieved and stay on track to achieve it (Department of Primary Industries and Regional Development, 2017).

The results showed that 87% of partners liked the SMARTT goal tool; partners mentioned that the tool stimulated their minds and assisted them to have a focus or a goal. Partners found this tool easy to apply and it took them middle time to apply the tool. The cost of not doing was also high and partners found value in the tool. Partners were highly motivated to apply the tool again. In Gray (2013), 83% partners found the tool very easy to use, however indicated a number of constraints such as, it made partners to think; to be accountable; required time and effort to practice; it required a mentor; and partners also indicated they would use the tool again. Engle (2010) emphasizes the importance of developing clear and specific goals from the start of the business as very significant to focus thinking and action in order to meet targets and goals. Griffith and Mullen (2016) emphasized that "a clear, shared and agreed focus can save time, effort, money and other resources".

8.3. Situation Analysis

The SMARTT goals for all partners were developed in the previous step of focus and now brainstorming tool was used to generate ideas. Brainstorming was invented by Osborn (1938) famously known as the father of brainstorming. It assisted groups of people to quickly come up with ideas and opportunities to achieve the goal (Osborn, 1953).

The word *market* was expressed by 93% of partners as the current situation in their businesses. Partners used the phrase market and product simultaneously as to ensure *market liaison to fit product into market (KC41)*, and also reported secured market for every kilogram of fish catfish produced at a secured price. Others expressed market as lack of access to market; however, some reported having a secured local community market for catfish. This agreed with what Water Research Commission (WRC) reported, indicating that fish placed in a sack / bag was sold within 20 minutes at the road-side in Limpopo (Berold, 2005). DAFF (2012) disagreed as they indicated that lack of marketing services, marketing structures and market penetration were threatening aquaculture development. Lack of market access remains a challenge in the sector in South Africa (AgriSETA, 2020).

The results also showed that 70% of partners articulated *water* a lot of times in the study. The current situation was that partners wanted to ensure sufficient quality and quantity of water supply that met standard species requirements during testing to ensure business growth. Other partners using river water as a source of water supply, experienced high mortalities due to lack of sufficient water during drought season. Others lacked information regarding type of water suitable to raise catfish. Others indicated that their fish lived in dirty water that was not exchanging. Others lacked water access entirely in their projects while others indicated that their water was shut down due to high unpaid water bill from municipality. Others had poor water quality in their indoor production systems. DAFF (2012) also revealed that the industry of aquaculture was limited by lack of access to suitable water quality and quantity for freshwater aquaculture amongst others. Therefore, access to water was critical to running a viable business. AgriSETA (2020) also reported that drought had significant impact on South African aquaculture.

Equipments were reported by 13% of partners and it was reported as lack of harvesting equipments. Engle (2010) also indicated that capital to purchase equipment was needed when initiating a business in aquaculture.

Electricity was also reported by 13% of the partners. Lack of electricity was indicated as a current constraint and some businesses also reported lack of solar panels to keep the power on. Running indoor system required high capital to ensure optimal fish growth (Laboratory Report, 2014) and although installing solar was seen as sustainable intervention from government, constant maintenance and management was lacking. Other partners failed to indicate lack of electricity in the study, which was observed by the researcher during project site-visit. This was a critical finding. Failing to remember farming activities was evident in

beef industry where farmers were seen to be prioritizing other lifestyle activities over farming in South Africa (Nengovhela, 2010).

Training was mentioned by 10% of the partners, aquaculture technical skills was lacking in this study. Lack of aquaculture technical skills was reported as a hazard to the growth of aquaculture in South Africa (DAFF, 2012; 2014; 2016a). Having one commercial catfish system in South Africa that assisted with training remained a key issue and was not capable to capacitate fish farmers across the country (Laboratory Report, 2014). Lack of technical skills was also obvious in beef sector in South Africa as a major constraint and very frustrating for farmers and impacted on production (Nengovhela, 2010). The need to capacitate local, community enterprises and cooperatives was important to improve the existing gap between rural and urban economies (AgriSETA, 2020).

Lack of *project management* skills was identified by partners in the study and it was also reported as a constraint by AgriSETA. Lack of *security* and poor *fish growth* caused by poor water quality were also identified in the study. The Laboratory Report indicated that local catfish suffered from slow growth due to low Food Conversion Ratio (Laboratory Report, 2014). However, Ter Morshuizen (2014) painted a different picture that catfish performed well in high densities and achieved better Food Conversion Ratio in their business.

Government *support* and *system performance* were also eluded by 7% partners as constraints. Poor government understanding and support was amongst the obstacles hindering growth of aquaculture (DAFF, 2012). AgriSETA (2020) also eluded that, extension support were not well vest in aquaculture and were often rendering unreliable advice to under resourced farmers yet expecting successful business turnarounds.

Lack of *reliable and cost effective feed* supply also emerged from the study, however some partners indicated that they were feeding catfish expired feed due to feed staying for longer in store rooms. Indeed, lack of local quality feed constrained development in aquaculture (DAFF, 2012) and was also quite common in beef sector (Nengovhela, 2010).

Hatchery for fingerling supply was reported as a constraint by partners. A base-line survey conducted in South Africa had recommended that projects should be designed in the correct manner; farmers should have access to fingerlings at an affordable rate and best government extension support should be available (Berold, 2005; Britz *et al.*, 2009). This report conferred troubleshooting responsibility of fish farming solely in the hands of extension, and was quite about the farmers (Berold, 2005). However, Griffith *et al* (2008a) cautioned that extension improvement methods in animal production failed to make profit, retaining them with less likely to achieve improvements and innovations. This was contrary to the principle of CI & I alluding that everyone could be innovate (Clark *et al.*, 2008a).

Other phrases mentioned only once were lack of *funding* and however Laboratory Report (2014) emphasized that difficulty in access to funding was attributed by poor track record of catfish farming and it was also unpopular. DAFF (2012) agreed that accessibility of the

financial sector and poor financial support services were amongst the many obstacles in aquaculture. Lack of *information* on the growth of catfish, *permit* to import catfish also emerged from the study. Fish farmers were required to have an import permit to import aquaculture products (Aquaculture Development Bill, 2018). Even in South African beef industry, farmers experienced hardships to obtain permits to retain cattle in their farms (Nengovhela, 2010). Level of financial knowledge was mostly inadequate as they could not in many case create or put together or accumulate savings, lack of productivity and financial planning necessary in effective farm management, lack of drive towards self-sufficiency mostly in grant acquisition, appropriation and subsequent settlement of such resources (Chang *et al.*, 2013).

The results also showed that cost of distribution had to be cost effective so that the catfish product was not too expensive. Laboratory Report (2014) also highlighted that high fish feed cost makes cost of production to be too high to remain competitive.

The above mentioned situations from the catfish projects were converted into opportunities in order to refrain from being misunderstood into being critiquing the sector. Even CI & I applied in a group of economist research group in Australia converted brainstormed situations into opportunities to avoid the perception of being viewed as critical to their industry (Griffith and Mullen, 2016). The opportunities in this study were at practice level. Practice level focus was defined as the view of the detailed activities involved in presenting a particular meal in a restaurant (Timms and Clark, 2014). These types of issues require 'specific-project approaches'. It was recommended that mechanisms that addressed specific project issues should be established in order to increase production of the sector. The research must be locally relevant resulting in globally competitive industry (Laboratory Report, 2014).

Brainstorming Tool Assessment

The outcomes of the study indicated that 80% of partners liked the brainstorming tool; they found it easy to use; it enhanced their thinking; time was in the middle; cost not doing was high; value was high and motivation of practicing the tool again was the highest. It was the first time partners applied this type of a tool. Partners did not report the qualitative results to motivate their scores. Similarly, partners found brainstorming easy to use, relevant, innovative, spontaneous, quick, simple, and not intimidating and enhanced their thinking I Agriculture (Gray, 2013). Capacity building in people's thinking and action to achieve improvement and innovation were not so common (Timms and Clark, 2008a).

8.4. Impact Analysis

The ideas developed from the previous step, partners converted them into opportunities and were assessed for level of impact and influence on the goal. There is scanty literature of continuous Improvement and innovation (CI & I) in aquaculture. Average of the opportunities

was determined.

Secure market access, 68% of the projects articulated an opportunity of obtaining a secure market access as most significant. The impact and influence were high with a mean score of 8. The benefit of securing market access was high with a mean score 9; cost of not doing was high with a mean score 8. Commercial partners articulated market as ensuring active market liaison to fit product to market and if market was not implemented and wanted to deliver what customers wanted, as they might send the product back if not satisfactory. Other partners from small-scale also reported reluctance in searching for formal market because they may slaughter the fish and retailers fail to take them up. They were prepared to wait until monthly product take-off was guaranteed. Britz (2014) also highlighted that steady markets for catfish exists within West African emigrant community in Gauteng that took up bulk of farmed produce and Nigerians preferred live fish sold at R20 / kg with an estimated market demand of 2000 tons.

Ease was medium with a mean score 6; motivation was high with a mean score 9 and the total positives were high with a mean score 33/40. Costs was slightly high with a mean score 7; risk was medium with a mean score 4 and partners reported that standard product might change trying to accommodate the customer's preference; time was medium with a mean score 6; term was slightly high with a mean score 7 and total term was short with mean score 3 and total negatives were 23/40. The importance of establishing market access in aquaculture sector could not be over-emphasized to ensure success (Laboratory Report, 2014; Britz, 2014; DAFF, 2016a; AgriSETA, 2020).

Water access, 68% of the projects articulated the opportunity of improving water access. The impact was high with a means core 9 and influence was slightly high with a mean score of 7. The benefit was high with a mean score 9; cost of not doing was high with a mean score 8; ease was moderately high with a mean score 7, commercial partners reported the opportunity was not easy to do because they had to bring in experts to do it and also do a lot of begging and pushing to get work done. Motivation was high with a score 7 and the total positives were high with a score of 33/40.

Costs were high with a mean score 8; risk was medium with a score 5; time and term were slightly high with a mean score 6 and partners articulated that benefits would be seen immediately after successful implementation. Total negatives were medium with a mean score 25/40. Farmers often assumed that water was available at no costs, even when water was from the municipality there may be costs associated with permits or delay in business launch due to permits taking long to acquire (Engle and Stone, 2007). Also in Myanmar, small scale farmers suffered from inadequate water supply competing with crops and rice production (World Fish Center, 2020).

Improve feed supply, 64% of projects in the study reported improving feed supply. The impact was high with a mean score 8; cost of not doing was high with a mean score 8 because commercial partners reported that if they do not implement this opportunity, things could go very wrong for the business. Ease was low with a mean score 4 motivation was high with a mean score 8 and total positives were high with a mean score 28/40. Cost were slightly high with a mean score 8, however partners indicated that with fish feed suppliers locally and they did not fall as compared to trout and tilapia and they had aspirations to build a feed mill in their business. Partners also developed their own catfish-specific recipe and the company just pelleted for them. Risk was low with a mean score 3; time was medium with a mean score 6; term was low with a mean score 5 and total negatives were medium with a score of 20/40. Engle (2010) reported that feed were the largest costs on raising farmed fish in aquaculture, however in trout industry the cost of obtaining feed were fairly low because they managed to develop a good relationship. Rising costs of fish feed had crippled many operations in catfish farming in SA (Britz, 2014).

Other partners articulated feed as improving late feed supply due to the delay in delivery of fish pellets from government and the matter was ignored when reported. Even in beef sector farmers expressed feelings of being unheard, unseen, ignored, hurt and overlooked amongst others by government officials in South Africa (Nengovhela, 2010). Most of research in aquaculture was focusing more on finding various means of bringing the price of fish feed down to maximize production (Britz, 2014), less on developing timeous delivery of services to the farmers to increase economies of scale in the potential businesses.

Others articulated feed differently as ensuring live food production in order to produce zooplankton to curb the problem of cannibalism in catfish because they start hunting for food as early as two days. Partner spent lot of money in trying to get rid of cannibalism. Applying zooplankton and egg yolk solved the problem of cannibalism completely and they fed 24 hours without sleeping. This agreed with the work of Onwuteaka and Chocko (2015) indicating that the fast growing catfish consumed 42% of juveniles in nine days of the experiment during the morning hours. Umanah and Okure (2017) described cannibalism as devouring of one species by another species of the same species as food.

Partner further alluded to the exorbitant prices on fish food and manufactures stopped production of these feeds and the solution would be having your own feed company. Partner further indicated that the feed company would be next to silo because there was a railway station there, sunflower and soya. Partner further reported that his business was identified as an aquaculture development zone from operations Phakisa. The rising costs of feed caused the price of catfish to be sold at high price, this caused production to be suspended while other market strategies were been investigated (Britz, 2014).

Increase number of ponds, 57% of small scale projects selected the opportunity of increasing number of ponds. The impact was high with a score of 8 and influence was slightly high with a score of 7. The benefit was high with a mean score of 9; cost of not doing was medium with a score of 5; time and term were slightly high with a mean score of 6. Total negatives were high with a mean score of 28/40. Many people in villages and cooperative setup were utilizing ponds as the main method for fish farming and if not planned correctly then farmers could be trapped in a low productivity cycle (AgriSETA, 2020). Cost for depreciation of fish ponds must be budgeted for, failure to do so meant that enterprises would not be ready fiscally to re-work the production systems when required (Engle and Stone, 2007). However, there was a need to improve training and information on pond construction in Myanmar and more information on pond building best practices could improve productivity (World Fish Centre, 2020).

Obtain equipments, 50% of projects reported obtaining equipments. The impact and influence were slightly high with a mean score 7. The benefit was high with a mean score 9; cost of not doing was slightly high with a mean score 7; ease and motivation were high with a mean score of 8 and total positives were high with a mean score 33/40. Cost was slightly high with a score of 7; risk was low with a score of 3; time was slightly high with a score of 7 and 6; term was slightly high a mean score of 6 and the total negatives were medium with a score of 24/40. The cost of equipment is often ignored in aquaculture and a successful farmer must have all equipments available for emergency situation, to keep the fish alive (Engle and Stone, 2007). The problem of gear shortage prevented fish farmers to catch fish in Kenya was reported (Omwega, 2006). Jia *et al.* (2016) reported greater revenue in farms that invested extra in land, machinery labor costs and chemical expenditures.

Improve aquaculture skills, 43% of projects reported improving skills. They found the impact high with a score of 9 and influence of 7. The benefit and cost of not doing were high with a score of 10 and partners reported that if they were not trained on catfish farming, the chances of succeeding were slim. Ease was slightly high with a mean score of 7; motivation was high with a score of 8 and total positive scores were high with a mean score 35/40. Cost were medium with a mean score of 5; risk was low with a mean score of 3; time was medium with a mean score of 5 and partners reported that time would be quicker if they were referred to aquaculture trainers; term was slightly high with a mean score of 6 and total negatives were 10 with a mean score 16/40. In Myanmar small-scale farmers received donor training from government however still failed to adopt improved pond management practices putting the blame on lack of time, knowledge and resources (World Fish Centre, 2020).

Prevent predation, 39% of projects selected the opportunity of preventing predation. The

impact was high with a means score of 8 and influence was slightly high with a mean score of 7, partners expressed that the land animals were depleting their fish stock and they were unable to get rid of them. Benefit was slightly high with a mean score 7; cost of not doing was slightly high with a mean score of 6; ease was medium with a score of 5; motivation was high with a score of 8 and total positives were high with a score of 26/40. Cost was high with a mean score of 9; risk was medium with a score of 6; time was medium with a score of 5 and term was medium with a score of 6. Total negatives were high with a mean score of 28/40.

Increase number of fish, 39% of projects reported the opportunity of increasing number of fish. The impact was high with a mean score of 10 and influence was slightly high with a mean score of 7. Benefit was high with a mean score 9; cost of not doing was high with a mean score of 8; ease was medium with a score of 6; motivation was high with a score of 8 and total positives were high a score of 33/40. Cost was high with a mean score of 8; risk was medium with a score of 5; time was medium with a score of 5 and term was slightly high with a score of 7. Total negatives were high with a mean score of 25/40. Partners indicated that their catfish raised in indoor system failed to grow quicker. However, Hancock (2015) reported the “resilient nature, quick growth and low mortality rates” of farmed catfish in the Eastern Cape, and the business even switched from tilapia to catfish.

Obtain funding, 36% of projects reported the opportunity of obtaining funding access. The impact was high with score of 8 and influence was slightly high with a score of 6. Benefit was high with a mean score 10; cost of not doing was highly high with a score 7; ease was medium with score of 6; Partners expressed that access to reliable finance timeously was out of their control. Motivation was high with a score of 10 and total positives were high with a score of 31/40. Partners gave an example of driving to funders just to sign two forms which incurred costs to the business. Partners further alluded that this service was supposed to be speedily rendered by extension services who were supposed to be competing to offer assistance, however they were non-functional.

Cost was high with a score of 9 because of the exorbitant amount of money spent on communication. They even implemented a chat group on social media named “Do or Die” emphasizing that things needed to be done speedily, risk was low with a mean score of 2; time was high with a mean score of 7; term was medium with mean score of 4 and it could be quick if the funders actually paid quickly and total negatives were 21/40. Aquaculture development fund proposed by Operations Phakisa was identified to speed-up funding access timeously in aquaculture (Laboratory Report, 2014).

Improve security, 32% of projects reported the opportunity of improving security. The impact

was high with a mean score of 9 and influence was high with a mean score of 8. Benefit was high with a score 9; cost of not doing was high with a score of 8; ease was medium with a score of 6; motivation was high with a score of 8 and total positive score was 31/40. Cost was slightly high with a score of 7; cost of not doing was medium with a score of 6; time was medium with a score of 5; motivation was medium with a score of 6 and total negative score was 26/40. James (2018) also emphasized how theft is hampering the growth of aquaculture in South Africa and cautioned that chances of small scale farmers to succeed were non-existent if they are forced to redirect resources into installing security systems.

Establish accredited processing facility, 21% of projects reported the opportunity of establishing accredited processing facility. The impact was high with a mean score 9 and influence was medium with a score of 6. The benefit was 10; cost of not doing was 9; ease was low with a score of 3; motivation was high with a score of 10 and total positives were high with a score of 31/40. Cost was high with a score of 8. Partners reported this opportunity was very costly and often were forced to compensate for unexpected budget of around two million rands to fix municipal road that was just too high. Partners articulated the high score for risk as coming across difficult neighbors protesting against processing facility constructed next to them; risk was high with a score of 9; time was medium with a score of 6 and term was high with a score of 9 and partners indicated that the opportunity was a long term process and total negatives were high with a score of 29/40. Hancock (2015) confirmed that funds were already acquired from Department of Trade and Industry (DTI) for the assembly of the processing house in this business. Some of the requirements of approved processing facility hot or cold water, sewage disposal, hand-washing basins, toilet facilities, ventilation and refrigeration (Riggins, 2018).

Improve electrical works in RAS, 21% of projects reported the opportunity of improving electrical works in their businesses. Impact was high with a score of 10; influence was also high with a score of 7. Benefit and cost of not doing had high score of 9; ease was high with a score of 8; motivation was high with a score of 9 and total positive score was 35/40. Cost was slightly high with a score of 6; risk was low with a score of 4; time and term were medium and total negative score was 19/40. (James, 2015b) reported that economies of indoor systems operation were not prioritized in aquaculture and what proved to be a good investment turned into a nightmare months later leaving farmers stuck and unproductive. Production of high quality products that are high in quality in recirculating aquaculture system required effective management of good water quality (Xiao *et al.*, 2019). Britz (2014) also emphasized that costs of electricity to heat water were exorbitant and often have the potential to close down operation if not addressed.

Improve communications, 18% of projects reported the opportunity of improving communication with high impact 9 and high influence 8. Benefit was high with a score of 10; cost of not doing was high with a score of 9; ease was medium with a score of 8; motivation was high with a score of 8 and total positives were high with a score of 32/40. Cost was high with a score of 6; risk was medium with a score of 5; time was slightly high with a score of 7 and term was medium with a score of 5 and total negatives were high with a score of 23/40.

Appoint aquaculture experts, 11% of projects reported the opportunity of appointing experts. The impact was slightly high with a means score 7 and influence was medium with a score of 5. Benefit was high with a score of 10; cost of not doing was high with a score of 9; ease was low with a score of 3 and motivation was high with a score of 8 and total positives were 28/40. Cost was low with a score of 3; risk was low with a score of 4; time was low with a score of 4; term was low with a score of 3 and the negatives were low with a score of 13.

Improve agent transparency, 7% of projects selected the opportunity of improving middle man transparency. The impact was 9 and influence was 8. The benefit was 10; cost of not doing was 9; ease was medium with a score of 5; motivation was high with a score of 8; total positives were 38/40. Cost was 6; risk was 5; time was 7 and term was 5 and total negatives were 23/40.

Improve fish growth, 7% of projects reported the opportunity of improving fish growth. Impact was 10 and influence was 9. Similar percentage of partners reported building an aquaponics system with high impact 9 and influence 7. The opportunities were not assessed on the eight dimension criteria.

Prevent fish escape, 7% of projects selected to prevent fish escapes with impact 10 and influence 6. The benefit was 9; cost of not doing was 6; ease was 6; motivation was 8 and total positives 27/40. Cost was 6; risk was 4; time was 4; term 7 and total negatives were 21/40.

Secure take -offs of all products at a required price, 4% of projects reported the opportunity to secure take-offs of all products at a required price. The impact was 10; influence was 8. Benefit was high with a score of 10; cost of not doing was 10; ease was low 3, this was caused by the difficulty in reaching the finishing line and the cumbersome process of obtaining a letter of intent which was later converted into an off - take; motivation was high with a score of 10 and total positives were 33/40. Cost was 5; risk was 2; term was 4; motivation was 2 and total negatives were 13/40. Partners indicated differences between market liaison and off-takes were that off-takes happened now, while liaison can happen later or in the future. This opportunity was critical to partners as they indicated there would

be no progress if not implemented. About 120 tons of catfish off-takes have been secured with letters of intents to increase production from this business (Hancock, 2015).

Develop and implement quality management systems, 4% of projects reported the opportunity to develop and implement quality management systems. Impact was 8; influence was 9; benefit was 9; cost of not doing was 9; ease was 4; motivation was 8 and total positives were 30. Cost was 4; risk was 6 because if the process was not right, many things might be changed and that will be costly. Another partner disputed saying they were constructing the factory based on activities carried out in a small factory, therefore most of the things were thought through; time was 7 and term was 4 and total negatives were 21/40 because auditing required six months of record to be carried out. AgriSETA (2020) also highlighted that issues of compliance to food safety standards were recently gaining momentum in aquaculture than in the past and they were critical towards development of aquaculture. Engle (2010) expressed that, farmers delivering fish to a processing plant were also required to meet the quality standard and delivery requirements of the processor to avoid high volumes of rejected fish.

Develop Contiguous Professional Development (CPD) for all staff, 4% of projects reported developing CPD for all staff with impact of 6 and influence of 8. Benefit was 7; cost of not doing was 5; ease was 4, partners expressed mixed feelings about ease, others reported it was easy to implement while other disputed reporting that if a wrong person was given the task to implement, it would not have any progress. And motivation was high 8 and total positives were 24/40. Cost was 4 because some things would be out-sourced while others would be taken in-house; risk was 2; time was 6 because production manager might be capacitated by attending six months courses; term was 4 it would be quick to see the benefits. 'It was critical to *appoint right people with skills, who know what to do what needs to be done (Karoo Catch KC69)*' and total negatives were 15/40.

Identify cost effective product distribution options, 4% of projects reported the opportunity of identifying cost effective product distribution options with impact 8 and influence 7. Benefit was 8 partners reported that if cost effective way of transport could be determined, the end user would pay less; cost of not doing was 8; ease was 5 because it required a networking and motivation was medium 5 and total positives 26/40. Cost was 1, partners indicated it would be telecommunication and searching for a quotation; risk was 2; time was 3; term was 2 and total negatives were 8/40. Britz (2014) indicated that the low volumes of distribution logistics required for catfish were uneconomical although upmarket responded favorably to the value added catfish products.

Maintaining and improving genetics of stock, 4% reported the opportunity of maintaining and improving genetics of stock. Impact was 7 and influence was 10. Benefit was 7 because partners believed that improved genetics would improve growth and in turn improve yield;

cost of not doing was 6; ease was 6 because the opportunity required infrastructure, space and time. Genetic improvement programme also required skills and they might be imported and motivation was medium 5 and total positives 24/40. Cost was 3; risk was 1; time was 3; term was 3 and total negatives were 10/40. Partner indicated that their catfish broodstock and fry were ordered from Holland for better genetics. Britz (2014) also supported that the catfish in this business were genetically improved and sourced from the Netherlands. The opportunity to influence the permitting system (1.1) had impact 9 and influence 5. Partner indicated he would obtain import permits from Department of Agriculture, Forestry and Fisheries (DAFF), Department of Environmental Affairs (DEA) and from Veterinarians. James (2016) reported that permit system in South Africa was disordered and expensive and hindered business to thrive. DAFF via office of Operations Phakisa aimed to develop one stop shop where people could receive various services timeously of all kinds (Laboratory Report, 2014).

Improve system performance, 4% of projects reported the opportunity of improving system performance with an impact 9 and influence 8. Benefit 8; cost of not doing 9; ease 6 and motivation 10 and total positives 33. Cost was 7; risk was 7; time was medium 5; term was 6 and total negatives were 25/40. Partners articulated that bacteria in the biofilters were not sufficient to convert harmful ammonia into ammonium gas and partners further indicated that their project lacked water testing kit to monitor the quality of water. This was also supported in the study that found high levels of ammonia to be the major cause of water pollution due to excess feed and faeces. In RAS, biofilters are used to remove ammonia to increase survival and growth of fish, however, their performance in removing ammonia differed significantly with the type of substrate (Suantika *et al.*, 2016).

Vortex was malfunctioning and it was supposed to catch all the waste from fish and food so that they do not return to the system, if they go back they could cause fish salmonella disease. Another partner expressed vortex as similar to fish toilet that catches the wastes and flush them away. Xiao *et al* (2019) confirmed that vortex removed waste particles from fish wastewater, and this water carried a number of harmful substances such uneaten feed, faeces and small suspended solid particles (i.e. ammonia, nitrite, bacteria and carbon dioxide). This affected the quality of products so water quality instruments needs to sustain standard quality of water (Xiao *et al.*, 2019). Engle (2010) emphasized that constant monitoring of water quality to prevent problems associated with waste accumulation.

Improve labor shortage, 4% of projects reported the opportunity improving labor shortage with an impact 5 and influence 5. Partners reported that aquaculture was a labor intensive business; they needed to hire more people to share workload. Engle (2010) also indicated that the availability of labor resource was significant in shaping the achievements or failures

of the aquaculture start-up business, labor can include family members available to assist. Pond construction was associated with high capital costs in Myanmar and small-sale farmer's sourced people to dig up their ponds and even assisted by family members in some cases (Chertkov *et al.*, 2019).

Basic financial information, basic financial information had impact 6 and influence 6 Partners articulated that there was no information about aquaculture business and gave an example cost of production, what to expect and how much it was. Similarly, the Laboratory Report indicated this challenge of shortage of information and implementation of aquaculture information database and development of one stop shop were on the pipeline (Laboratory Report, 2014; Aquaculture Bill Draft, 2018). Fisherman in Kenya also lacked accessed to information on saving option and did not qualify for credit (Omwega, 2006).

Fix inlet/outlet pipes, 4% reported fixing inlet/outlet pipes with 8 and influence 6. Benefit 6; cost of not doing 5; ease 7 and motivation 5 and total positives 23/40. Cost was 6; risk was 5; time was medium 7; term was 5 and total negatives were 23/40.

Improve amount of diesel, 4% reported improving amount diesel. Impact was 10 and influence 9. Benefit 10; cost of not doing 10; ease 10 and motivation 10 and total positives 40/40. Cost was 10; risk was 10; time was medium 5; term was 5 and total negatives were 30/40. The opportunities to obtain fish transport permit with an impact 10 and influence 10. Kick start the business had an impact 9 and influence 9. Reduce nitrogenous substances had impact 5 and influence 8. Destroy invader plant had impact 4 and influence 9.

8.5. Opportunities Taken Further

The opportunities generated and taken forward and were displayed Table 8.1. Some partners selected to implement more than one opportunity as they were all currently ongoing. Department of Primary Industries and Regional Development (2017) also supported that it was possible to take more options given the availability of resources. This was not surprising because action research dealt with real world problems as people experience them and there was a partner who dealt with two foci at the same time and indicated they were already happening (Gray, 2013). Clark and Timms (2008) also indicated that an individual involved in CI & I could have several focuses going on at the same time. Things that required management during implementation were highlighted by eight dimension criteria (Department of Primary Industries and Regional Development, 2017); in order to avoid wasting time and resources on things that would not have impact on the business (Clark and Timms, 2014). It was better for partners to run short and quick cycles than long ones that would take time to reveal results (Clark and Timms, 2008).

Table 8.1: Opportunities generated and taken further in cycle 1

Research partner	Opportunities assessed	Opportunities taken further
Karoo Catch (KC)	1.1. Secure off-take for all products at required price 1.2. Active market liaison to fit product to market 1.3. Establish accredited facilities to process products 1.4. Develop and implement quality management systems 1.5. Appoint qualified and experienced management team 1.5. Plan Continuous Performance Development (CPD) of all staff 1.6. Access reliable finance timeously 1.7. Ensure sufficient water quality and quantity	1.1. Secure off-take for all products at required price 1.2. Active market liaison to fit product to market 1.3. Establish accredited facilities to process products 1.4. Develop and implement quality management systems 1.5. Appoint qualified and experienced management team 1.5. Plan Continuous Performance Development (CPD) of all staff 1.6. Access reliable finance timeously 1.7. Ensure sufficient water quality and quantity 1.8. Ensure cost effective products

(Full version Appendix 4)

8.6. Impact Analysis Tool Assessment

Profit Driver Tree

The generated opportunities were placed on the profit driver tree to identify the strongest driver (see Figure 4.51.5). In this study strongest drivers identified to make a real difference were marketing, genetics, nutrition and management. In genetics, improving genetic selection programme would improve profit. In nutrition, partners articulated that fish pellets were costly, searching for alternative fish food, while some were in possession of expired feed and they lacked proper storage facilities. In marketing, partners opted to fit products into market which was broken further into formal market and local market, securing product off-takes, branding or packaging and advertising. Similarly, in beef industry participants identified marketing, genetics, nutrition and management as variables affecting profit the most (Timms and Clark, 2008). Nutrition was the best option to increase growth rate of cattle and management practice that could improve nutrition was rotational grazing over feeding supplements and feedlotting (Timms and Clark, 2014)

In the study management was further broken down into operational (i.e. technical skills, water, communication, record keeping, indoor system, electricity). Development of technical skills such as: breeding, nutrition, water quality management, and management skills (manage aquaculture farm and supervisory skills) were required to contribute to the development of aquaculture (AgriSETA, 2020).

In the current study, Human Resource and Development, partners wanted improvement in accessing aquaculture trainers and aquaculture advisors. Aquaculture had limited pool of skilled professionals and quite often services were rendered by extension that never seen or touched fish before (Britz *et al*, 2009; Laboratory Report, 2014, AgriSETA 2020). The need for technical support is supreme in South Africa (James, 2016). World Fish Centre (2020) also found key challenges such as water, fish food and production system construction to be hindering productivity in small-scale farm.

In the current study quality management was articulated as building accredited or processing and product handling. Financial management was articulated as searching for funding and appropriation of available funds in projects. Access to funding continues to be an obstacle to the development of aquaculture (Britz *et al.*, 2014; Laboratory Report 2014; AgriSETA, 2020), and funders were often unfamiliar with this Agricultural activities and were reluctant to fund (Laboratory Report, 2014). The best method of preventing financial losses in aquaculture was to have good planning, monitoring and assessment of financial performance throughout the life of the business (Engle, 2010).

Impact and Influence Tool Assessment

The tool was not to be used or seen by partners before. 83% of people liked the tool; they found it easy to use; it enhanced their thinking; time to apply the tool was medium; cost of not doing the tool was high; they found high value in the tool and their motivation to apply the tool again was also high. When people had a lot to choose from, impact and influence assisted in selecting the best option (Department of Primary Industries and Regional Development, 2017). Gray (2013) found that when participants generated ideas, reasoning and implementation did not but they were measured and implemented. Project managers must be able to conceptualize and strategies properly, and prepare to outpace problems of tomorrow (Engle, 2010).

Eight Dimensions Bar Graph Tool

Partners did not use or see the decision-making tool before. 83% of people liked the tool, it was easy to use, cost of not doing was high, value was high and motivation to implement again was high. Gray (2013) also reported that partners in her study never encountered this tool and it proved to be challenging due to requiring consistency in thinking approach during rating of all the eight dimension criteria. They also reported that the tool improved their

reasoning capacity and the prospects yielded in better judgement and they found high benefits in the tool. Eight criteria were necessary to indicate which opportunity would have high scores when implemented (Department of Primary Industries and Regional Development, 2017).

Eight Dimension Pinwheel Versions

The tool was never been used or seen before. All partners liked the tool, found it simple to apply; reasoning was improved; cost of not doing was high; they valued the tool and were highly motivated to use the tool again and it took partners medium to implement the tool. Similarly, in Australian Agriculture, there was highest recognition and value in the tool and they acknowledged that they would be behind if they did not use tool (Gray, 2013).

8.7. Action Design

Critical success factor: Secure market access, the results showed that 47% projects across the provinces found it critical to obtain market access. Then 35% of those projects expressed that it was critical to secure local/community market via designing and administering a questionnaire. The questionnaire was designed, discussed with partners and ethical approval was obtained from the institution. Partners were trained through CI & I sessions to administer the questionnaire to their local communities and results were analyzed. Efforts of marketing fresh fish in large supermarkets have not been historically fruitful in South Africa, and in shelves the most predominant products were frozen hakes and tin sardines (Britz, 2014). It was further added that fresh fish was not marketed in supermarkets and its intake was normally associated with informal subsistence fishing (McCafferty *et al.*, 2012). Engle (2010) emphasized that projects that market their products direct to consumers required close management attention to activities of marketing. Aquaculture enterprises will fail if they do not possess a workable market strategy suitable for that specific business and must also be able to identify competition (Engle, 2010). All businesses must sell a product that their customer prefer especially at a price higher than the production cost and there were hidden costs that were normally assumed away in small-scale fish farming that could be detrimental to success of the business (Engle and Stone, 2007). The results also showed that 6% from commercial partners would provide a sample to fit product to the market, obtain inputs, conduct product adjustment and received a signed order for product acceptance. People seeking aquaculture formal market access thrived to be the preferred supplier who delivered quality fish, within specification and on time (Engle, 2010). Market could be found anywhere, for example, in Germany there was a huge potential market for larger catfish from United States (Lombardi and Anderson, 2008).

Another action identified within the study was that four projects would attain market by branding and designing business cards and posters. Advertising on local radio station, pamphlets and shops, billboards and create social network page for the business. Engle

(2010) highlighted that marketing plan should include effective promotion and advertising plan, especially small-scale farmers should think about the plan to spread the word about their business. (Britz, 2014) emphasized that aquaculture producers have to develop innovative marketing strategies to remain relevant or be out of business before they even begin, especially where consumers regarded catfish as ugly and muddy.

It was also critical to obtain market access through searching for market selling prices for catfish and the action design was to secure market access. Britz (2014) reported that fresh water fish had a poor image and consumers were not willing to purchase at price high enough to cover production costs. Engle (2010) reported that it was essential for aquaculture business manager to be able to match the price of the fish with the consumer's expectations, inform consumers what value they receive in purchasing your products and the price has to cover the production costs to remain lucrative.

Critical success factor - improve aquaculture skills, the opportunity of improving technical skills in catfish farming was mentioned by 41% of the projects as critical to achieve the goal. In this study majority of the small-scale partners took action of sourcing training from their government training center and also their local university. Partners indicated that the training would be valuable if they could receive practical skills such as fish dissection and also have equipments such as nets and protective clothing. Others indicated that they required developing skills in aquaculture to prevent feed wastage in ponds. Others took further action of engaging in a catfish self - study from the manual "Culture of catfish" obtained from the researcher. Aquaculture is hands-on; capacity development had to be practical to be effective rather than slide show presentation (James, 2014). Britz (2014) reported that provinces had existing and attractive catfish training and breeding centers, equipped with fish experts and a mandate to serve their local farmers. On the other hand, one commercial partner project articulated training differently, as taking action of training of their staff according to their training needs identified from Continuous Development Programme (CPD).

Critical success factor - water access, in the study the results showed that it was critical for 35% projects to improving water access. The action designed by small - scale projects was to obtain water licenses from their local chief and Department of Water Affairs (DWA), and also obtain quotation from borehole drillers and water surveyors. While a unique action from one project was to purchase pipes to deliver water from the river to the farm, and also to install inlet/outlet pipes on the ponds. The commercial partner project also indicated that it was critical to ensure water quantity and quality. Catfish farmers in the study displayed an understanding that water access was costly and required licensing. Other partners indicated that increasing water pressure was also critical in RAS to circulate the water and meet water quality standards. It was reported that access to all water bodies in SA were administered by

DWA, while fish were managed by provincial departments (Weyl *et al.*, 2007). Although there was lack of unity amongst government departments to manage fishing activities, and there was no national policy that regulated access rights to dams (McCafferty *et al.*, 2012)

Critical success factor - ensure cost effective feed supply, in this study, 47% projects reported that it was critical to increase availability of alternative catfish food in their businesses. Alternative fish food were reported as earthworms, chicken dung, traditional brewery, chicken intestines, mixture of sunflower and maize meal, fig tree fruit and mulberry would be collected and fed to catfish to assess growth performance. However, kikuyu grass would be collected and fed to Grass carp in those projects that have mixed species in the systems. Partners displayed knowledge of feed intake according to the type of fish species. Similarly, inputs such as manure, cassava maize bran, vegetables and household waste administered to fish have contributed significantly to gross margins in Malawi (Steward, 2002). James (2015b) reported new use of animal manure supplemented with pellets in Mozambique.

An experiment of assessing the growth performance of catfish fed with live earthworms and tilapia fingerlings would be conducted and ethical approval would be obtained from the University. The commercial partner project would take a unique action of ensuring cost effective and reliable feed supply from manufacturers. FAO (2016) reported that feed formulation and species-specific feeds that satisfied nutritional requirements in all stages of farmed fish growth for commercial sectors. In aquaculture feed constitute between 60% and 75% of the total cost of production (Babalola and Apata, 2012), there was a number of authors who successfully found alternative protein sources to fishmeal in the diet of catfish (Djissou *et al.*, 2016; Anvo *et al.*, 2017; Adeoye *et al.*, 2019). High costs of feed were rendering South African aquaculture uncompetitive (Britz, 2014) and profit can be realized if farmers have nutritious food at affordable amounts formulated from locally available products (FAO, 2016).

Critical success factor - obtain equipment; according to the results it was also critical for 41% of the projects to obtain processing and harvesting equipments. Partners referred processing equipments as knives, scissors, containers, pliers and chopping board, while harvesting equipments were items such as waders and nets. One projects reported equipments related to recirculating aquaculture systems such as airstones and air tubes to connect to the air blowers, fish tanks and vortex filters.

Critical success factor - Improve security; improving security was also a critical to achieve the goal in three small - scale projects. Their designed action included obtaining quotation for security materials such as fencing, alarm system, razor wire and sport lights; some would advertise and hire a security guard for night duty. Theft is a major threat to sustainability of

fish farming in Malawi, and measures to limit includes construction of ponds close to homes, to cover ponds with branches of leaves and timing of harvesting and stocking season to avoid predation (Steward, 2002).

Critical success factor - obtain aquaculture experts; the results also indicated that 12% of the projects reported obtaining aquaculture expert/expertise as critical for them to achieve the goal. Partners in the small-scale project have selected to appoint aquaculture engineers from their local area to conduct aquaculture system assessment in order to optimize performance. While in the commercial partner project, preferred aquaculture expertise as to hire qualified aquaculture management team via job advertising; conducting interviews and appointment of new staff. Lack of experienced aquaculture management team was identified as technical constraints (Britz, 2014). Technical performance of standard in farms does not depict generation of good revenue, however, systems can benefit from sound technical advice (Sterward, 2002).

Critical success factor - obtain funding, the results also showed that 12% of the projects found it critical to improve capital. Small-scale partner project took action of approaching Small Enterprise Development Agency (SEDA); Land Bank; Agriculture and even prepare a funding pitch to attract funding. Access to reliable funding timeously was also found evident in partners with commercial background. Access to credit was also a constraint in the study conducted in Myanmar (Chetkov *et al.*, 2019) and was also highlighted in most of the aquaculture reports conducted in South Africa (Britz *et al.*, 2009; Britz, 2014; Laboratory Report, 2014;).

Critical success factor - Establish accredited processing facility, the results showed that it was critical for partners to have an accredited processing facility. The designed action was to obtain guideline, conduct an inspection, obtain accreditation and construct the facility. The costs of constructing processing plant were exorbitant, for example the processing plant already been built in some of the provinces amounted to a budget of around 12, 5 million Rands (Britz, 2014).

Critical success factor - secure off - takes of all products at a required price; the results also found that it was critical for commercial partner project to secure off-takes of all products at a required price. The designed action was to identify potential customers, provide samples and prices and secure orders.

Critical success factor - improve amount of diesel, it was critical to obtain diesel that would be utilized in the generator as a back-up power supply. The action was to search for funding

and collect contributions from members.

Critical success factor - Improve system performance; it was critical for partners to have a system that operated effectively. The action was to compile a letter to the Member of the Executive (MEC) of Agriculture to report the issues faced in the business. The contact details were obtained from their local Agriculture. Hire a system designer to fix the Recirculating Aquaculture System (RAS) and install the right pumps. The KPIs were increased fish growth, less ammonia and high oxygen levels, less accumulation of fish waste and effective aeration system installed. Partners articulated that Societies for Prevention of Cruelty to Animals (SPCA) would arrest them for animal cruelty of putting fish in system that failed to meet its water quality standards. Britz (2014) cautioned aquaculture investors of “turnkey” systems, which were enterprises that sold fish systems without looking at their economic viability, and had no experience in selling and producing fish.

The results also showed that it was critical to improve bacteria in the biofilters to lower levels of ammonia. The action designed was to take water to the lab to test the bacterial count and receive results. Partners reported that their fish are stressed due to unfavorable conditions that they were subjected to live under.

Critical success factor - increase number of ponds, partners selected to increase number of ponds. The action was to prepare the soil and construct. While others reported to re-work or strengthen the pond wall and cover with a pond liner.

Critical success factor - prevent predation; preventing predation by fish and land animals was critical for small - scale partners. The action was to install fence around the ponds, design a trapping machine and cover the ponds with hail net. Fish farmers lost benefits due to the presence of otters which depleted their stocks in Malawi, although yields were low, fish was a significant contributor to gross margins (Stewart, 2002).

Critical success factor - prevent fish escape; some partners reported preventing fish escape from the bottom of the ponds. The action designed was to request engineers from government to rebuild the pond and also seek for private engineers as a backup plan.

Critical success factor - maintain and improve genetics of stock, the results also show that it was critical to obtain import permits for catfish from government departments. The action was to obtain information regarding import permit requirement, submit application for, make follow-up and receive confirmation.

Critical success factor - improve electrical works in Recirculating Aquaculture System (RAS), to upgrade electricity in order to increase voltage at the transformer and meter box was critical for partners who had RAS in their businesses. The action was to obtain a copy of the quotation from the electricity supplier at the department of Agriculture and source alternative financial assistance. Items such as proof of payment that electricity was settled and was never received from government, multiple attempts to raise the issue with extension services were fruitless as a result partners expressed feelings of being unheard, ignored, demoralized and being afraid of the friction it would cause if the issue was followed up. Partners articulated that their initial pumps were functional and energy efficient, however after they were upgraded by a service provider from government, electricity bill went up, if they were consulted they would have informed the service provider not to replace the water pumps.

Critical success factor - improve fish growth; fish record keeping was another critical success factor to monitor growth performance of the fish. The action designed was to take measurements of fish growth monthly and record in a book. Partners indicated that their fish were stocked in 2014 and failed to reach market size, Therefore they wanted to learn the correct manner of taking length measurements, they were familiar with weight.

Critical success factor - increase number of fish, increase number of fish was critical to have in order to achieve the goal. The action was to learn to breed catfish; breed or also to search for service providers and purchase the newly hatched fry. James (2015c) reported that Africa has a recurring constraint of producing and selling poor quality fingerlings.

Critical success factor - improve communications and transparency, improve communication and transparency was critical to have in order to achieve the goal. The action designed was to organize meetings with fish farmers and also with government. Partners wanted to improve transparency amongst them and the implementing agents assigned to their projects.

Critical success factor - develop Continuous Professional Development (CPD) for all staff, it was critical for partners to develop CPD for all staff. Action designed was to determine training need analysis, design training programme, source funds and implement.

Critical success factor: Fix inlet/ outlet pipes, partners reported to fix inlet/outlet pipes for draining purposes. The action was to obtain quotations; contribute monies, purchase the pipes and install.

Action Design Tool Assessment, 83% of partners liked the action design tool and a calendar.

Partners found the tool easy to use, their thinking was enhanced and they applied the tool in the medium time. Cost of not doing action design was having a high score and they found the tool valuable and their motivation to keep applying the tool was very high. Commercial partners associated this tool with what they applied in their business where they designed and monitored their actions. Partners also reported that their motivation was very high due to the risk they took when their business was initiated, taking loans against their properties.

8.8. Action Implementation

Continuous Improvement and Innovation (CI & I) in aquaculture is new, there is scanty literature on this topic to compare the results of the current study with.

Obtain market access, market survey: partners reported that market questionnaire established community preference of fish; the type of remedial action would be to put in place to change people's behavior; questionnaires created awareness and the type of market opportunities within their local communities. Partners reported liaising with people in communities to determine if they would buy fish. Partner's required financial support to demonstrate value added fish in their shopping centers.

Advertising: partners failed to advertise their business in shops, they mentioned that their community knew about their fish and they were expecting a different species. Others advertised in social media and applied for funding. Support required was data and training on new technology. Business cards and advertisement stickers were developed to show which farm produce came from. Financial support was required to advertise their projects on billboards. Local radio station was approached and they were able to meet the station manager and schedule an interview. Financial support was required to advertise on radio. Partners required smartphones to be able to capture photos and place them on the network page and also wanted financial assistance to pay graphic designer.

Billboards: partner reported that the service provider and government were supposed to have erected a billboard long time ago during the construction of the indoor systems. Government would collect fish from the indoor system to the processing plant, therefore no need for them to have a vehicle. Some project did not implement anything on this.

Determine fish pricing; partners already had secured market for vegetable produce and took the opportunity to discuss take-off of fish products. No agreement was reached since the fish were not stocked yet. They would feed the fish waste from poultry farm, chicken livers, chicken intestines and cow dung. They required experts to install water pumps and electricity was available on the farm.

Restaurants, feeding schemes, prisons: restaurants preferred hake, for prison partners should sign a contract to obtain approval to supply fish. Some partners liaised with Chinese restaurants and wholesalers shops regarding purchasing fish. They preferred big catfish between 50 to 70 g. Partners harvested carp and left catfish due to their small size to sell to customers. Partners also managed to liaise with Agriculture manager regarding utilization of

government transport.

Improve aquaculture skills, catfish farming training was already received from government and partner submitted copies of the Chinese manual obtained from the training. Partners failed to indicate this essential information during action design and impact and influence step. Researcher observed that during the session for focus, situation analysis, impact and influence and action design, all members of the cooperative were present. This session the member was alone and could have felt free to express this critical phenomenon better. Timms and Clark (2014) emphasized the importance of doing different things in order to achieve different results.

Self-study: other partners received copies of the catfish manual, printed, distributed amongst themselves and shared chapters for self-study, production, breeding and nutrition. Training workshop was not successful since the coordinator was on leave, so alternative training venue was sourced.

Water access, partners were not able to obtain quotations for inlet/outlet water pipes due to not having their sizes. Some partners checked the state of the quality of water by dipping his hand inside the water and required support to purchase water quality instruments.

Partners from other businesses worked out how many pipes would be needed to transport water from the river to ponds. Partners also reported to have obtained quotation of water storage tanks so that they would be in a position to store water. Partners mentioned a huge challenge of predation from frogs in their ponds. Partners also showed a sense of pride in being able to implement their actions.

Other partners reported to already have access to water, electricity and a generator. Water drillers charged R21, 560; borehole machine amounted to R5, 500; control box R1, 500; pipes costed R500; electric equipments amounted to R1, 200 and acquired another land to construct more ponds.

Partners installed inlet/outlet pipes, outlet were placed at the bottom of the pond and inlet on top. Water pump was not installed there and the pond was not filled with water. Some project was already commercial in other Agricultural crops and water license was obtained long ago, therefore there was not need to attain license for fish farming. Water drillers were contacted to visit the project and they failed to come. The type of support would be for government to intervene however partners expressed lack of confidence in them. They have ponds and they were in a good condition.

Partners prepared ponds on their own; source of water was a spring. Partners indicated they were excelling in poultry farming, they were producing and selling. Partners indicated they lacked of fish farming skills and were reminded by the presentation from others. Partners were sitting with *Oreochromis mossambicus* for three years without selling and they wanted to switch to catfish.

Ensure cost effective feed supply, here partners wanted to explore various types of food to feed to catfish at an affordable price. They reported that earthworms were available to be fed to catfish in their local areas and some partners explained the process of farming with earthworms. Cow dung, pig waste and chicken waste were also available from local farmers. Grinding mill was not implemented.

Increase harvesting equipments, partners reported that containers were available, there were no paper plates in town and they received donation from a member of A4 book. Others failed to meet to implement the CSF of obtaining equipments. Some were able to obtain quotations from the hardware store and they required support with transport to travel to shops where these items were sold in bulk.

Others reported to have arranged a meeting accidentally on their home street and still failed to hold a meeting and they reported lack of commitment from members. Further probing revealed that recruitment of partners to the project was also ad hoc, for example assisting the chairperson when fish were sold landed those positions in the cooperative.

Water quality equipments were bought and they were never delivered to projects, service provider forgot the equipments in the vehicle and decided to drop them with extension officers, and alerted partners. Extension officers promised to deliver the water quality equipments however they were never delivered. If extension officers were knowledgeable of how critical water quality was, they would have prioritized to deliver this item. Partners attested to have attended ad hoc catfish training organized by government. Partners confirmed the existing conflict between them as a project and government.

Improve security, ponds were situated at a long distance from their homes and there was a high level of theft, partner wanted to put a trap machine however he had to obtain permission from the traditional house. The issue of having a fish license came up to be able to obtain assistance from traditional house in cases of theft, partner emphasized that the old government was arresting people holding fish and would take three months without arbitration. Researcher also observed vandalized indoor systems of partners during data collection phase.

Others reported no need for water license when farming nearer to the river, government refers to it as agrarian right. Installing a fence would solve the problem of theft and partner reported that the workers must also be trained on attitude so that they are not the ones who steal the fish; partner would look for training from AgriSETA and Agriculture. Partner would search for quotations on alarm system, spot light and fencing materials.

Access to reliable finance, partners applied for funding for aquaculture and also advertised their project on social media. Partners required training in technology to improve

consumption of fish. Other partners indicated that old people do not qualify for funding however funding was obtained by luck. Young people stood a better chance of receiving funding because even government lobby them, took pictures with them and they obtain assistance.

Constructing fish processing plant, the issue of a processing plant was very quiet, no communication was received by partner, and the contractors completed the work. Partners on the Critical success factor (CSF) processing plant reported about being able to obtain a generator to drain water out of the pond. The report was not associated with construction of the processing plant.

Project registration, quotations for stationery was obtained which amounted to R45, 000. Partners required financial support to be able of purchase office equipments. Other partners emphasized the importance of office equipments to be able to safely keep the important project information.

Improve aquaculture recirculating system, there was no implementation of forwarding a letter of complains to member of the Executive Committee (MEC) by partners. Others also failed to liaise with the private system designer due to existing conflict between the designer and government, confirming that they already worked with the designer before, government bought *Oreochromis niloticus* from him and they failed to grow. Again this critical information was withheld during action design stage. James (2015c) also reported the failed white elephant aquaculture indoor systems littered throughout the country indicating that the first world fish systems were not suitable for South Africa environment.

Obtain import permits for catfish, partner failed to implement, misplaced the notes and was fully focused on chicken farming however promised to implement. Partner managed to accidentally just pop by to Department of environmental Affairs (DEA) and the response was that there was no one who worked on aquaculture. Permits were issued haphazardly and were uncoordinated in South Africa (SA) amongst nation and provincial administration offices (James, 2015c).

Upgrade electricity, electricity bill was settled by government for a period of 12 months and they lacked proof of payment. Government also bought fish pellets, invoice was not obtained, and quotations from a different service provider to conduct indoor system assessment were received.

Observation, Questions, Ideas and Opportunities (OQIO), partners were requested to come up with observations, questions, ideas and opportunities from every feedback presented. There were 23 observations, 43 questions, 35 ideas and 25 opportunities. The data was

collected from documents utilized during sessions, tools worksheets and audio records. The thinking of partners was enhanced (see Figure 8.1). The first CI & I cycle generated 480 observations, 16 questions, 503 ideas and 125 opportunities in Australian Agricultural Businesses (Gray, 2013).

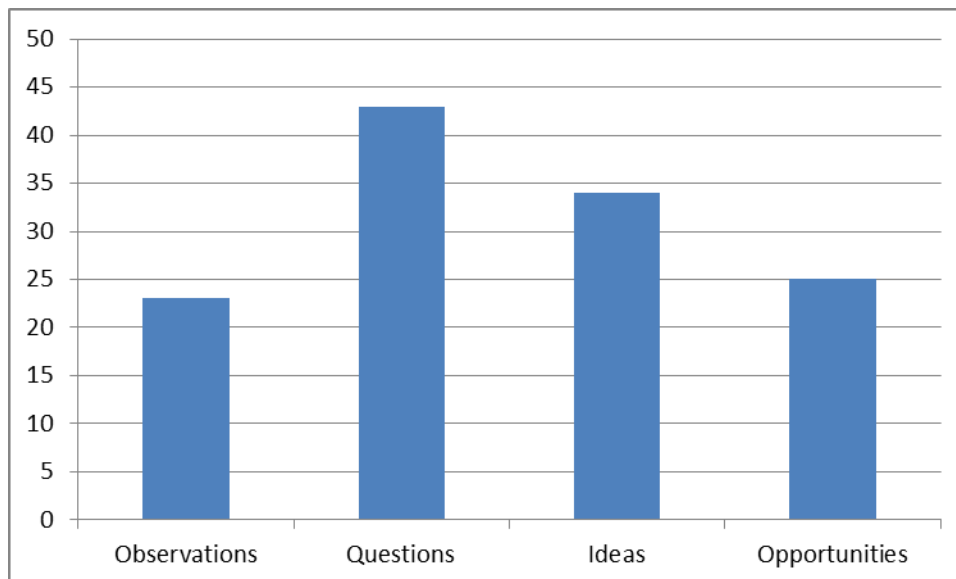


Figure 8.1 Number of generated observations, questions, ideas, and opportunities for cycle 1

Action implementation tool assessment, liked, ease of use, thinking enhanced, cost of not doing and value scored second highest mean and median of 8. Partners had high motivation in action implementation with a mean 9 and median 9. In contrary, action reporting and support framework scored a low value in the Australian Agricultural Businesses (Gray, 2013).

Observations, Questions, Ideas and Opportunities (OQIO) tool assessment, liked were high with mean 8 and median 8. Ease was high with mean 8 and median 8. Thinking enhanced was high with mean 8 and median 8. Time was medium with mean 6 median 6. Cost of not doing was high with mean 8 and median 8. Value was high with mean 8, median 8; motivation was high with mean 9 and median 9. OQIO scored moderately high with a mean 7 and median 7 in Australian Agricultural Businesses (Gray, 2013).

8.9. Performance Assessment

Improve technical skills; training was not achieved because partners were told by government that they were already trained and advised to source funding elsewhere if they needed to be trained again. Probing revealed that partners reported that in the training that they attended, they only did fish dissection, and breeding catfish on over-head presentation, no practicals. Partners gave an example of the trainer injecting the female catfish with a hormone and stripping eggs overnight in their absence and displaying the outcomes in the

morning. They even received a catfish training manual. Researcher observed that of the manual was pulled from an old dusty box indicating that it was not in use. Probing revealed that the reason for selecting this opportunity was to refresh their memory because they have not worked with fish in a long time. However, others showed lack of interest in improving technical skills in catfish farming when the chairperson requested them to meet. While others reported struggling with organizing transport from extension office due to lack of a driver in order to attend training at aquaculture breeding station to improve technical skills.

Others managed to organize and attend the catfish training and learnt that fish could be farmed indoors, water could circulate and the temperature inside was very hot, they could breed fish all year round. Partners realized they did not have enough ponds and the ponds at the training station were small and portable and could generate money. Partners reported that indoor systems required lot of money to circulate the water.

The training was usefully to partners because they just read the manual and now they had to link what they read with a practical situation. Partners showed initiatives of even securing a practical training with the trainer in their own farm. Partners also learnt that indoor systems should stay very hot and they saw ponds inside a hydroponic system.

Self-study training, partners understood that catfish required lot of clean water that was moving, not water that stood still and full of mud. Catfish could be grown in high densities and they grew quicker. Catfish bred at a temperature of 18 - 22°C, water temperature should be kept at this level for optimum performance.

Another chapter reported on artificial propagation and fry production in order to learn how to produce their own fry and avoid purchasing. Partners reported that the breeding size of fish should be 1.5 kg, it can produce between 3000 - 5000 eggs and the best season to breed was September and October. Water temperature might be warm on top and cold at the bottom. Catfish do not breed in captivity and female were injected with a hormone to get ready to release the eggs, a male catfish must be sacrificed to harvest the sperms and mix with eggs in a container and they hatched and released the fry.

Some of the partners showed lack of preparation because they reported on nutrition and presented about water temperature, fish benefits and their local community did not prefer catfish.

Commercial partner project appointed a dedicated person to manage continuous development programme and training needs analysis and training was on-going and this was a different performance interment of capacity building.

Improve market access; commercial partners reported that signed orders for potential customers were secured. Signed orders were also obtained for active market liaison to fit

product to market. Partners elaborated that fish farming and Agriculture were the same in that farmers can sit with stocks for 6 - 8 months without buyers while the money invested is very high?

Ideas popped up during this session such as obtaining R & D funding and partners wanted to focus on one single production unit verses the whole business so that the output would be of use to out - growers. The input was from a newly appointed staff that suggested that the first focus was too broad it would be narrowed down to a single focus.

The results also showed that small-scale partners were sure that they would supply formal markets such as retailers, guest houses, school feeding programmes and old age house and were relying on their processing plant also for fish off - takes, although they lacked a signed contract.

Researcher probed partners to elaborate further on the processing plant; partners reported that the processing plant was built for fish farmers in order not struggle with market. The fish will be processed and canned and sold to Agripark. However, currently processing plant was owned by government, Department of Agriculture, and according to partners the loan used to construct the processing plant was requested in the name of farmers to be able to purchase materials.

Partners lacked clarity of ownership of the processing plant due to sponsors often requested signatures from beneficiaries when they ran out of materials, and upon completion of the work the keys were given to government, not beneficiaries.

Community members and neighboring towns showed interest in purchasing fish from partner's project. Other partners approached Chinese wholesalers and foreign nationals and they showed interested in buying their fish, however they lacked proof.

Some communities refused to fill in the market questionnaire since it was not a job application and the fact that the questionnaire was not giving incentives.

Other partners motivated that in their communities fish was sold quickly, they get depleted while they are still on the way to find a selling spot. Partners do not meet supply and demand due to small number of ponds they have and their major challenge was lack of water.

Partners did not require formal market because their fish were small and stunted. They do have ponds and they lacked water and the license was issued from their local chief.

Some partners managed to administer 30 market questionnaires in their community and were generally people were happy to purchase fish from the project.

Partners managed to determine fish pricing from local retailers and partners wanted to ensure that the quantity of fish was high to be able to supply their fish. During the feedback the partner reported on action that did not belong to them such as approaching radio stations to advertise their project and this maybe due to feeling that their results were inadequate and they had to add something.

Partners did not advertise their project and their reasons was that they would advertise that

they have fish while they don't, the community will come looking for fish and they will not find it.

Partners once sold fish in a wheel barrow and they were bought, and some visited the project looking for fish and they were not there. Partners wanted to buy from their local government hatchery, and not from Limpopo. Fish is sometimes available and sometimes not, partners emphasized that for a business to succeed fish must be available on order.

Some partners reported that they did not approach wholesalers, restaurant, prisons and hospitals due to lack of money to hire a transport.

Obtain equipments; obtaining vortex filters was not implemented due to conflict between partners and government and this showed dependency of partners on government.

Improve aquaculture recirculating system; results showed that aquaculture system designer experts were not willing to assist partners until they were sure who was settling the bill.

Partners also requested assistance from their municipality to get hold of an engineer and they did not receive any response.

This CSF revealed underlying conflict between partners and government due to failure to pay the service provider who delivered bricks for construction of a hatchery. When he gave invoices to government, they referred him to the service provider who built the hatchery and he was never paid until the contract expired. The service provider went to the project and confiscated a generator and said he would bring it back when he received his money. Government bought new bricks and requested him to pick them up and he refused, as he wanted to be paid in monetary form.

The second underlying conflict revealed was when the local chief also confiscated a boat demanding to know who it belonged to between the project and government because it was bought by the service provider. Government also withdrew support to the project due to the missing generator and a boat.

The third conflict revealed was that government officials also failed to deliver water test kit that was bought and paid for, the service provider forgot to give to the project owners during delivery of fish feeds, and left it with government officials.

Partners had idea of selling fish quicker before they show any signs of stunting when their breeding facility is fixed.

Upgrade electricity, partners wanted to upgrade the electricity to solve the trapping issue; they reported that an electrician advised that the problem might be plugs and partners checked and it was like that.

Increase harvesting equipment; no feedback given.

Obtain aquaculture experts/expertise; partners wanted to appoint an aquaculture system designer expect with a track record of raising fish successfully to market size without upgrading his system.

Water access; partners requested assistance from extension officers who were present when inlet/outlet pipes were installed and he promised to visit but never came. The pipe that drains water was not functioning well and the one that brought water was connected to all ponds. Therefore, fish moved freely from one pond to the other this pipe.

Partners did not apply for water license due to lack money to pay for administration fees and still waiting for water driller to visit the project, the one that visited was the surveyor and he needed money to check the farm.

Partners made contributions and bought cement to plaster the leaking pond, they have put in water and the fish looked well. Water driller promised to visit the site and never came and partners wanted to switch species because their tilapia was not growing well for three years now.

Partners struggled to get hold of their extension services and they even engage them at ad hoc venues during weekend.

This CSF revealed an existing conflict that the chairperson once got a temporary work at road construction site and resigned from the project and the road construction dissolved. Now the chairperson came back to the project and denied that resigned from the project and that caused a lot of conflict.

Project registration; partners received SARS certificate and saved some money in the business account. Partners wanted to fence their project however lacked funds. Partners gave feedback on this action and reported on the results of others regarding availability of alternative fish food.

Access to reliable finance; partners reported not being able to compile a letter of project needs to the MEC because their ward counselor invited them to a meeting and promised them funds and they were still waiting.

Partners did not implement requesting funds from Agriculture due to the infighting amongst members and whenever there was a meeting they would come up with excuses of going fishing in the local dam. The infighting was caused by the chairperson who resigned before and now came back to claim his position, and the other member do not want him back in the project.

Increase availability of alternative food for catfish/ensure cost effective feed supply; partners did not implement purchasing grinding mill, chicken dung was put in an orange bag and placed at the corner of a pond, water quality deteriorated and the fish performed well. The fish were weak when given traditional brewery waste, however it lengthened their lifespan.

Partners reported that earthworms were the best for fish and growth performance was high. Fish did not prefer kikuyu grass and consumption is high when they are starving and affects the quality of water negatively, and these case partners were reporting for tilapia fish.

Grinding mill is expensive and requires finances and partners can grow earthworms. Alternative such as chicken dung, cow dung and traditional brewery waste were locally available free of charge. Fish did not consume kikuyu grass. A study was done where fish grew well on kikuyu grass but this information shelved. Some partners were growing tilapia to feed catfish because catfish consume life food and grow.

8.10. Support Needed

Funding will assist partners to grow their business and create jobs to support communities and save some money and buy equipments. Partners showed excitement of being interviewed by Closed-circuit Television (CCTV).

Partners wanted to be supported by obtaining assistance from someone who can check the sizes of the inlet or outlet pipes.

Access to water is limited and partners don't have water to exchange the pond water. Lack of finances inhibited partners to implement, check cost from eight - dimension tool.

Partners have catfish and feed them with tilapia pellets and support is funding.

Partners achieved door to door advertising of the project. Support needed is government to assist to harvest the fish so that they can sell.

Commercial partner project needed support to secure further off-takes at Department of Education, and further funding support was required to develop the product.

8.11. Achievements

Partners achieved marketing via processing plant. A graphic designer was found. Partners who missed some session on CI & I expressed feelings of being lost. Partners found that community members were interested in buying fish. Harvested and sold 50 carp fingerlings and they managed to make R250. Partners bought petrol for grass cutters and cleaned their ponds. The action was very critical to partners because they wanted to proof that they could be independent from government, therefore their excitement was very high. Partners acquired knowledge about catfish living conditions through self - study despite their old age. Partners acquired knowledge about catfish artificial propagation.

Some partners were still shy to express themselves in front of others and when encouraged to present they seemed unprepared and confused.

Chicken waste were placed in an orange bag and placed it at the edge of the pond to feed fish and determined that water quality was compromised, earthworms were mostly preferred by fish and caused them to grow faster. Earthworms and chicken waste made fish to grow, however some partners were confused by giving grass to fish. Business registration

certificate, struggling with funds and others supported that they must prepare ponds by themselves. Partners displayed knowledge of the sizes of ponds going down should 1.5m and also as woman already dug her own pond.

8.12. Failed to Achieve

Failed to secure training and advertising. Training did not achieve. Partners would obtain Permission to Occupy (PTO) from their local traditional house, these partners reported about availability of food in the previous session and in the current session presented about their own Critical Success Factors (CSFs).

8.13. Tool Assessment

In result assessment tool, liked and ease of use had mean 8 and median 9; thinking enhanced mean 9 and median 9, time was median 5 median 5, cost of not doing 8 and median 8, value mean 9 and 10 median, motivation mean 10 and median 10.

Achievement stacker assessment, partners liked the tool with a mean 9 and median 9. Ease of use and thinking enhanced scored mean 8 ad median 9. It took partners medium time to apply and most of not doing the tool achieved second highest score 8 and median 9. Partners were highly motivated to apply the tool again with a mean 9 and median 10.

8.14. Creation and Synthesis

Generated Black Hats

The outcomes of the black hat - the logical negatives, why it won't work showed that 22% of partners articulated unregistered business and they were not funded. At least 8% did not know where to obtain aquaculture funding. A total of 5% articulated that government assistance was always incomplete, some lacked the impetus to continue farming, cooperative conflicts, and lack of market access and preferential treatment from famers support were articulated by 3% of partners. Additionally 3% reported fish farming takes long to generate income, unavailable financial information and old age restriction inhibited access to funding displayed in Figure 8.2.

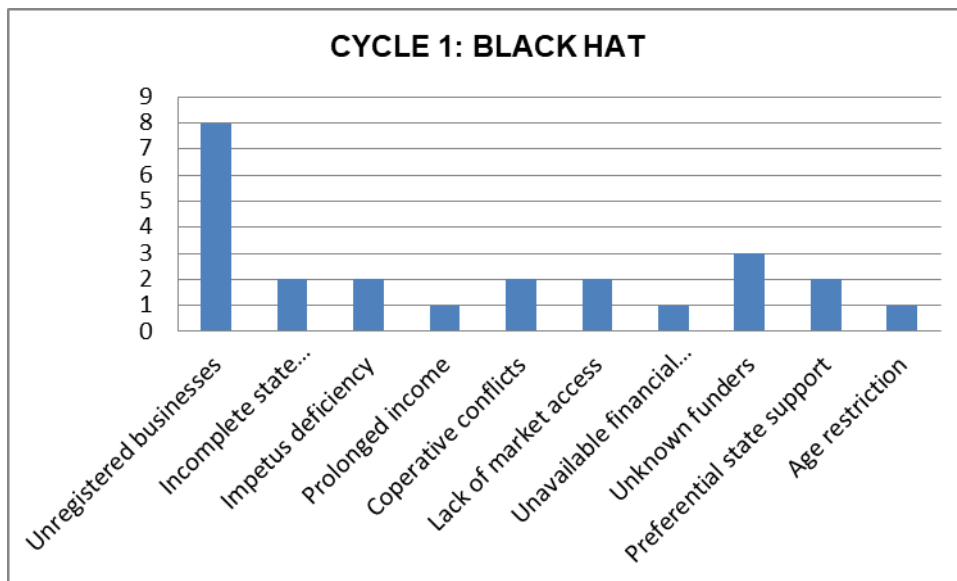


Figure 8.2. Outcomes of black hat-reasons why it won't work

Unregistered businesses; the results showed that partners lacked business address, tax clearance, business account, and the type of business plan partners had was incomplete. Lack of updated information regarding government activities and there were no regular meetings held to discuss business progress and plans.

Partners placed unreliable information on the applications form with the fear of losing benefits if they indicate that their business have no address and other reported not knowing where to obtain funding. Lack of Permission to Occupy (PTO) and registration fees; unclear farming priorities in business plan; formal project registration and limited government support inhibited funding to be acquired.

Impetus and motivation deficiency; partners with indoor systems reported feelings of being stuck and not being able to move without funding access and that made them to lack the drive and motivation each morning. Other funding requirements stipulated that people must be in cooperative setup and they felt demoralized and forced to be in a cooperative.

Prolonged income generation; farming with fish was a long process of waiting for them to grow before they can generate income from the ponds.

Cooperative conflicts; partners reported lack of unity and problem solving in cooperatives to be able to plan and move forward. Others reported that working in a group is hard as other lack commitment and they do corruption and fail to produce proof of purchase, partners had a good example from a poultry farm in their community that was heavily sponsored by government and today they dissolved.

Absence of market access; partners do not have market access even though they have fish in their systems.

Unavailable financial information and expertise; partners lacked financial information that reflected correct financial figures to assist them during business plan compilation. There were no experts available to assist with the business plan at an affordable price. Without a business plan partners cannot secure a market because they don't know how much would be the production capacity.

Unknown funding organization; partners were not familiar with methods of requesting for funding, where to obtain funding and who would be offering the funding. Projects needed to be recognized by government to be in a good position to obtain funding.

referential government support; partners reported that when their projects is loved by government, it would be recognized, supported and recommended to receive certain benefits, and if not then they would be ignored. Therefore nepotism existed in government funding processes.

Age restriction; age restriction also inhibited partners to obtain funding as government prioritizes youth and women.

Generated Yellow Hats

Partners were requested to think about yellow hat- logical positives, constructive. The results showed that 16% of partners reported that funding would improve business pitch to funders. 14% articulated funding would improve their infrastructure and equipments. 11% of partners reported funding would create jobs via fisheries. 3% articulated that they would be an exemplary business, obtain business plan, work as a team, more focused on business development, and understand their business plan (see Figure 8.3).

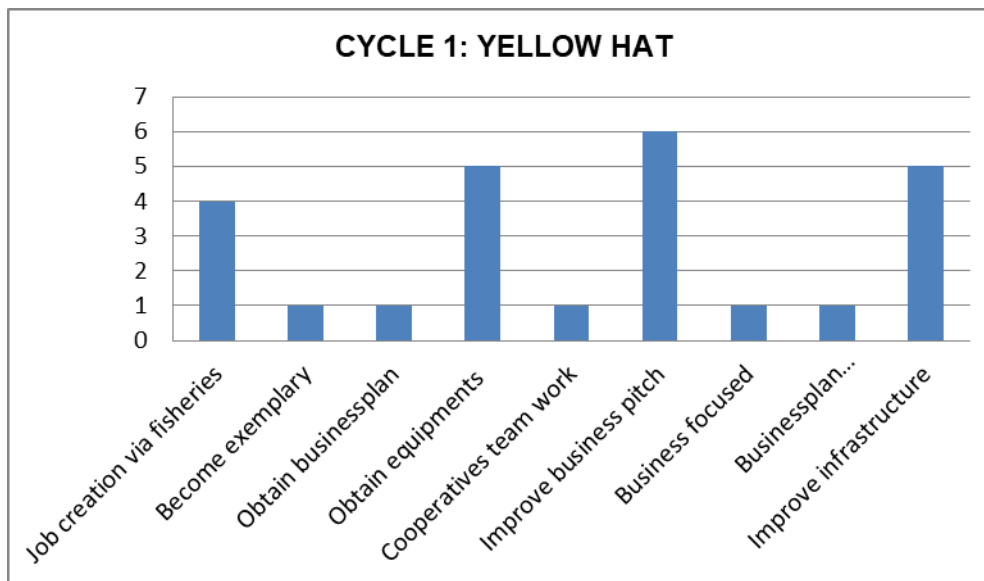


Figure 8.3. Outcomes of yellow hat- logical positives, constructive for cycle 1

Job creation via fisheries; funding would assist in job creation for youth, be in a position to purchase a boat, vehicle and harvesting equipments to engage in fisheries while awaiting for the indoor system to be fully functional. Partners would be in position to be in full production and reduce high levels of unemployment.

Improve livelihoods and enhance fish production and create employment and eradicate drug abuse by youth. There would be progress in the business and create employment. Projects would become exemplary in communities and would be able to teach them about aquaculture.

Obtain business plan; to obtain and pay for a business plan and also obtain a fish license.

Obtain equipments; purchase cartridges for the printer and make copies for people. Some partners needed to obtain grass cutting machine to clean their ponds, waders and nets. Partners wanted to obtain a small boat to be able to maintain fish ponds, a vehicle to be able to attend meetings and refrain from asking for people's vehicles.

Cooperatives team work; working together effectively and generate ideas that would make them succeed.

Improve business pitch; partners would be in a good position to approach funders and also determine if what they are doing made business sense. Partners would be able to determine their cash flow and know if they would be profitable or not. Funds would improve overall business life; motivates for hard work to make fish appealing in order to generate income; manage a sustainable business and purchase items with ease.

Business focused; partners would be fully focused on the business operations without

worrying about input costs and implement what is in the business plan to be able to succeed, however it would be problematic to obtain funding on a business plan that they lacked understanding.

Business plan understanding; most farmers failed to implement because they were given funding for a business plan that they did not understand. They wanted to be clear about what needs to be done, what would be prioritized on and which activities could be implemented for profits. Partners wanted to avoid being gossiped and labeled as mismanaging government funds.

Improve infrastructure; partners would construct more proper ponds covered with a shade net and also replace the inlet/outlet pipes. When these items were in place, partners would be in a good position to search for high standard markets. Partners would build an abattoir. Business growth, create jobs and work truthfully to ensure that money is well spent and search for market. However, others reported a high demand of fish from local / community market. Partners indicated infrastructure would make them to be highly committed and motivated.

Fish would grow and reach market size on time and they would be able to meet demand and supply and that would cause business to bloom. The system that is not fully functional caused partners to feed fish less and affected its growth performance.

Generated White Hats

In white hat, partners were asked to think about the facts, data, figures and information about funding. The results showed that 27% of partners articulated that funding would grow their business, while 11% reported no progress without funds. 8% articulated unreliable service providers, 5% reported they would obtain equipments with funding and 3% they were unable to care for their families due to lack of income in fish farming displayed in Figure 8.4.

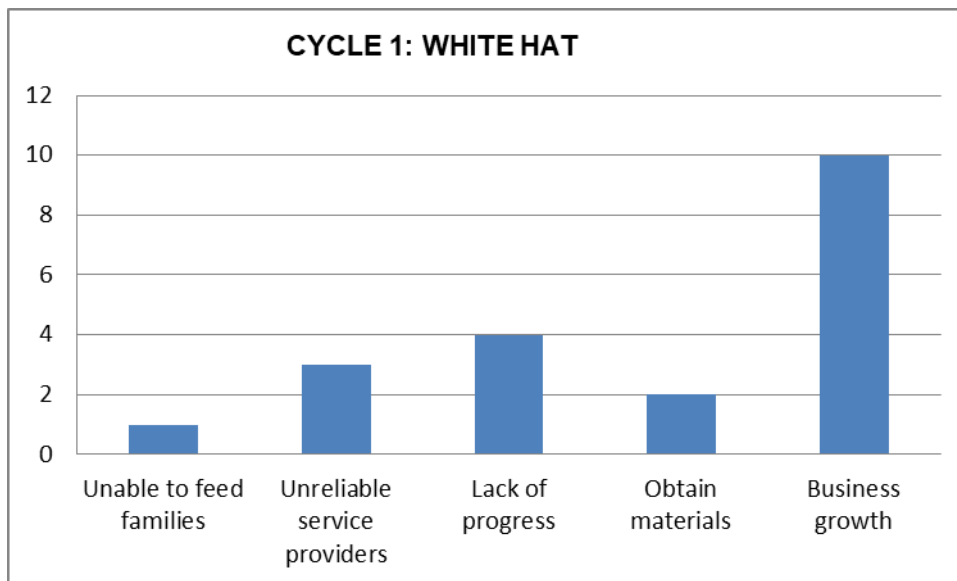


Figure 8.4. Outcomes of white hat- pure facts, data, figures and information for cycle 1

Unable to feed families; partners indicated that their business is struggling and they were also affected because they cannot feed their families and unemployment is very high. If they have funding they would be able to hire people in the business.

Unreliable service providers; partners reported an incident where they paid a business planner to compile business plan and he never did. The business planner visited the project to advertise his business referred by the bakery manager. He robs poor people who are trying to make something of them.

When someone is compiling a business plan alone they might include things that were not in line with our thinking, therefore it is essential to be involved to reflect your own ideas.

Lack of progress; there would be no progress without funds. Acceptance of the fact that the business is not generating income and work together to build the business. Without a business plan, you are already planning to fail because the idea might not be profitable; therefore, business plan assists them to know exactly what to implement and how it would generate income.

Obtain materials; obtain equipments and also to pay salaries and obtain a vehicle.

Business growth; funding would make aquaculture thrive and the management would be good. Be exemplary to the community that indeed aquaculture is a good business and purchase their own vehicle. Business growth and income generation. Increase fish consumption rate of food. To demonstrate to the community that the business is doing well and create jobs. Fish would be distributed to other nearby town because transport would be available and people would be able to obtain fish at a reasonable price.

Production would increase and equipments would be obtained and you would succeed. Funding would be able to employ more youth and the old aged people would transfer skills to the young ones. The water in the indoor system would oxygenate, consumption rate would increase and water quality would be good with funding.

Generated Red Hats

Partners were encouraged to think about emotions and feelings, hunches and intuitions regarding funding. The results showed that 27% of the partners reported that funding would create progress. 8% reported emotions and feelings of tendering their resignation from projects and aquaculture lacked business plan compilers. 5% articulated that government had no sustainable projects and they were not familiar with how to apply for funding. 3% of partners reported prolonged funder response, government economists was inactive, partners were in possession of misleading business plans, funding is given to their relatives and they were sabotaged by government officials (Figure 8.5).

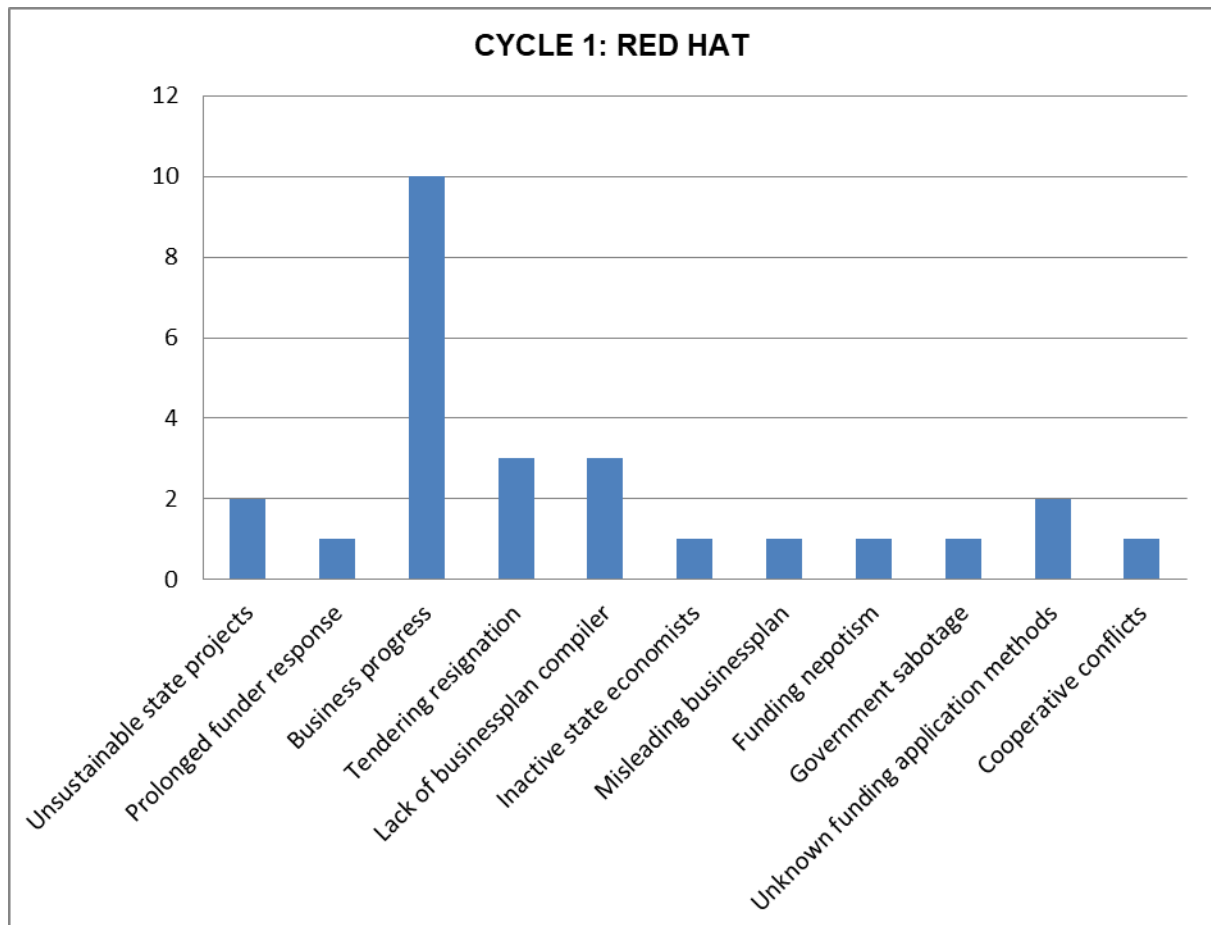


Figure 8.5. Outcomes of red hat- emotional and feeling, hunches and intuition for cycle 1

Unsustainable government projects; government funding was slow and there were no exemplary sustainable projects that partners knew and what caused frustration was that they would assist you in 30 minutes, raise your hopes and after that you realize that they were failing and just doing it for the sake of reporting to the Member of the executive Committee (MEC). Sometimes they rely on prayers to obtain an approval.

Prolonged responses from funders; funders do not give straight answers whether they would fund or not, they often left partners hanging.

Funding creates business progress; partners would have made lot of progress if they were funded. When the project was working well they would be hosting students and visitors and that might impact on their business.

Partners would be in a position to buy materials; partners would purchase equipments and sort the issue of water and predation that made them feel so sad. Funding would make partners happy and motivated and plan properly.

Some partners mentioned they would fix their indoor system and strive to be independent from government. Experts would pretend to know how to fix indoor systems but they don't. Without funding nothing would be easy and they would also be unable to attend meetings. Everything was centered on money. Some partners did not grasp the red hat properly and failed to report.

Tendering resignation; partners felt tendering their resignation from the business; however, felt that either chairperson or vice chairperson should reign for the sake of progress. Both of them contributed significantly to the business for example if there were a break-in, the chairperson volunteers to stay at the project, while the vice-chairperson looks for funding. Some partners showed a spirit of not giving up on applying for funding, and believed funding would grow their business.

Lack of business plan compiler; partners have no one who can assist them to compile a business plan, the one they have someone just compiled it for them and it does not speak about what they do daily. They have one template of a business plan applying it from one project to the other, just changing company names. They normally compile it without consulting the partners and they have a business plan for the sake of adhering to funding application requirements.

Inactive government economists; when the researcher probed asking if partners had a dedicated economist from government. The response was that, someone once came from

government and requested aquaculture financial information from partners and they did not have and they ended up been stuck and looked for someone who can do it at a cost. However, this time partners were looking for someone who would interact and take them through the processes step by step. Someone who would engage them step by step.

Misleading existing business plan; researcher probed further asking if partners ever applied for funding with the current business plan. The response was that, that type of a business plan was dangerous because it did not reflect true project information. They would submit it to funders and did not reflect their business and if they obtain funding and they would not be able to translate and implement. A true business plan would assist them to grow as a business and not steal government's money just like other projects given as examples.

Funding nepotism; funding from government would not be given to dedicated project; you have to know someone inside to receive it.

Government sabotage; partners expressed feelings of being hurt by their aquaculture government personnel who failed to nominate their name when the stakeholders were looking for aquaculture projects. Just by luck due to partner being part of another organization, the chairperson knew the partner and was able to nominate them. The aquaculture official conduct frequent site visits at their business and she failed to mention their project to stakeholder gatherings to receive assistance. Now the stakeholders wanted to visit partner's project and suddenly the aquaculture official remembered them and was facilitating the visit. Researcher observed the amount of anger and frustration partners were having regarding this matter.

Unknown funding application methods; some partners do not have experience of applying for funding; they just rely on requesting donations from community members, and were told by extension to be in a cooperative for them to be assisted. The method of requesting funding is doubtful that they would acquire funding.

Cooperative conflicts; to be a cooperative was problematic to partners because members pitched up when they hear that the project was funded to claim their shares. Partners had a good example of a cooperative for fish farming where members abounded the project but when the chairperson sold fish they would come back and demand for money to be shared.

Generated Green Hats

Partners were asked to think about creative, provocative and beyond the obvious ideas regarding funding. 60% of partners articulated that they needed to seek funding independently from state. 3% reported ideas such as top state management should

strengthen monitoring and evaluations of projects, some thought of seeking assistance from prayers, some wanted to be involved during compilation of business plan, business plan comes at high cost. Follow state procedure when seeking assistance and funds were misappropriated in projects in government (see Figure 8.6).

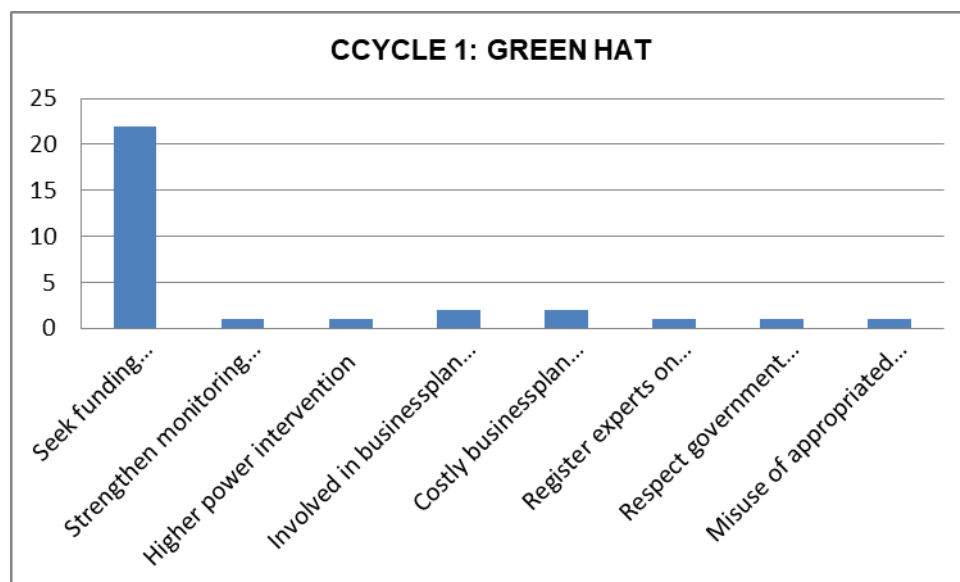


Figure 8.6. Outcomes of green hat - creative, provocative and beyond the obvious ideas for cycle 1

Seek funding independently

Partners indicated a number of places where they would obtain funding from National Development Agency (NDA), Social Development, National Department of Agriculture and they could advertise on social media and place pamphlets in shop to attract funding.

Partners suggested making small contributions towards their own projects and sell other things such as sweets, register the project and open a business account and obtain proof of project registration.

Funding would assist partners to build an abattoir and they would request fish breeders to come and train them on site. Partners wanted a vehicle to transport their produce.

The fish net that partners used was hurting fingerlings, therefore, they needed a net with bigger mesh size to be able to release the fingerlings during harvesting.

Partners did not like the manner in which they were looking when they slaughtered the fish and would like to have protective clothing, processing clothing and processing equipments.

'To improve our project by buying our instruments by feeding our fish to grow very fast, to expand the place where we are before and in our place we can do more ponds if possible (Funyufunyu FF76)'

'By having extra chemicals for cleaning water and improving the business (FF77).'

'Funding will buy more food, funding will improve my ponds (Tshaundi Tshelwala CF32).'

'I will start by looking for different types of fishes and get what will make us quick profit. Buy good food for our type of fishes we have. Improve our fish ponds, increasing the number or sizes of fish ponds if what we have seems small (FF78).'

Partners wanted funding that fund individual projects and not cooperative.

'For you to get funding you must do business plan, everything, tax clearance and have them with you (Jubelly JB27).'

You have to have tax clearance, business plan to be able to be funded, 'If you don't have a business plan you will not get anything (Masibambisane MB10).'

Partners would make awareness campaign and open fish and chips. Putting solar system, installing new pumps and doing value adding. Partners had an idea of approaching retailers and hotels to request for funding. Partners reported an idea of feeding fish integrated farming with chicken house on top of a pond. Fish would consume the chicken droppings and then the water will be used to irrigate their crops. This will increase chances of applying for funding from chicken farming sponsors. Some partners reported various other ways of raising funds such as owning car wash and hosting beauty pageants.

Strengthen monitoring and evaluation of project; some partner suggested strengthening monitoring and evaluation system that report to the office of the Member of the Executive (MEC), they should run all the projects and monitor them to have sustainable businesses.

Higher power intervention; partners suggested praying for their members to be able to solve their conflicts so that they can be able to plant vegetables and sell, buy hake fish, fry and sell.

Involved in business plan compilation; the business plan partners had been not been in consultation with partners and they don't understand it in order to be able to present it. They just have it for the sake of applying for funding. Now they wanted to obtain someone would assist them with a business plan that they would understand.

Costly business plan services; professional aquaculture business plan compilers obtained from the internet charged R24 per kilometer when they conduct business site visits, and required accommodation to organize for a week. Partners showed dependence on government by reporting that it would be easier and cheaper if the business plan designer was organized by government and not them.

Register experts on funder database; there are no aquaculture experts knowledgeable with fish available anywhere. So partners submitted to Small Enterprise Development Agency (SEDA) the name of the above mentioned service provider and they asked SEDA to look

into paying for these services in their business.

Respect government process; partners were cautious of not burning bridges by not following government procedure when requesting for business plan assistance which might bring negative consequences.

Misuse of appropriated funds; partners misuse funded monies and end up failing to implement and they needed to put a management that holds people accountable. Partners reported an idea of feeding fish integrated farming with chicken house on top of a pond. Fish would consume the chicken droppings and then the water will be used to irrigate the crops. This will increase their chance of obtaining funding from chicken farming sponsors. Some partners reported various other ways of raising funds such as owning car wash and hosting beauty pageants.

Generated Blue Hats

Partners were requested to summarize all the hats together. 19% of partners would obtain funding independently from government. 8% articulated that funding would create jobs and pay salaries. 5% reported they would register their business formally. 3% articulated that state support was incomplete, state was under administration hoping for service delivery to speeded up, improve problem solving skills in cooperatives, familiarize themselves with making a submission of queries to the highest state offices and they would obtain project materials (Figure 8.7).

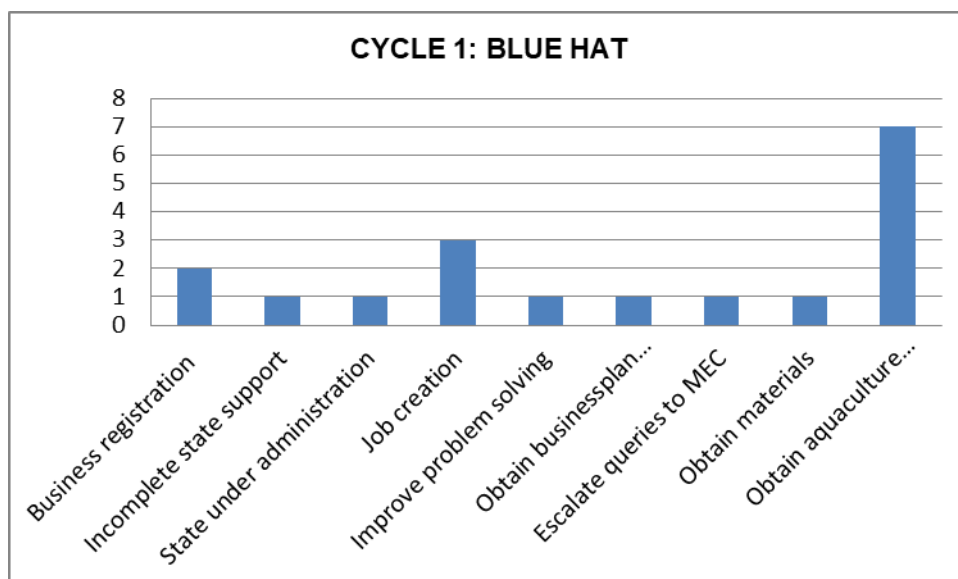


Figure 8.7. Outcomes of blue hat - summaries, thinking about generated hats for cycle 1
Business registration

The results for the summaries of the hats as lack of proof of address, tax clearance, and business plan made us to struggle to obtain funding. Funding would assist us to have proof of address, equipments and the business would flourish.

Incomplete state support; even when you can obtain funding, government and service providers could eat your money and promise things that they will never deliver, government could give you a system and they say work it out for yourself.

State under administration; MEC has put Department of Agriculture under administration to uproot the nepotism and corruption.

Job creation; we can be able to create jobs with funding and improve livelihood and we must also contribute small monies in our business. Funding would create jobs, and be able to pay salaries. Partners would look for people whom they could relate easier with, who do not come to work drunk. It was important for partner to make the members of the cooperative to cooperate with each other to achieve more; Agriculture should assist to resolve this matter.

Obtain business plan specialist; partners wanted someone who is an expert in aquaculture systems to compile a business plan for them to avoid having problems of water quality later and end up with fish mortalities.

Escalate queries to MEC; some partners thought about escalating their queries to the MEC's office in order to obtain assistance.

Obtain materials, funding would assist us to obtain proper equipments and protective clothing and have an abattoir and be in a position to request fish breeding team to offer training.

Obtain aquaculture funding; partners indicated that their business would improve if they were familiar with places where funding was offered. Funding would make fish to grow quicker and make profit. To qualify for government funding partners have to be in a cooperative setup and partners also lacked business plan. To qualify for funding partners require the correct information and places where they could apply. Funding would enable partners to hire a professional system designer with a track record for their fish to grow faster and reach market size. To install a solar system as an alternative energy supply, fixing the indoor system and making value adding on catfish products would generate income.

Thinking hats generated in cycle 1

Red had generated highest number (11) of emotional feelings in this study; followed by black hat (10); blue hat (9); yellow hat (9) respectively and the least number was found in white hat (5) (see Figure 8.8).

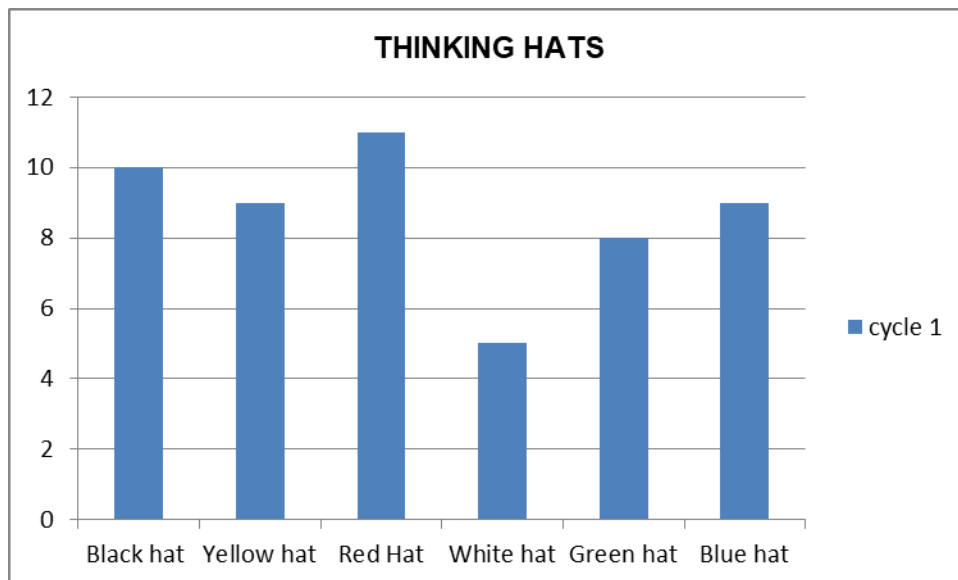


Figure 8.8. Frequency of ideas in each thinking hats

Quality of Experience

Understanding of CI & I concept was high with a mean 9 and median 10. Value of the concepts was high with a mean 9 and median 10. Use of CI & I mechanisms was high with a mean 8 and median 9. Use of CI & I steps was high with a mean 8 and median 9. CI & I process was high with a mean 9 and median 10. Cycle 1 was high with a mean 9 and median 9 and cycle 2 was high with a mean 8 and median 8. Motivation was high with a mean 9 and median; Support was high with a mean 9 and median 10. Satisfaction was high with a mean 9 and median 10. Interest was high with mean 9 and median 10. Stimulating thinking and action was high with a mean 9 and median 9. Session value was high with a mean 9 and median 10. Being part of innovation and improvements in groups was high with a mean 9 and median 10.

All of the *mechanisms enhanced thinking and action* and received a high score of 10. Partners only reported mixed feelings on the brainstorming tool reporting that it lacked guiding information on how they should brainstorm. Some reported being comfortable with the plan, do, review process and CI & I was overelaborated and it cannot be suitable for commercial businesses.

Partners were asked to score out of ten the quality of experience (Figure 8.9). There was increase understanding of CI & I concepts with a mean 9 and median 10.

'Understanding of the concept is high because we've been doing them, we really do believe in the process the whole planning, doing, assessing how well it went and planning again which is essentially what we are looking at here. Yours is somewhat in-depth process but the principle is the same (Karoo Catch KC41).'

CI & I Provided guidance, *'It has opened our eyes (Lephoi LP51).'* The steps assisted the business to be managed better, *'Yes, without those steps believe me there is no business that is going to run smoothly. You have to be involved in that CI & I steps from 1-7 in order for your company to move in the right direction (One Vision OV57).'*

The process improved thinking, *'It has helped us a lot of thinking and to improve our knowledge (Gariep Dam GD57) and without it we did know nothing (Gariep DamGD58).'*

It gave knowledge and guidance to partners, *'We understand that it was able to give a lot of knowledge of how to go about many things and the direction of where to go (Tladinga TD06).'* and the initial plans can change as action is implemented *'We understood its importance because when we start with step ten because they are building up from each other, by the time you finish implementing your first action, it would have changed already (Tladinga TD05).'* Improved business management strategy, *'now I've got a green light to do about my fisheries (Funyufunyu FF36).'* Partners were aware of the constraints that required fixing to have progress derived from the research, *'we understand it because we are fixing the issue of a business plan to move forward and that comes from this plan (Mudau MA39).'* Partners were able to identify problems and solve them, *'It made me to realize many things, and it was able to guide me to be able to solve things that I was not able to solve initially, now I can (Disaneng DS01).'*

The value of CI & I concepts was very high with a mean 9 and median 10. The tool was essential, *'It is vital it is very high (Karoo Catch KC41).'* The thinking was improved, *'since the start of this tool I was never absent so that's why I say my thinking improved and I have some actions since it started (One Vision OV57).'* The course was unique and brought a lot of enthusiasm, *'So most people who has not done this cause they don't know about fish, they only catching fish, breed fish, they don't understand the whole concept of this course of us so now we are very happy that you came by and gave the course (Gariep Dam GD57).'* The concept was able to clearly distinguish between the negative and positive opportunities, *'It is very important all things we started today the negatives ways and positive ways, we take the frustrations even the ideas how to do about the frustrations (Funyufunyu FF36).'* Some partners indicated the importance of the CI & I as a diagnostic and problem solving

concept. *'So it is important to troubleshoot and diagnose, that is true because some of our projects are not profitable and part of this CI & I is to help us identify where the problem lies and be able to solve problems that as a business have experienced (Jubelly JB26).'*

Use of CI & I mechanisms was high with a mean 8 and median 9. CI & I process was too detailed and some steps could be combined, *'Although I fundamentally believe in the process, for me this is unnecessarily detailed, for me there is steps here that are not warranted and there are steps that could be combined. So from a commercial perspective I wouldn't want to streamline the process maybe not as streamline as plan, do, review, definitely streamline it but the need to do it is not negotiable (Karoo Catch KC41).'* It's a stepwise guidance; *'it is a good tool because it goes step by step (Lephoi LP51).'*

The mechanisms were difficult initially and became understandable with time. *'We are in cross place because it was a little bit difficult because we did start it from number one, right now I don't have a problem with it (One Vision OV57).'* CI & I solved existing business challenges and outcomes were re-fenced in the business. *'The way it is, everything we troubleshooted involved all our activities in the business, to get more understanding, last time I mentioned business plan is there, business cards are there, branding is completed, the only thing not done was to air on radio, so part of the outcome of the whole thing was to produce all those things (Jubelly JB26).'*

Use of CI & I steps was also high with a mean 8 and median 9. Partners showed enthusiasm in the steps, *'I would exactly follow those steps (Karoo Catch KC41).'* Another partner mentioned the steps are good for step by step guidance from the beginning to the end. *'The use of steps I think it is okay because it starts there by the focus and you go to situation analysis, every step it gives you where you are going from step one to seven, you can see where you must start and where you must end (One Vision OV57).'* Partner emphasized the need to have right tools for the job and the importance of following the sequence of steps. CI & I steps provide step by step guidance; *'We understand the steps because they can direct you from one step to the other (Tshaundi Tshelwala TT30).'* The process performed problem diagnostics and guidance to solve them, *'We were able to trouble shoot and identify what kind of problems we have, which ones we can improve, we didn't also achieve business funding (JB26).'*

CI & I process was high with a mean 9 and median 10. Cycle 1 was high with a mean 9 and median 9. Activities from CI & I cycles were easily forgotten due to engagement in many other business commitments, *'We forgot because we've got other staff that are like top of*

mind (Karoo Catch KC42)'. Some partners found the cycles to be more re-learning from the beginning than building up. 'The time framework is too long, for me to understand something, I need to see pictures and I will be able to do it, that is how I really grasp something it's a repetition and the repetition timeframe is like it, it's almost re-learning from scratch each time rather than building on previous experiences (Karoo Catch KC41)'. Cycle 1 was forgotten because of many other responsibilities, 'Once the session is over and I go home there is another stress that is coming, I did even go to the clinic to go and check my high blood pressure (One Vision OV57)'. CI & I increased confidence and improved partners with business management skills, 'I feel good because these sessions educated me how to do things step by step (Funyufunyu FF36)'.

Motivation of partners is high with a mean 9 and median 10, 'as I said to me for a commercial operation is too detailed, but I am not a detailed person (Karoo Catch KC41)', and, for me process is very important I would have the steps written down and I would have notes under each one (KC42)'. Partners indicated that if the research was introduced during the initial stages of the business they would have had a lot of progress. 'We are thankful the manner in which you were teaching us, even the things that we were not aware maybe you should have introduced when the time was still there, when we were starting maybe we would have been far by now with our project, but we are promising to keep going up (Lephoi LP52)'. Partners expressed not to give up hope and keep trying. 'CI & I has helped us, even when doors do not want to open, go next door, knock again, maybe one day you will find hormones being okay. It has uplifted us too much, sometimes you find that he has a problem and hopeless without knowing what to do, with funding we are depending on Agriculture only, we didn't know we can ask other organization, it is something, it is a big something (Disaneng DS04)'.

Support received from CI & I was high with a mean 9 and median 10. The process gave partners support to continuously improve, 'as a process whether is this one or plan, do, review, yes definitely. You cannot I don't think you can go forward until there is continuous improvement, otherwise you just doing the same thing day in and day out (KC42). Although the process was the first being seen by partners, partners felt supported and motivated to know it by heart and apply it across all their business weekly.

'Personally from my side there are things related to business that we know but in terms of CI & I, like this it was my first time seeing it. It has supported us a lot and we still want to know it by heart like the book of Genesis in terms of how to use it in terms of physical the things happening in the business, but in terms of knowing the cycle without looking, I am more motivated to put it in every business I make exactly, it will be very nice to make a weekly one, it will really be nice (Jubelly JB26)'.

Satisfaction was having a mean of 9 and median 10. Partners expressed the joy of knowing things are done better. *'It's really nice to know you are doing things better but again it is the type of people we are. We don't like to do the same thing, the same way over and over (Karoo Catch KC42)'*. Some partners gave satisfaction a low score, *'because to me the process is unnecessarily hmm... It has got too many steps but I feel like I am repeating myself for the previous ones, for me this particular process is too detailed, too detailed for daily, weekly, monthly application on a business (KC41)'*. It was further added that the process gave them satisfaction, *'it gives me big satisfaction all the time, but it is because of the way I work, I like to have it and that is why I get the job of writing a business plan and then things will run around and gather all the information and throw it at me (KC41)'*. CI & I gave partners tangible evidence. *'We are satisfied because we had results, if there were no results the score would have been low (Tladinga TD05)'*. CI & I taught partners how to manage fish farming business, *'it has helped us to know how to do fish farming and it has helped us not to lose hope (TT30)'*. Some partners still needed to learn more from the process, *'I am satisfied but I still want to learn more and more (JB26)'*.

Interest of partners was high with a mean 9 and median 10, *'definitely, again you can't run a commercial business and not continuously improve, you just going to go back, back and back, I prefer the more detailed approach especially if we are doing it more often and we were applying it to everything that we do and not just an overarching. So it sought of like forced continuous improvements by having this process in place your forcing people to improve (KC42)'*. Running a business without advice and guidance causes lack of progress, *'The thing that you've been doing was a right thing because when you run a project without advice you will not go far, so you've been guiding us from the beginning until now, it is an important thing (LP51)'*. Research makes partners to learn new technologies, *'I am interested because without fish research this nowadays you can't do anything, how will you know about new technology outside and the entire dream (OV57)'*. The process was able to provide comfort to partners to achieve something against all odds, *'we are interested it, it has helped us a lot and it was able to comfort us and we have achieved something (MB10)'*.

Partner indicated that CI & I stimulated their thinking with a mean 9 and median 9. The value of CI & I sessions held was very high with a mean 9 and median 10.

'You see again if we look at a perspective of, if we didn't have a process this would be very valuable (Karoo Catch KC41) and remember we upfront knew the importance of continuous improvement process was important and so what we've been telling you here is what we are doing in parallel (KC42)'. Some partners were able to think better about business expansions to increase other streams of income. *'My thinking improved to tell you the truth*

even right now I am busy with the garden at the back and now busy with the Department of Land Reform with funding for an ice cream machine, and It helped us to think better because before we just thinking for the sake of thinking but now we know that there are timelines (Tladinga TD05)'. Partners learned about how to construct a pond, 'now at this moment I know how to make a dam and also go to my place and I make a dam, now I've got a dam and I will continue with the opportunity of how to make my goal (Funyufunyu FF36)'. Partners wanted to learn more from the process and its outcomes were valuable, 'I felt like we could have had more and to keep the brain stimulated, when you are taught something at the beginning you struggle, once you see its value, its outcome had value and that's why we were here until business has a profit (JB26)'.

Being part of improvements and innovation groups was high mean 9 and median 10. I think that is group work was better because you have more points of view, sometimes completely different angle. As long as you have the same goal, it gets it interpreted in different ways. 'I think group is important, if you do it as wells as if you are in a group (Karoo Catch KC42)', and 'I wanted to say I work on my own 99% of the time, its only when I am here but each time everything I do is on my own and I can see the difference. Working with other people definitely stimulates to a much broader thinking hmm and you achieve so much more when working in a team (KC41)'.

The sessions were essential to be able to learn how to manage a business. 'The sessions were very valuable because without those cycles you will never run a business, without CI & I cycle you will never run a business you going to stay there at the back, that is why I never missed a session (OV57)'. Partners value in working hard together and encouraging each other, 'It is good because you can push together, you can ask each other and also help each other and to give us inputs, if it was not important we would have not known each other (Mthaiza MT23)', and 'We managed to learn from others who were doing well in the things that we were struggling with (Jubelly JB28)'.

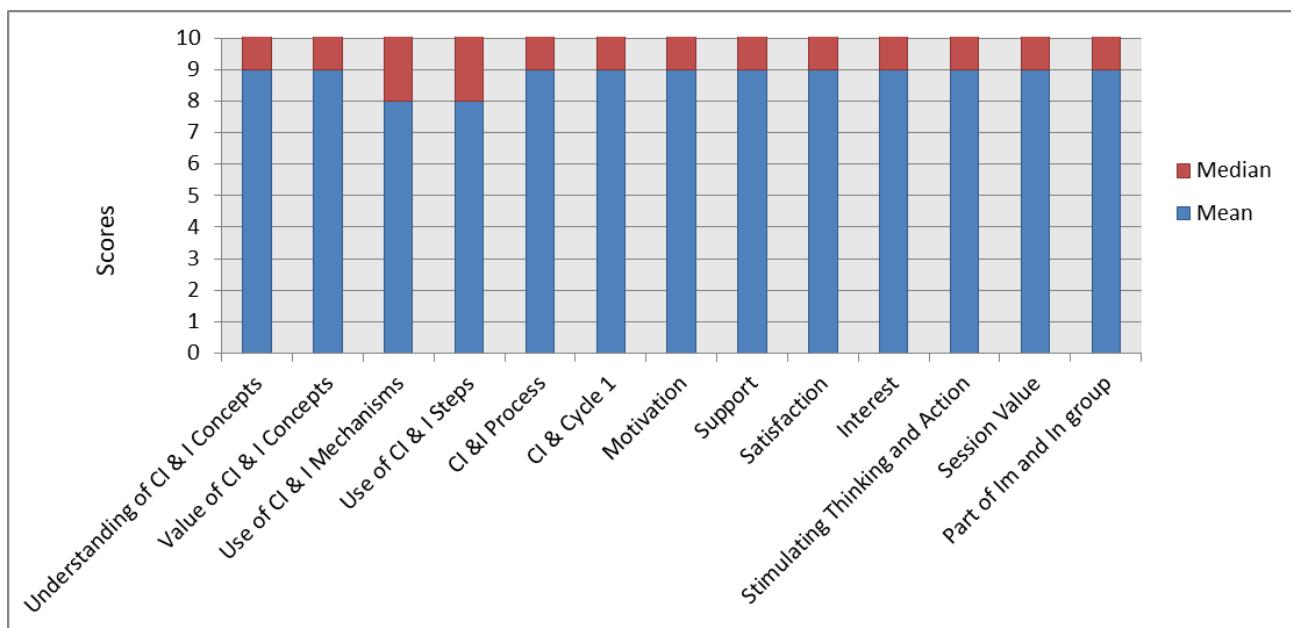


Figure 8.9. Scores for quality of experience in CI & I Process from all the partners

CHAPTER 9: Effect of different types of feed such as pellet, live earthworms (*Eisenia fetida*) and tilapia fish (*Oreochromis mossambicus*) on the growth of African catfish (*Clarias gariepinus*) fingerlings

9.1. Introduction

The above topic was derived as a result of the action implemented by partners to demonstrate the applicability of the Continuous Improvement and Innovation (CI & I) model in the real life researches. World population is on the rise causing an increase in the demand and supply of animal protein (Bahadori *et al.*, 2017). The demand of fish as food globally is increasing (FAO, 2019) and aquaculture sector is continuously searching for ways and means of reducing production costs in which feeds are amongst the highest input costs to realize sustainability (Musyoka *et al.*, 2019). Feeds account for 50-80% of production costs (FAO, 2017) attributed by the rising costs of unsustainable fish meal hence the need to explore other locally available food (Musyoka *et al.*, 2019). Fish meal has high nutritional qualities and palatability properties and was preferred as the main dietary protein source (Musyoka *et al.*, 2020). Its availability in future is also diminishing (Goda *et al.*, 2007) and this demotivates rural people to farm with fish (Gbai *et al.*, 2018).

FAO (2017) reported that significant efforts were made to reduce the dependency of aquaculture on fish meal. The use of insects as live feed or protein replacement demonstrated their prospective use in aquaculture due to their high protein content (Ng *et al.*, 2001; Bahadori *et al.*, 2017, Belghit *et al.*, 2019). *Clarias gariepinus* are indigenous to many African countries and have wide eating habits of literally feeding on everything on their way (Loveline *et al.*, 2018), from crustacean to fish and predation was evident in invertebrate prey (Bruton, 1979). In Lake Sibiya, food items such as crabs were 40% and 32 % were small cichlids and other food types were insects (12%), mollusks (10%) and small amount of algae and diatoms in the stomach of *C gariepinus* (Minshull 1969 as cited by Bruton, 1976). Furthermore, 164 specimens of the stomach content of *C gariepinus* showed that 33% were fish remains and 9% were identified as cichlids (Bruton and Bolt, 1975 as cited by Bruton, 1976).

Vermiculture has being in practice for centuries and are being revisited for the potential in Agriculture and aquaculture (Mohanta *et al.*, 2016). Earthworms (*Eisenia foetida*) have been identified as the best fish meal replacement due to their high nutritional value, they grow and reproduce quicker and have the ability to withstand all sorts of environmental conditions (Dedeke *et al.*, 2001; Bahadori *et al.*, 2017, Musyoka *et al.*, 2020). Profitability of farming with earthworms as fish feeds remains controversial to date due to the existence of anti-nutritional elements and incorrect processing methods (Musyoka *et al.*, 2019, Musyoka *et al.*, 2020). Although earthworms were also widely used as a bait in commercial sport fisheries for long periods (Tacon *et al.*, 1983), their moist and sticky nature causes

harvesting to be prolonged and time consuming prompting earthworms to release foul smelling coelom fluid, which causes un-palatability and toxicity to fish (Kobayashi *et al.*, 2001). They are made of 580-710 g/kg of crude protein and have increased concentration of Lysine (Loh *et al.*, 2005). Earthworms are conventional fish food and contain all the essential amino acids including increased iron content (Charkrabarty *et al.*, 2009).

Rural farmers commonly farm with Mozambique tilapia (*Oreochromis niloticus*). The species is limited by reproduction at an early age causing farmers to sit with overpopulation of undersized and un-marketable fish (Guerrero, 1975). The solutions were to produce all-male tilapia due to their growth abilities to reach market size quicker (Wasserman and Afonso, 2002). Limited access to technology, stunting and inefficient management strategies of small-scale farmers are prevalent in Sub-Saharan Africa (Ampofo - Yeboah, 2013). A number of breeding techniques were reported to date and each one had its own limitation (Mair and Little, 1991). In this study farmers hypothesized that feeding tilapia fingerlings and earthworms to catfish improved growth and lacked scientific records to support this finding; literature is also silent regarding this issue. The present study aimed at reducing the cost of manufactured pellets by utilizing low-cost earthworms and tilapia fish as live food of African catfish (*Clarias gariepinus*).

9.2. Problem Statement

The problem is that world population and the demand to supply cheaper protein to humans are on the rise (Ssepuuya *et al.*, 2017). Capture wild fisheries are near extinction and aquaculture was identified as an option to replenish this lag (Musyoka *et al.*, 2020). Since 2014, fish consumed by humans were supplied by aquaculture and that made aquaculture to be the fastest growing food sector globally (FAO, 2017).

Fish meal was causing the cost of feed to be exorbitant, and zooplanktons and aquatic organisms were seen as affordable options (Anetekhai *et al.*, 2018). Rutaisire (2007) emphasized that commercial diets were not readily available to small scale farmers of which majority rely on organic fertilization of earthen ponds. The need to culture earthworms as alternative protein source rose as they were used as live food; bait and fishmeal supplement (Charkrabarty *et al.*, 2009). Musyoka *et al* (2020) emphasized the advantageous of fused action amongst vermicomposting and earthworms. The cost of production would be reduced and attract interest of fish farming to small-scale farmers (Goda *et al.*, 2007).

Mozambique tilapia reaches maturity as early as the age of three months resulting in overpopulation of stunted population in earthen ponds (Mair and Little, 1991; Popma and

Lovshin, 1995). More authors also emphasized increased fecundity in females which caused diversion of energy into reproduction (Dabrowski *et al.*, 2005). Hence, males are desired in tilapia culture due to their faster growth rates than females (Bhatta *et al.*, 2013). Methods such as hand sexing are cost effective in ponds, labor intensive and prone to errors due to limited pool of skills (Popma and Lovishin, 1995), and even people with expertise managed to only acquire 90% all male (Mair and Liittle, 1991).

9.3. Literature Review

The first study on earthworms was conducted in 1881 by Charles Darwin (Charkabarty *et al.*, 2009). Subsequently more authors carried the work further and found a varied range in their conducts, feed intake, biology and ecological conditions (Charkrabarty *et al.*, 2009; Joshi and Aga, 2009; Kouba *et al.*, 2018).

African catfish (*Clarias gariepinus*) is an appropriate candidate for small-holder farm in Africa, consuming feed made locally available ingredients of lower grade compared to those of tilapia. This caused researchers to investigate alternative cost effective protein sources with high nutritional quality that were readily available (Goda *et al.*, 2007; Abdel - Hay, 2020). The production of eel required 180 000 tons per annum of earthworms to be sustainable (Deolaiikar, 1997). Better results were also achieved in Common carp and tilapia fed pellets replaced with 50% of fishmeal by earthworms (Deolaiikar, 1997). *C. gariepinus* fed a diet containing marine seaweed showed a better growth at 10% replacement of fish meal (Al - Asgah *et al.*, 2016). Toutou *et al* (2018) reported *C. gariepinus* can feed on poultry viscera immersed in vinegar as alternative to feedstuff source to commercial high-priced feed and improved environmental conditions. However, there were other fish species such as Rainbow trout that found frozen *Eisenia foetida* unpalatable and had showed little growth (Tacon *et al.*, 1983).

A number of fish species and livestock, pigs and chickens performed well on live earthworms (Kouba *et al.*, 2018). Earthworm meal was the desired feed incorporated into the diet of variety of animals (Edwards, 1985). Use of earthworms as fish feed in areas where high quality feed was low, unaffordable and safe for consumption was critical (Kouba *et al.*, 2018). Furthermore, there was a rising consumer demand and awareness for chemical free fish that were produced organically globally (Charkrabarty *et al.*, 2009). Breeding and use of insects as feed is not prohibited in Africa (Diehl *et al.*, 2014).

There was scanty published and unpublished literature regarding consumption of live fish for sustenance and insects by aquatic species in Lakes (Peretti and Andrian, 2008; Barbe *et al.*, 2013; Ssepuuya *et al.*, 2017). Few scientific reports were available were fish and poultry were fed insects as food in rural communities, however, only 5% of farmers were reported to have administered termites to fish in Uganda (Rutaisire, 2007). Given the nutrient value and

potential of earthworms in aquaculture, Rohu fry fed pelleted earthworm diet grew significantly better than those fed whole earthworms and earthworm custard (Mohanta *et al.*, 2016).

Polyculture of African catfish and tilapia in ponds is mainly used as police-fish against overpopulation of the tilapia (Middendorp, 1994; Lazard and Oswald, 1995) and seldom as feed to optimize growth of catfish. The author recommended that rural Africa and Asia should be involved in a “low - cost and low - output” type of fish production in order to remain relevant. This study investigated the effect of live earthworms and tilapia fish on the growth of African catfish fingerlings.

9.4. Aim

To reduce the high cost of manufactured pellets by utilizing locally available insects and tilapia fish as alternative food of African catfish (*Clarias gariepinus*).

a). Objectives

- To evaluate the effect of two alternative live food (earthworms and tilapia fish) on the growth rate of African catfish (*Clarias gariepinus*) fingerlings
- To determine the correlation of feed intake, cumulative feed, consumption with body weight and body length

b). Research Questions

- What is the effect of live earthworms and tilapia fish as an alternative food option on the growth performance of African catfish (*Clarias gariepinus*) fingerlings?
- What is the correlation between feed intake, cumulative feed, consumption with body weight and body length.

9.5. Method and Materials

The experiment was conducted at Disaneng Village, 41 km from Mahikeng Town, North West Province, South Africa. A batch of 300 African catfish fingerlings (5 g) were sourced from Aquaculture Innovations Company, Eastern Cape, South Africa. Earthworms 1000 per plastic bag per week were sourced from Worm-farm based in Johannesburg, South Africa. Mozambique tilapia (100) were sourced from Aquaculture Innovation, Myaquaponics (100), Pretoria and (200) from Roodeplaat, Pretoria, South Africa. One bag (50 kg) of starter fish diets was sourced from Aqua Plus Company, Pretoria, South Africa.

The experiment was approved by ethics committee of the University of South Africa, Florida Campus, Johannesburg (approval no 2017/CAES/009). Circular indoor system tanks with 1000 L capacity were utilized in this experiment. Each tank was randomly allocated with 20

African catfish (*Clarias gariepinus*) fingerlings for seven weeks. The tanks were divided into three groups of treatments (control, tilapia fish and earthworms) with four replicates for each. Catfishes, earthworms and tilapias were acclimatized to the new environment for seven days. The fingerlings were fed ad libitum two times daily (8H00 and 16H00). The fingerlings in control group were fed manufactured pellets; earthworm group were fed live earthworms (*Eisenia foetida*) and in fish group were fed live Mozambique tilapia (*Oreochromis mossambicus*) fingerlings. The earthworms were washed with clean water to remove the debris from compost and weighed before feeding. The tilapia were scooped live from separate tanks, weighed on an electronic scale and stocked in the experimental tanks.

The tanks were cleaned every morning by siphoning out one third of the water and the dead fingerling were removed, counted and recorded. Water quality parameter were monitored and recorded daily with water quality meter. Dissolved oxygen ranged between 2.3-7.1 mg/L; Ammonia was <0.05 mg/L; nitrite was between 0.05-2 mg/L; nitrate was 250 mg/L; pH was between 6.8 - 8; temperature was 24.7-29.8. Catfish were weighed individually at the beginning of the experiment, then every week for seven weeks. Standard length was measured from the mouth of the fish to the end of the hypural bone determined by bending the caudal fin; while depth was measured between the dorsal and the ventral fin (Skelton, 2001).

Specific growth rate, food conversion ratio, weight gain, survival ratio and feed application were calculated as follows:

$$\text{Specific growth rate (SGR)} = \frac{\ln \text{ final weight} - \ln \text{ initial weight}}{\text{Experimental duration (days)}} \times 100$$

$$\text{Experimental duration (days)}$$

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed intake (dry weight)}}{\text{Total live weight gain}} \times 100$$

$$\text{Weight Gain (WG)} = \text{Final fish weight (g)} - \text{Initial fish weight (g)}$$

$$\text{Survival ratio (SR \%)} = (\text{Final fish} / \text{Initial fish}) \times 100$$

$$\text{Feed used (FU) (kg)} = \text{Daily ration (kg)} \times \text{Rearing time (days)}$$

One Way Analysis of Variance (ANOVA) was used to determine the effect of live food on the growth rate of cultured species. Duncan's multiple range test was used to separate means of the different treatment groups. Significance was declared at probability level of $P < 0.05$. All data was analysed with Statistical Package of Social Sciences (SPSS) version 25 (2017). Correlation between length and depth was also utilised to determine the strength of relationship between two variables or to predict perfect fit or negative fit of variables to treatments. Correlation greater than 0.8 was a positive correlation while less than 0.5 was a weak correlation (Gerber, 2019).

9.6. Results

The body weights of the catfish fed earthworms differed from week 0 to week 3 ($P<0.001$) compared with those fed pellets and tilapia. There were no differences ($P>0.05$) in growth performance of catfish in week 4 between treatment groups. The growth performance from week 5-7 differed ($P<0.001$) in catfish fed tilapia fish compared with those fed control and earthworms (Table 9.1).

Table 9.1: Growth performance of African catfish fed three treatments (control, fish and earthworms) in weeks (W) (n=240)

Treatments					
Parameter	Control	Tilapia fish	Earthworm	SE	P-value
Weight W0, g	4.61 ^c	5.55 ^b	7.61 ^a	0.27	0.0001
Weight W1, g	6.13 ^b	5.51 ^c	10.03 ^a	0.27	0.0001
Weight W2, g	8.76 ^b	6.18 ^c	9.86 ^a	0.27	0.0001
Weight W3, g	9.84 ^b	9.38 ^b	11.80 ^a	0.27	0.0001
Weight W4, g	12.11	12.44	13.30	0.27	0.249
Weight W5, g	15.49 ^b	16.51 ^a	11.96 ^c	0.27	0.0001
Weight W6, g	18.96 ^b	21.31 ^a	14.94 ^c	0.27	0.0001
Weight W7, g	21.91 ^b	25.28 ^a	15.98 ^c	0.27	0.0001

^{a, b, c} Row means with different superscripts differ significantly at $P<0.001$

Table 9.2 showed that there were no differences ($P>0.05$) in average weight gain, specific growth rate and food conversion ratio between treatment groups. Survival differed ($P<0.05$) in catfish fed control compared to tilapia fish and earthworms.

Table 9.2: Average mean weight gain, feed conversion ratio, specific growth rate and survival for catfish fingerlings (n=3)

Treatments					
Parameters	Control	Tilapia fish	Earthworms	SE	P-value
Average weight gain (g)	2.98	4.46	1.10	0.88	0.425
Feed conversion ratio (FCR)	3.36	2.58	3.51	21.88	0.517
Specific growth rate (SGR, % day ⁻¹)	0.43	0.64	0.16	0.13	0.425
Survival (%)	97 ^a	84 ^c	86 ^b	5.06	0.053

a, b, c Row means with different superscripts differ significantly at $P<0.05$

The results showed that body length differed ($P<0.001$) in catfish fed with earthworms compared to control and tilapia fish between week 0-2. Further differences ($P<0.05$) in body length were observed in tilapia fish than in control and earthworms in week 2. There were no differences ($P>0.05$) in body length between experimental groups from week 3-7 (Table 9.3).

Table 9.3: Mean body length of African catfish fed three treatments (control, tilapia fish and Earthworms) in weeks (n=240)

Treatments					
Parameter	Control	Tilapia Fish	Earthworms	SE	P-value
Length W0, mm	7.91 ^c	8.29 ^b	9.45 ^a	0.27	0.001
Length W1, mm	8.66 ^b	8.37 ^b	10.09 ^a	0.27	0.001
Length W2, mm	9.20 ^c	13.75 ^a	10.04 ^b	0.27	0.036
Length W3, mm	9.86	9.42	10.44	0.27	0.08
Length W4, mm	10.42	12.73	10.72	0.27	0.243
Length W5, mm	11.16	11.17	10.85	0.27	0.689
Length W6, mm	11.60	11.62	11.04	0.27	0.432
Length W7, mm	12.13	12.49	11.31	0.27	0.084

a^bc Row means with different superscripts differ significantly at $P<0.001$

Figure 9.1 showed that cumulative feed intake per fish was higher (76 g) in catfish fed tilapia fish; followed by control (56 g) and low feed intake was found in earthworms (46 g).

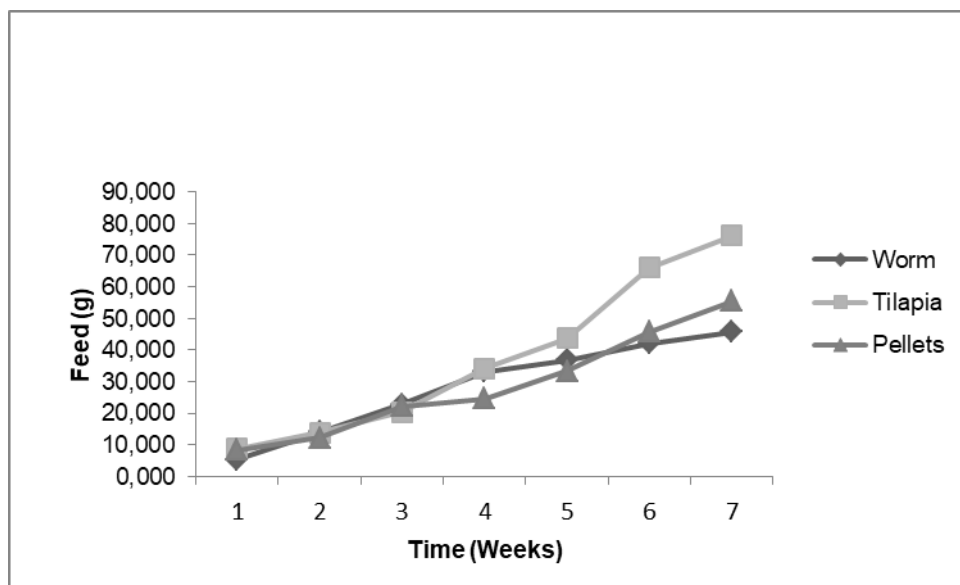


Figure 9.1. Cumulative feed intake per treatment per fish (earthworms, tilapia and control) week 1-7.

The results showed that weight differed and positively correlated ($r=0.857$, $P<0.001$) with depth between treatments at end of this study (Table 9.4). Weight did not differ and correlated negatively ($r=0.032$, $P>0.05$) with depth at the initial week of the experiment between treatment groups.

Table 9.4: Correlation between weight and depth of African catfish per week (W) (n=240)

Parameter		Depth W0, mm	Depth W1, mm	Depth W2, mm	Depth W3, mm	Depth W4, mm	Depth W5, mm	Depth W6, mm	Depth W7, mm
Weight W0,g	Pearson correlation	-	0.092	0.124	0.077	-	-	0.025	0.032
		*				*			
	Sig.(2tailed)	0.049	0.154	0.054	0.235	0.035	0.980	0.700	0.620
	Covariance	-	0.211	0.577	0.291	-	-	0.062	0.061
		1.865				0.863	0.007		
Weight W1, g	Pearson correlation	-	0.272*	0.099	0.020	-	0.019	-	-0.097
		0.290*	*			0.035		0.046	
		*							
	Sig.(2tailed)	0.001	0.001	0.126	0.756	0.585	0.773	0.481	0.132
	Covariance	-5.102	0.743	0.551	0.091	-	0.096	-	-0.221
						0.269		0.135	
	Sig.(2tailed)	0.988	0.135	0.004	0.004	0.003	0.001	0.001	0.001
	Covariance	0.025	-0.380	1.481	1.025	2.081	1.800	1.190	1.454
	Covariance	5.499	-1.289	0.889	1.178	2.708	3.928	4.650	3.923

** Correlation is significant at the $P < 0.01$ level (2-tailed). * Correlation is significant at the $P < 0.05$ level (2-tailed).

The results revealed that there was strong correlation (0.792) between length and weight in week 7 and the strong correlation was highly significant ($p < 0.001$), indicating that there was a significant difference between length and weight at 95% confidence level (Table 9.5).

Table 9.5: Correlation between Length and Depth of African catfish per week

		Wei ght W0, mm	Wei ght W1, mm	Weigh tW2, mm	Weigh tW3, mm	Wei ght W4, mm	Weigh tW5, mm	Wei ght, W6 mm	Wei ght, W7 mm
Lengt h W0, mm	Pearso n	.740**	.537**	.303**	.297**	.236**	-0.069	-0.044	-
	Correlat ion								0.084
	Sig.(2- tailed)	0.001	0.001	0.001	0.001	0.001	0.288	0.494	0.193
	Covarian ce	2.065	1.797	1.004	1.131	1.132	-0.447	-0.390	-
									0.910
Lengt h W1, mm	Pearso n	.428**	.750**	.479**	.380**	.266**	0.013	-0.087	-
	Correlat ion								0.047
	Sig.(2- tailed)	0.001	0.001	0.001	0.001	0.001	0.841	0.177	0.471
	Covarian ce	1.634	3.438	2.177	1.986	1.752	0.116	-1.054	-
									0.690

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed). (Full version Appendix 12)

Correlation between Depth and Length

The results revealed that there was strong correlation (0.917) between depth and length in week 7 and the strong correlation was highly significant ($p < 0.001$), indicating that there was a significant difference between weight and depth at 95% confidence level (Table 9.6).

Table 9.6: Correlation between Depth and Length of African catfish per week

		Length_ _W0	Lengt h _W1	Lengt h _W2	Lengt h _W3	Lengt h _W4	Lengt h _W5	Lengt h _W6	Lengt h _W7
De pth h_ W0	Pearson	-.249**	-	-0.120	-.132*	0.043	0.048	0.028	0.074
	Correlatio non		.348**						
	Sig.(2- tailed)	0.001	0.001	0.063	0.040	0.512	0.463	0.666	0.254
	Covarianc e	-1.395	- 2.678	-7.811	-1.511	2.178	0.690	0.483	1.373
De pth h_ W1	Pearso n	.145*	.329**	0.002	0.086	-0.078	-.178**	- .221**	-.171**
	Correlat ion								
	Sig.(2- tailed)	0.025	0.001	0.976	0.182	0.228	0.006	0.001	0.008
	Covarianc e	0.126	0.394	0.019	0.154	-0.622	-0.403	- 0.592	- 0.494

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed). (Full version Appendix 12)

9.7. Discussion

In this study, final growth was improved ($P < 0.001$) in catfish fed tilapia fish (28.21 g) than in control and earthworm treatment groups. This was consistent with improved growth observed in African catfish that swallowed tilapia whole during pond polyculture trial (Limbu *et al.*, 2015). Tacon *et al.* (1983) also reported increased interest of African catfish to prey on *mossambicus* fish in nature. Low growth was observed in catfish fed earthworms (16.84 g) in this study and this was not surprising since Rohu fry fed with whole frozen earthworms showed unsatisfactory performance due to the presence of the chitin layer obtained from the hard cuticle (Mohanta *et al.*, 2016). Ng *et al.* (2001) also reported poor growth in catfish fed meal worm or solely meal worms due to the presence of the chitin. Furthermore, the presence of chitin decreased growth in *Oreochromis niloticus* crossed with *Oreochromis*

taurus (Shiau and Yu, 1999). Rainbow trout fed increased amount of frozen worms showed suppressed growth (Pereira and Gomes, 1995). Tacon *et al.* (1983) also indicated that Rainbow trout fed worm meal (*Eisenia foetida*) at 100% inclusion level found the food unpalatable and depressed growth. In contrary, Djissou *et al.* (2016) reported better growth in fish fed with a mixture of earthworms and maggot based diets than those fed with fish meal.

There were no differences ($P>0.05$) in average weight gain, specific growth rate and food conversion ratio between treatment groups in this study. Gbai *et al.* (2018) reported lower weight gain in Nile tilapia fed earthworm diet than maggot diet. This was consistent with this study where lower weight gain was observed in catfish fed earthworms. Adámek *et al.* (1999) found lower SGR of 0.36 in catfish fed live fish maybe due to losing too much energy in capturing the prey. Catfish fed tilapia fish in the present study obtained SGR of 0.64, which was higher than that reported by Adámek *et al.* (1999). The authors further reported that catfish only consumed the fish they had repeatedly injured and attacked on their own. This maybe the case in this study as catfish showed high interest of preying on tilapia. According to literature standard feed conversion ratio (FCR) for aquatic animals raised intensively with commercial pellets was 1-2.4 (Fry *et al.*, 2018; Toutou *et al.*, 2018).

This study found FCR of catfish fed commercial diet to be higher (3.36) maybe due to the fact that the commercial diet utilized were that of tilapia and not catfish species-specific. Limbu (2020) also reported this continuous lack of suitable diets for African catfish to be a limitation in developing countries to-date. Catfish fed earthworms in this study had an FCR of 3.51. Toutou *et al.* (2018) emphasized that FCR of aquatic animals given fresh earthworms would vary depending on the price of feed utilised to produce one kilogram of fish. Tadesse (2019) reported a significantly lower FCR of 2.14 in catfish fed diet containing a mixture of earthworms, soybean and brewery waste, indicating a better consumption rate between treatments. Low FCR was also found in Nile tilapia fed earthworms (Gbai *et al.*, 2018; Musyoka *et al.*, 2020) and South America catfish (Arslan *et al.*, 2009). No differences found in FCR of fish fed with insect meal in Atlantic salmon (Belghit *et al.*, 2016). Tilapia fed group in this study had the lower FRC (2.58) which was almost within the desired ranges for aquaculture species. This differed with a higher FCR of 4.73 attained when catfish preyed on tilapia fish (Adámek *et al.*, 1999). The percentage of catfish in control showed higher survival ratio ($P<0.05$) than in control and earthworms treatment groups. Similarly, complete survival of all black bass given a dietary protein during the period of their study was reported (Cai *et al.*, 2020). Gbai *et al.* (2018) found low survival in earthworm diet fed to Nile tilapia, and this was consistent with this study where catfish fed earthworms had low survival ratio. In contrast, Common carp fed earthworms had 100% survival rate (Ogunji *et al.*, 2008). Survival rate was also not affected by the poultry viscera diets in *Clarias gariepinus* higher than 92% (Oke *et al.*, 2016; Toutou *et al.*, 2018).

Weight differed and positively correlated ($r=0.857$, $P<0.001$) with depth between treatment groups at end of the study. In contrast, Shoko *et al* (2015) found no significant correlation between fecundity, total length ($r=1.78$; $P=0.941$), total weight ($r=0.681$; $P=0.592$) and oocytes ($r=0.263$; $P=0.257$) in monoculture and polyculture of Nile tilapia and Sharptooth catfish. However, protein in feeds correlated positively and significantly with final weight ($r=0.704$; $P=0.034$) of African sharptooth catfish juveniles (Limbu, 2020).

9.8. Conclusion

The growth of catfish fingerlings was affected the most by tilapia fish as live food. A lower growth was obtained in catfish fed live earthworms due to the presence of chitin which could be removed in future studies to enhance palatability. There was no difference in weight gain between different treatment groups, there was higher FCR for commercial diet with use of tilapia fish versus African diet as well as the survival ratio of catfish that its counterparts. Feed intake was also higher and weight correlated positively with depth in tilapia group compared to commercial diet and earthworms groups. In this study, it was concluded that tilapia improved the growth of catfish fingerlings the most and could be a solution for rural farmers who have limited access to fishmeal and feed formulation expertise to maximize productivity.

CHAPTER 10: Summary of Findings, Conclusion and Recommendation

10.1. Introduction

This chapter consists of summary of results, conclusion, recommendation, aim and objectives. The main aim of the study was to improve the profit drivers (i.e. price, throughput and cost) of the sharptooth catfish farming in South Africa using applying Continuous Improvement and Innovation (CI & I) approach to generate revenue.

10.2: Summary Findings and Conclusion

Decision to do CI or not; the highest number of interested projects was found in Limpopo Province followed by Mpumalanga, Free State; North West and Eastern Cape respectively. In this study majority of the projects were small scale and only a few were operating at commercial level.

There was the highest number of males than females involved in the study. The results showed that the mean age group was higher between 31-40 years and 41-50 years. Majority of participants held secondary, matric, primary and tertiary respectively as highest education level in this study.

The study revealed that the types of projects involved were sold traders and cooperatives respectively. Majority of the projects were utilizing borehole and stream/river/dam as their main source of water. The types of production systems owned by participants were ponds and recirculating indoor systems. This study revealed that majority of participants was involved in mixed farming between catfish/tilapia and catfish only respectively. Reasons for polyculture, majority of participants left the space blank and a few indicated customer preference, generating income and they were also given by government.

The majority of the projects were community project/ cooperatives types, small-scale/commercial/smallholding with <R5 million turn-over per annum and commercial/ industrial production with >R5m per annum turnover.

This study revealed that source of financing was private funding, followed by government assistance and a few obtained finances from domestic investments and loans.

Most of the businesses in the study were involved in the grow-out; grading and a few on spawning, fry rearing/weaning, processing, packaging and distribution.

Most of the projects in the study were operating under 10% capacity, others were between 40-60% and only one project was at 100% capacity.

The market channels used by majority of the businesses in the study were direct to consumers, and a few sold to supermarkets and wholesalers and restaurants/hotels. After harvest majority of the fish were sold live whole freshly killed, while a few applied some form of processing, value adding and did not apply any form of processing.

Majority of the price was determined via producer sets price and a few used bargaining and negotiating with buyer. Majority of the projects did not take any specific marketing activities.

Majority of the businesses did not take marketing activities to increase sales in this study.

They were described them as door to door, street vending and commercial marketing. Majority of the projects in the study indicated that government did not play any role in linking them to markets; however, a few did agree that government participated in linking them to markets. The type of role played by government the most was providing the projects with fish pellets; construction of processing plant; training via workshops and linking them to feeding school programmes. This study revealed that freshwater aquaculture catfish production created highest number of permanent jobs in 2016, and temporary employment in 2015. Improvement and Innovation in aquaculture were achieved via “mixed farming (i.e. planting vegetables as the main agricultural activity and fish as secondary”, “value adding”, “being involved in plan, do and review cycles and adapting constantly”. Other projects indicated “studying entrepreneurship” was some of the activities they undertook to keep innovating in their projects. Improvements and innovations were conducted five times a week, others yearly while others mentioned it was a continuous focus and did not require any quantification. A mechanism of improvement and innovation was never introduced before in partner’s lives. However, one project was already applying this type of innovation in house, while the other one received this type of information through a workshop of entrepreneurs. The value of CI & I was reported as improvement of business management skills, income generation, and problem diagnosis and provides answers and improving business outputs. The decision of participants to be engaged in the study was high with a mean score 9 because the process was a teaching and guidance tool and it was very new to most participants and gave a lot of hope to the participants.

Step 1 (focus); the results showed that majority of participants reported their Specific, Measurable, Achievable, Relevant, Targeted and Time-Framed (SMARTT) goal or focus as to create viable and sustainable businesses that generated income and created employment.

Step 2 (situation analysis); the results showed that *market access* was articulated the most by partners as the current situation in their businesses. Majority of partners articulated *water access* a lot of times in the study. The reported reasons for water shortage were: not having sufficient quantity and quality of water, and being unable to settle high water bills. *Lack of equipments* and *electricity* were reported by minority of partners as lack of harvesting equipments and lack of access to electricity. Variables such as lack of *skills / training* in aquaculture and *project management*, *poor security* and *fish growth* performance were mentioned by minority of the projects.

The study also revealed that lack of government *support*, *system* performance and lack of cost effective feed supply were articulated by minority of partners. Other phrases critical and

mentioned only once were: lack of *funding*; lack of *information* on the growth of catfish and *permit* to import catfish also emerged from the study. The results also showed that cost of distribution had to be cost effective so that the catfish product would not be too expensive.

Step 3 (impact and influence); majority of the projects articulated that an opportunity of obtaining a *secure market access* would make a real difference. The results showed that the impact and influence of having a secure market was high. The eight dimensions criteria revealed that benefit of securing market, cost of not doing, motivation and total score for positive dimensions were very high, and however, ease of securing market was on the borderline. Cost to implement secure market was high; risk as a result of implementation was low; time to implement was on the borderline; term between implementing and seeing benefits was longer and the total negative dimension was on the borderline. Securing market in this study had high impact, influence, benefits and motivation, however, it would also be so easy to implement. The opportunity was also costly, risky and would take time before reaping the rewards.

In this study majority of the projects selected to *improve water access*. Impact of improving water access and personal influence over whether water access would be successfully implemented were high. Eight dimensions criteria showed that benefit of improving water access, cost of not doing, ease, motivation and positive dimension were high in this study. Cost to improve water access and negative dimension were high; risk and time were on the borderline.

Improving feed supply was reported by the majority of the projects. Impact and influence meanscore to improve feed supply were high. Benefit of improving feed supply obtained was the highest; ease of improving feed supply was the lowest; motivation to improve feed supply, cost of not doing and positive dimension were very high. Cost of implementation was high; risk was low; time and term to implement were in the middle; and negative dimension was in the middle. Partners selected to improve late government feed supply; ensure live food production to combat cannibalism in catfish, administer earthworms and tilapia fish to catfish and reduce the high costs of pellets of feed factory construction.

Increase number of ponds was reported by over half the number of partners. Impact and influence over whether number of ponds would be successfully implemented were high. Benefit of increasing number of ponds, cost of not doing, ease, motivation and positive dimension were high. Cost to increase ponds was the highest; risk was on the borderline; time and term were slightly higher and negative dimension was high, meaning this opportunity was costly and it would take time to implement.

The results of this study revealed that, over half the number of the projects reported *obtaining equipments*. Impact and influence were slightly higher. The benefit of obtaining equipments was the highest; cost of not doing, ease and motivation were high and positive dimension was also high. Cost to implement obtained third highest mean score 7; risk was low with second lowest mean score 3; time obtained third highest mean score 7; term obtained fourth highest mean score 6 and the total mean score on negative dimension was 24/40.

The results of this study further revealed that, over half the number of projects reported *improving skills*. Impact and influence over whether skills would be improved were the highest. The benefit and cost of not doing training were the highest due to increased chances of failure if not trained. Ease and motivation to implement were high and positive dimension was higher. Cost was in the middle; risk was low; time was in the middle, since it would be quicker if they were referred to aquaculture trainers; term obtained fourth highest mean score 6 and total negative mean score was 19/40.

In this study, a small number of projects selected the opportunity of *preventing predation*. The impact and influence of preventing predation were high, due to land animals depleting fish stock and it was difficult to get rid of them. Benefit of preventing predation was slightly higher; cost of not doing and ease were on the borderline; motivation was high and positive mean score was on the borderline. Cost was high; risk, time and term were on the borderline and negative dimension was high.

A small number of projects reported the opportunity of *increasing number of fish*. The impact was the highest and influence was slightly high. Benefit of increasing number of fish, cost of not doing, motivation and positive dimension were high; ease was on the borderline. Cost and term were high; risk and time were on the borderline. Total negatives were slightly high because catfish raised in partner's indoor systems failed to grow quicker.

In this study, a small number of projects reported the opportunity of *obtaining funding access*. The impact was high and influence was on the borderline. Benefit was the highest; cost of not doing was slightly high; ease was on the borderline since access to reliable finance timeously was out of anyone's control. Motivation was the highest and positives were also high. Cost was very high due to spending a lot of money on communication alone and created a business chat group to fast track results. Additionally, high costs were incurred when partners travelled long distance to sign funding forms and this activity was supposed to be rendered by extension and they were inactive; risk was low; time was slightly higher; term was lower and it could be quicker if the funders actually paid on time and total negatives

were 21/40.

Improving security was reported by a small number of projects involved in this study. The impact, influence, benefit, motivation and positives were highest and, ease and cost of not doing were slightly higher. Cost was slightly high; time and negatives were on the borderline.

In this study, a small number of projects reported the opportunity of *establishing accredited processing facility*. The impact and influence were the highest. The benefit was the highest; cost of not doing, motivation and positives were high and ease was the lowest. Cost was high. Partners reported this opportunity was very costly and often were forced to compensate for unexpected budget of around two million rands to fix municipal road that was just too high. Risk was the highest, partners articulated the high score for risk as coming across difficult neighbors protesting against processing facility constructed next to them; time was on the borderline and term was longer, partners indicated that the opportunity was a long term process and total negatives were also high.

In this study, a smaller number of projects reported the opportunity of *improving electrical works* in their businesses. Impact was the highest and influence was slightly higher. Benefit, cost of not doing, ease, motivation and positives were the highest. Cost, time, term and negatives were on the borderline.

A smaller number of projects reported the opportunity of *improving communication* with highest impact and influence over the opportunity. Benefit, cost of not doing, ease, motivation and total positives were the highest in this study. Cost, risk, term and total negatives were in the middle; time was slightly longer.

A lower number of projects reported the opportunity of *appointing experts*. The impact was slightly higher and influence was in the middle. Benefit, cost doing, motivation and total positives were the highest; ease, cost, risk, time, term and total negatives were lower.

The results in this study also revealed that, a few percentages of projects selected the opportunity of *improving middle man transparency*. Impact, influence, benefit, cost of not doing, motivation and total positives were the highest. Cost and time were slightly high; risk, term and total negatives were on the borderline.

In this study, a few percentages of projects selected to *prevent fish escape* with impact 10 and influence 6. The benefit was 9; cost of not doing was 6; ease was 6; motivation was 8 and total positives 27/40. Cost was 6; risk was 4; time was 4; term 7 and total negatives

were 21/40.

A few percentage of projects reported the opportunity to *secure take-offs of all products at a required price*. The impact and influence were the highest. Benefit, cost of not doing, motivation and total positives were the highest; ease was low, this was caused by the difficulty in reaching the finishing line and the cumbersome process of obtaining a letter of intent which was later converted into an off- take. Cost was in the middle; risk, time, term and total negatives were low. Partners indicated that differences between market liaison and off-takes were, off-takes happened now, while liaison happened later or in the future. This opportunity was critical to partners as they indicated there would be no progress if not implemented.

A few percentages of projects reported the opportunity to *develop and implement quality management* systems. Impact, influence, benefit, cost not doing, motivation and total positives were the highest, ease and cost was slightly lower. Cost was also low; risk was slightly higher because if the process was not right, many things might be changed and that would be costly. Another partner disputed saying they were constructing the factory based on activities carried out in a small factory, therefore most of the things were thought through; time was slightly longer and term was shorter and total negatives were in the middle because auditing required six months of record to be carried out.

The smallest percentage of projects reported *developing Continuous Professional Development (CPD) for all staff* with the highest impact and influence. Benefit was slightly high; cost of not doing was 5; ease was 4, partners expressed mixed feelings about ease, others reported it was easy to implement while other disputed reporting that if a wrong person was given the task to implement, it would not have any progress. Motivation was high and total positives were slightly high. Cost was slightly lower because some of the things would be out-sourced while others would be taken in-house; risk was lower; time was slightly longer because production manager might be capacitated by attending six months courses; term was slightly shorter as it would be quick to see the benefits and total negatives were lower.

The smallest percentage of projects reported the opportunity of *identifying cost effective product distribution* options with high impact and influence. Benefit was high and partners reported that the most cost effective way of transport could be determined, the end user would pay less; cost of not doing was high; ease and motivation were in the middle because it required a networking and total positives were slightly higher. Cost was the lowest, partners indicated it would be telecommunication and searching for a quotation; risk, time, term and total negatives were very low.

A few number of the projects reported the opportunity of *maintaining and improving genetics of stock*. Impact was slightly high and influence was the highest. Benefit was slightly high because partners believed that improved genetics would improve growth and in turn improve yield; cost of not doing and ease were slightly high because the opportunity required infrastructure, space and time. Genetic improvement programme also required skills and they might be imported and motivation was in the middle and total positives were slightly higher. Cost, risk, time, term and total negatives were the lowest. Partner indicated that their catfish broodstock and fry were ordered from Holland for better genetics.

A few number of projects in the study reported the opportunity of *improving system performance* with high impact and influence. Benefit, cost of not doing, motivation and total positives were high and ease was in the borderline. Cost, risk, term and total negatives were slightly high. Partners articulated that bacteria in the biofilters were not sufficient to convert harmful ammonia into ammonium gas and partners further indicated that their project lacked water testing kit to monitor the quality of water.

Only a few percentage of the projects *reported fixing inlet/outlet*. Impact was high and influence was slightly high. Benefit and ease were also slightly high; cost of not doing, motivation and total positives were in the middle. Cost and time were slightly high; risk, term and total negatives were in the middle.

A small number of the projects reported *improving amount of diesel*. Impact and influence were the highest. Benefit; cost of not doing, ease, motivation and total positives were the highest in this study. Cost and risk were very high; time and term were in the middle and total negatives were high.

To answer the research question, in this study the opportunities that would make a real difference were: *secure market access; improving water access; improving feed supply; increasing number of fish; increase in number of ponds; obtaining equipments; improving skills; preventing predation; obtaining funding access improving security establishing accredited processing facility of improving electrical works; improving communication of appointing experts; improving middle man transparency; prevent fish escape; secure take-offs of all products at a required price; to secure take-offs of all products at a required price; to develop and implement quality management; developing CPD for all staff; identifying cost effective product distribution; maintaining and improving genetics of stock; improving system performance; fixing inlet/outlet; improving amount diesel*.

Profit Driver Tree: the study revealed that strongest profit drivers identified to make a real

difference were *marketing, genetics, nutrition and management*. In genetics, improving genetic selection programme would improve profit. In nutrition, partners articulated that fish pellets were costly, searching for alternative fish food such as feeding earthworms and tilapia to catfish, while some were in possession of expired feed and they lacked proper storage facilities.

In marketing, partners opted to fit products into market which was broken further into formal market and local market, securing product off-takes, branding or packaging and advertising. Local market partners selected to conduct a local market perception survey.

Management was further broken down into operational (i.e. technical skills, water, communication, record keeping, indoor system, electricity). Human resource development, partners wanted improvement in accessing aquaculture trainers and aquaculture advisors.

Quality management was articulated as building accredited or processing and product handling. Financial management was articulated as searching for funding and appropriation of available funds in projects.

Assessment of impact and influence tool: the results showed that partners never used or seen this tool before. Majority of people liked the tool, they found it easy to use, enhanced their thinking, time to apply the tool was medium, cost of not doing the tool was high, they found high value in the tool and their motivation to apply the tool again was also high.

Assessment of eight - dimensions bar graph tool: partners did not use or see the decision-making tool before. Majority of people liked the tool, it was easy to use, cost of not doing was high, value was high and motivation to implement again was high.

Assessment of eight - dimension pinwheel version tool: the tool was never been used or seen before. All partners liked the tool, found it easy to apply, thinking was enhanced, cost of not doing was high, they valued the tool and were highly motivated to use the tool again and it took partners medium to implement the tool.

Step 4 (action design); the results showed that majority of partners selected critical success factor of obtaining market access. The action was to secure local/community market via designing and administering a questionnaire. The questionnaire was designed by researcher and partners. The results also showed that one commercial partner would provide a sample to fit product to the market, obtain inputs, conduct product adjustment and receive a signed order for product acceptance. Another action identified within the study was that the market would be achieved via branding and designing business cards and posters; advertising on local radio station, pamphlets and shops, billboards and create social network page for the business. It was also critical to obtain market access through searching for market selling prices for catfish.

The results also showed that majority of the small-scale partners took action of sourcing training from their government training center and also their local universities. Partners indicated that the training would be valuable if they could receive practical skills such as fish dissection and also have equipments such as nets and protective clothing. Others indicated that they required developing skills in aquaculture to prevent feed wastage in ponds. Others took further action of engaging in a catfish self-study from the manual “Culture of catfish”.

The results showed that it was critical to improve water access. The action was to obtain water licenses from their local chief and Department of Water Affairs (DWA), and also obtain quotation from borehole drillers and water surveyors. While a unique action from one project was to purchase pipes to deliver water from the river to the farm, and also to install inlet/outlet pipes on the ponds. The commercial partner project also indicated that it was critical to ensure water quantity and quality. Catfish farmers in the study displayed an understanding that water access was costly and required licensing. Other partners indicated that increasing water pressure was also critical in Recirculating Aquaculture System (RAS) to circulate the water and meet water quality standards.

In this study, it was critical for partners to increase availability of alternative catfish food in their businesses. Alternative catfish food were reported as chicken dung, traditional brewery, earthworms, chicken intestines, mixture of sunflower and maize meal, fig tree fruit and mulberry would be collected and fed to catfish to assess growth performance. However, kikuyu grass would be collected and feed Grass carp in those projects that had mixed species in their systems. This was conducted in the form of an experiment assessing the growth performance of catfish fed with live earthworms and tilapia fingerlings and ethical approval was obtained from the university. The commercial partner project took a unique action of ensuring cost effective and reliable feed supply from manufacturers.

According to the results in this study, it was also critical to obtain processing and harvesting equipments. Partners referred to processing equipments such as knives, scissors, containers, plier and chopping board, while harvesting equipments were items such as waders and nets. One projects reported equipments related to recirculating aquaculture systems such as airstones and air tubes to connect to the air blowers, fish tanks and vortex filters.

Improving security was also critical to achieve the goal. Their designed action included obtaining quotation for security materials such as fencing, alarm system, razor wire and sport lights; some would advertise and hire a security guard for night duty.

The results also indicated that obtaining aquaculture expert/expertise was critical to achieve the goal. Partners in the small - scale project selected to appoint aquaculture engineers from their local area to conduct aquaculture system assessment in order to optimize system performance. While in the commercial partner project, aquaculture expertise was expressed as hiring qualified aquaculture management team via job advertising, conducting interviews and appointing new staff.

The results also showed that two projects found it critical to improve capital. Small - scale partner project took action of approaching Small Enterprise Development Agency (SEDA), land bank, Agriculture and even prepare a funding pitch to attract funding. Access to reliable funding timeously was also found evident in partners with commercial background.

The results showed that it was critical for partners to have an accredited processing facility. The designed action was to obtain guideline, conduct an inspection, obtain accreditation and construct the facility.

The results also showed that it was critical for commercial partner project to secure off-takes of all products at a required price. The designed action was to identify potential customers, provide samples and prices and secure orders.

It was critical to obtain diesel that would be utilized in the generator as a back - up power supply. The action was to search for funding and collect contributions from members.

It was critical for partners to have a system that operated effectively. The action was to compile a letter to the Member of the Executive (MEC) of Agriculture to report the issues faced in the business. The contact details were obtained from their local Agriculture. Hire a system designer to fix the RAS and install the right pumps. The KPIs were increased fish growth, less ammonia and high oxygen levels, less accumulation of fish waste and effective aeration system installed. Partners articulated that Societies for Prevention of Cruelty to Animals (SPCA) would arrest them for animal cruelty for putting fish in system that failed to meet its water quality standards.

The results also showed that it was critical to improve bacteria in the biofilters to lower levels of ammonia. The action designed was to take water to the lab to test the bacterial count and receive results. Partners reported that their fish were stressed due to unfavorable conditions

that they were subjected to live under.

Partners selected to increase number of ponds. The action was to prepare the soil and construct. While others reported to re-work or strengthen the pond wall and cover it with a pond liner. Preventing predation by fish and land animals was critical for small scale partners. The action was to install fence around the ponds, design a trapping machine and cover the ponds with hail net.

Some partners reported preventing fish escape from the bottom of the ponds. The action designed was to request engineers from government to rebuild the pond and also seek for private engineers as a backup - plan.

The results also showed that it was critical to obtain import permits for catfish from government departments. The action was to obtain information regarding import permit requirement, submit application, make follow-up and receive confirmation.

To upgrade electricity in order to increase voltage at the transformer and meter box was critical. The action was to obtain a copy of the quotation from the electricity supplier at the department of Agriculture and source alternative financial assistance. Items such as proof of payment that electricity was settled was never received from government, multiple attempts to raise the issue with extension services were fruitless as a result partners expressed feelings of being unheard, ignored, demoralized and being afraid of the friction it would cause if the issue was followed up. Partners articulated that their initial pumps were functional and energy efficient, however after they were upgraded by a service provider from government, electricity bill went up, if they were consulted they would have informed the service provider not to replace the water pumps.

Improve fish growth was a critical success factor. The action designed was to take measurements of fish growth monthly and record in a book. Partners indicated that their fish were stocked in 2014 and failed to reach market size, Therefore they wanted to learn the correct manner of taking length measurements and weight in order to monitor fish growth.

Increase number of fish was critical to have in order to achieve the goal. The action was to learn to breed catfish or also to search for service providers and purchase the newly hatched fry.

Improve communication and transparency was critical to have in order to achieve the goal. The action designed was to organize meetings with fish farmers and also with government. *Improve transparency of implementing agents*: Partners wanted to improve transparency

amongst them and the implementing agents assigned to their projects in order to fast track service delivery.

It was critical for partners to *develop Continuous Professional Development (CPD) for all staff*. Action designed was to determine training need analysis, design training programme, source funds and implement.

Fix inlet/outlet pipes was another critical success factor. The action was to obtain quotations; contribute monies, purchase the pipes and install.

Step 5 (action implementation); this step revealed that in *obtain market access*, a questionnaire was designed, discussed with partners and obtained ethics approval and partners were trained on how to administer the questionnaire in their local communities. However, one project reported that they already liaised with their community members and they would buy their fish. This was a sign of exhaustion kicking in partners due to the increased demand and pressure that CI & I placed on the people.

Partners that wanted to *improve market access* through advertising managed to take an action on creating business cards and advertisement stickers, secured a meeting with their local radio station and created a business Facebook page. Partners from other projects did not implement anything on this opportunity and reported that their community was already aware about their project. Partners further reported that billboard was one of the activities that Recirculating Aquaculture System (RAS) service providers and government were supposed to have done before completing the work in their project. It was reported that government built a fish processing plant for all the beneficiaries and there was no need to search for local market.

Fish prices were not determined, however partners begun the discussion with the retailers that they were delivering their fresh produce to. Some partners liaised with restaurants, feeding schemes, prisons and restaurant and found that they preferred hake. Others managed to approach Chinese shops and wholesalers and were told they would buy fish between 50 - 70 g, sold carp and obtained permission to utilize government vehicles.

Improve aquaculture skills; partners took an action of requesting training to other local district manager who was not able to train them and indicated that they were trained before. Partners also submitted a copy of a manual received from the trainers in the past; however partners did not indicate this significant action in the previous steps. During this session partner was alone and the other members failed to attend and he might felt free to discuss this action.

Water access; partners were not able to obtain quotations for inlet/outlet water pipes due to not having the exact sizes of the pipes. Water quality was checked by dipping a hand inside the water. If water was dirty you will not be able to see the hand inside the water, there might be diseases and high levels of ammonia, observation must be recorded daily. This showed that partners had some knowledge on water quality requirements of fish. Others obtained quotations of the pipes required to deliver water to the project from the nearest river and showed a lot of confidence and enjoyment during reporting session. Others reported high price of water installation in their business from the water drillers and a few reported they already had access to water and already had water licenses. In other projects it was reported that water license was not required when the project was near to the river, it was named an agrarian right. Other action taken was *fixing ponds* and filling it with water; partners were new to aquaculture and lacked skills. They farmed with tilapia for three years and it was stunted, their main activity was poultry farming and they switched to catfish.

Ensure cost effective feed supply; various types of alternative were collected and were freely available on - farm such as cow dung, pig waste, earthworms and chicken droppings. The experiment of feeding catfish with earthworm and tilapia fish resumed.

Increase harvesting equipments; steps taken were obtaining quotations for equipments and stationery required in the projects and transport was needed to visit other bigger retailers. However, few projects failed to obtain equipments for their business and gave reasons such as failing to meet due to lack of commitment from members. Researcher's probing revealed that members recruitment to the project was ad-hoc and old members also existed on the project certificate. Therefore new members had no full ownership. Others reported that government officials failed to deliver water quality equipments purchased for them and this created conflict.

Improve security; partners were designing trap machine in order to combat fish theft in their ponds situated at distance from their homes. Permission to install the trap machine was sought from traditional house. Recirculating Aquaculture Systems (RAS) were also vandalized during data collection. Some were installing fence to reduce level of crime and highlighted the issue of training staff to have the right attitude and not loot from the projects.

Access to reliable finance; partners applied for funding for aquaculture and also advertised their project on social media it was highlighted that old people do not qualify for funding however funding was obtained by luck. Young people stood a better chance of receiving funding because even government lobbied them, took pictures with them and then receive assistance.

Constructing fish processing plant; the issue of a processing plant was very quiet in few projects, no communication was received, and commercial partner's contractors completed the work.

Project registration; quotations for stationery were obtained which amounted to R45, 000. Partners required financial support to be able of purchase office equipments. Other partners emphasized the importance of office equipments to be able to safely keep the important project information.

Improve aquaculture recirculating system; Partners were reluctant to liaise with the system designer due to the existing conflict between him and the government. They bought tilapia fish from him and they were stunted and this critical information was not indicated during action design step. Other partners did not compile a letter reflecting all the issues in their project.

Obtain import permits for catfish: partner failed to implement, misplaced the notes and was fully focused on chicken farming however promised to implement. Partner managed to accidentally just pop by Department of Environmental Affairs (DEA) and the response was that there was no one who worked on aquaculture.

Upgrade electricity: electricity bill was settled by government for a period of 12 months and they had proof of payment. Government also bought fish pellets and the invoice was not given to partners.

Observation, Questions, Ideas and Opportunities (OQIO); there were 23 observations, 43 questions, 35 ideas and 25 opportunities generated in this cycle.

STEP 6 (performance assessment); *what worked in improving technical skills?* The results revealed that self-study of catfish manual was completed and partners gave feedback and support to one another. Partners also successfully organized and attended catfish training at the university. Partners managed to link theory and practice and the experience was critical. Few partners still showed lack of preparation as they reported on activities that were not theirs. Commercial partners managed to achieve continuous development programme according to employee's needs analysis and they appointed someone dedicated for this role. *What did not work well in improving technical skills?* The training was a slide presentation and a tour on different production systems and not hands-on practicals.

What worked well in market access? Signed orders for potential customers were secured. Signed orders for market liaison to fit product to market was also achieved. This was done to

avoid sitting with stock for 6 - 8 months without buyers. During the session ideas popped and partners realized that the first focus was too broad and it would be narrowed down to single production unit. Small-scale partners had a secured market due to the newly completed processing plant and reported that the loan was borrowed against their names. Probing revealed that issues of the processing plant ownership were not dealt with. Others conducted a consumer survey in the various communities to determine the type of local market interested in their fish. Some partners met a challenge with administering the questionnaire as people refused because it was not a job application instead they approached Chinese restaurants and wholesalers. Market survey was conducted to evaluate the factors that influenced consumers' decision to purchase aquatic products. The results revealed that education level positively influenced consumers' decision to buy while quality negatively influenced consumer's decision to buy. Affordability of meat, poultry and fish negatively influenced consumer's decision to buy catfish (these results were reported as a separate paper).

What did not work well in market access? The results showed that the projects were not advertised in shops due to fear of increasing demand and hope of community and fail to supply. Local state hatchery also failed to stock fish in beneficiaries' indoor systems. Wholesalers, restaurant, prisons and hospitals were not approached due to lack of money to hire a transport. Training/improve technical skills was not achieved because partners were told by government that they were already trained and advised to source funding elsewhere if they needed to be trained again. Partners reported that in the training that they attended, they only did fish dissection, and breeding catfish on over-head presentation, not practicals and it was long time ago.

What worked in upgrade of electricity; electrician was sourced and advised partners to check plugs to solve the tripping of electricity

What worked and did not in improve aquaculture recirculating system; Experts refused to conduct a RAS assessment until they were sure who will pay them. This issue revealed a huge problem of items such a boat and generator being confiscated from the project by a service provider whom government failed to pay and the local chief.

What worked and did not in water access? Water drillers were sourced to make a quotation of how much it would cost to construct a borehole and they did not visit projects yet. Lack of money to pay water drillers was also a constraint. One pond was plastered with cement to retain water. Assistance was requested from extension officer who was there when the fish ponds were constructed with sizes of inlet/outlet pipes and he did not visit the project. Water license was not applied due to lack of funds. Underlying conflict was revealed concerning the in denial of the old chairperson for not being part of the project any longer. He tendered his resignation to work for a road construction company which became insolvent and he was

back to the business and claimed to still be heading the business.

What worked and did not in access to reliable finance? Funds from government were not requested due to the infighting between the interim chairperson and the old chairperson. Letter to MEC was not submitted due to waiting for funding assistance from the ward counselor.

What worked and did not in alternative food for catfish? Fish fed with chicken droppings grew well and water quality deteriorated, fish fed traditional brewery did not grow well; fish fed earthworms grew well and some fed catfish tilapia fingerlings and reported a good growth. Partners lacked proof to back-up their theory of what can be utilized as an alternative food. An experiment was conducted to evaluate the effect of live earthworms and tilapia fish on the growth of catfish fingerlings to test partner's theory.

Lack of feedback and implementation of critical success factors such as obtaining import permit for catfish, construction of fish processing plant, improve security and obtain harvesting equipments.

Performance assessment tool was highly liked by all partners and were highly motivated to apply the tool again with a mean score 10; and median 10; ease of use was scored mean 8 and median 9; thinking enhanced and cost of not doing the tool and value was high with mean 9 and median 9. The length of time was medium.

Step 7 (creation and synthesis): *in black hat*, a small percentage of partners articulated unregistered business and their businesses were not funded. A few did not know where to obtain aquaculture funding. A few also articulated that incomplete government assistance, lack of impetus to continue farming, cooperative conflicts, lack of market access and preferential treatment from farmers support. A small number reported fish farming took long to generate income, unavailable financial information and old age restriction inhibited access to funding.

Yellow Hat; the results showed that a small percentage of partners reported that funding would improve business pitch to funders. A few articulated funding would improve their infrastructure and equipments. A few percentage of partners also of partners reported funding would create jobs via fisheries. A few articulated that they would be an exemplary business, obtain business plan, work as a team, and become more focused on business development and understand their business plan.

White Hat; the results showed that majority of partners articulated that funding would grow their business, while a few percentage reported no progress without funds. A few articulated unreliable service providers, a few reported they would obtain equipments with funding and they were unable to care for their families due to lack of income in fish farming.

Red Hat; the results showed that majority of partners reported that funding created progress. A few percentages reported emotions and feelings of tendering their resignation from projects and aquaculture lacked business plan compilers. A few also articulated that government had no sustainable projects and they were not familiar with how to apply for funding. A few number of partners further reported prolonged funder response, government economists were inactive, partners were inpossession of misleading business plans, funding was given to their relatives and they felt sabotaged by government officials.

Green Hat; majority of partners articulated that they needed to seek funding independently from state assistance. Ideas such as top state management should strengthen monitoring and evaluations of projects, some thought of seeking assistance from prayers, some wanted to be involved during compilation of business plan, business plan came at high costs were reported by a small number of people. Follow state procedure when seeking assistance and funds were misappropriated in projects.

Blue Hat; partners were requested to summarize all the hats together. Majority of partners reported obtaining funding independently. A small number articulated that funding would create jobs and pay salaries. A small number further reported registering their business formally. A few also articulated that state support was incomplete, state was under administration hoping for service delivery to change, problem solving skills in cooperatives, familiarizing themselves with making a submission of queries to the highest state office and obtain materials.

Effect of earthworms and tilapia fish on the growth of catfish fingerlings; the results revealed that catfish fingerlings could be raised on tilapia fish and earthworms by small-scale farmers. However, the worms have to be self-cultured on farm to reduce production costs for better revenue. Intensive training on vermicomposting and its related costs has to be provided to farmers to improve productivity and profitability. Further studies could be conducted on utilizing mixed feed in both treatments and determine meat quality.

10.2. Recommendations

This section provides description of the recommendations derived from the research findings. The recommendations to improve profit drivers in catfish farming were as follows:

Establish aquaculture awareness campaign; catfish farming in the study was dominated by old aged people and males. Establishment of awareness campaigns could attract youth to the industry, especially participation of women.

Improve market access; local market required to be established for quicker support and take - offs from of small businesses. Commercial businesses recommended to improve

market liaison to fit products into the market would improve market access.

Improve water access; water in the study was reported to be inaccessible, therefore improving quantity and quality of water would improve performance of aquaculture small businesses.

Skills development; skills development such as fish husbandry, nutrition, market and general maintenance were necessary in the study to improve performance of small business. In commercial business skills development was conducted in the form of continuous professional development for all staff. Skills development should also be learning how to improve and innovate continuously and this is new in aquaculture in order to create viable business.

Harvesting equipments; small projects lacked harvesting equipments such as nets, protective clothing, buckets and slaughtering equipments. Procurement of this type of harvesting equipments would encourage fish to be harvested timeously and not be abandoned by farmers.

Electricity installation; Recirculating Aquaculture System (RAS) lacked electricity installation due to its high costs. Those businesses that installed electricity did not settle electricity bill timeously and it was often switched off. Those that had solar panels, they were not connected to the system.

Install security systems; theft in aquaculture is high and installation of security systems and personnel was necessary to prevent equipments been stolen and impacting on finances

Revamp recirculating aquaculture systems; according to the study RAS were non-functional and require revamping to optimize production.

Improve funding access; improving access to funding was critical to bolster catfish farming in the study. Extension should assist in the funding acquisition and access to prevent business from spending a lot of money running around to access the funds.

Improve access to financial information; financial information required in business plans was not readily available. Development of aquaculture financial information would improve performance of small projects.

Identify cost effective product distribution; according to the study it was critical to identify cost effective product distribution in order to lower the price of catfish

Improve feed supply; the supply of feed from manufacturing companies is not reliable and costly. Catfish farmers were not receiving the pellets on time from government. The results also showed that earthworms and tilapia could be utilized as food to improve growth of catfish fingerlings, however, the earthworms should be self-cultured to combat high cost from worm companies. Therefore, vermicomposting capacity building is recommended in aquaculture.

Prevent predation; birds and land animals were depleting fish stock in ponds. Equipments acquisition such as nets would assist in preventing predation.

Establish accredited facility; accredited facilities in aquaculture are costly and businesses carry the responsibility of unexpected budget to improve roads access to projects.

Establish quality management system; quality management in the study was articulated as costly and cumbersome if things needed to change.

Maintain improved genetics of stock; to maintain best performing fish genetics required to be improved. The genetics improvement programme should be established in catfish farming.

Establish business plan assistance; small business in the study did not have aquaculture business plan and lacked assistance from government to develop a business plan. Those that obtained business plan were not involved in the compilation stages of the business plan; therefore business plan assistance should be established.

Assessment of continuous improvement and innovation mechanisms; Specific, Measurable, Achievable, Targeted and time - framed (SMARTT) goal tool; Impact and influence tool, eight dimension bar graph and pinwheel version, Acton design tool; action monitoring tool, performance assessment tool and six thinking hat tool were all liked, valued and enhanced thinking in this study to improve profit of catfish farming businesses. Further training on the range of other available tools was recommended to boost business performance.

Improved feed access; The earthworms must be self-cultured on farm to reduce production costs for better revenue and skills development on vermicomposting are also recommended. Farmers without access to fishmeal and feed formulation expertise could attain improved growth of catfish with locally accessible Mozambique tilapia fingerlings and earthworms to improve productivity. Further studies could be conducted on utilizing mixed species to feed catfish and also determine its meat quality.

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Glossary of Applied Terminologies (Timms and Clark, 2008)

Adoption

The decision to implement an improvement or innovation as an appropriate course of action to achieve a specific outcome e.g. increase in profit

Capacity

The necessary knowledge, skills, technologies, tools, support and resources to achieve specific outcomes.

Communication

The successful transmission of information so that the recipient understands what the sender intends

Continuous Improvement and Innovation (CI&I)

A shared process that enables individuals in teams, networks and partnerships to focus their thinking and action to achieve improvements and innovations, regularly and frequently

Critical Success Factors (CSFs)

Those things it is critical to have in order to achieve a focus or target outcome

Culture

A system of shared philosophies, ideologies, values, assumptions, beliefs, expectations, attitudes and norms that is considered valid by those within the system

Decision

An opinion or conclusion reached after consideration or analysis. Within the adoption pathway, the decision phase includes:

1. Analyzing the potential impact that different practices or technologies are presumed, expected or promoted as having in relation to increasing profit
2. Selecting to take forward to the trial phase, one or more particular practices or technologies that appear to have the greatest potential to increase profit

Design

To conceive and outline the set, sequence and relationship of components of something (e.g. a system, process, strategy) which will achieve a particular outcome

Development

The incorporation of knowledge and relevant results from research into complete technology packages that are usable and of demonstrable value in achieving specific outcomes in the workplace, market place or community

Effectiveness

The degree to which specific target outcomes are achieved relative to the inputs invested.

Effectiveness = Outcomes/Inputs

Efficiency

The degree to which specific target outputs are produced relative to inputs invested

Efficiency = Outputs/Inputs

Focus

A specific area and target outcomes on which to concentrate attention, thinking and action.

Gross margin

The difference between the gross income and the variable costs directly associated with a particular activity or enterprise. It excludes fixed or overhead costs.

Improvement

Enhanced practices, processes, systems, products, services, outputs and outcomes of value in the marketplace, workplace and/or community

Improvement & Innovation Partnerships

A social infrastructure of people, teams, networks and partners committed to achieving measurable improvement and innovation in their enterprises, businesses, supply chains, projects, organisations or industries. They have a shared focus for improvement (often at a fairly high level of focus) and within this focus choose relevant individual focuses that will make the most difference in their situation. They regularly measure, share and celebrate their results with others, and benefit from the achievements and support of others in the infrastructure.

Innovation

The creation and implementation of new products, services, systems, practices or processes that generate additional value for a business, organization industry or society

Inputs

Resources put into systems, processes and practices to achieve outcomes.

Key Performance Indicators (KPIs)

The specific, agreed measures that are of most value in measuring and assessing performance

Management

The process of leading and directing all or part of an organization through the deployment and manipulation of resources (human, financial, material, intellectual or intangible). The main functions of management are planning (i.e. defining goals for future organizational performance and deciding on tasks and resources needed to be used in order to attain the goals), organizing (i.e. assigning tasks, grouping tasks into organizational units, and the assignment of authority and allocation of resources across the organization), leading and controlling (i.e. monitoring the activities of people, determining whether the organization is on target with its goals and making changes when necessary).

Model

All models are representations of real things (e.g. systems, processes or real world situations) simplified for some purpose. They include those features that are essential for the

purpose and they leave out those that are not essential. Models are usually used to help people to better visualize, understand and comprehend the situation, system or process. They can provide a framework for thinking, assessment or implementation. Descriptions of models often contain an explanation of what the model does/is designed to achieve and in what contexts, its limits, the assumptions underpinning it, its status and lineage (when it was first developed, how often it has been used, what theories it is based on), descriptions of major improvements made to the model over time, and evidence about its performance.

Network

A purposeful value--adding partnership based on reciprocal transactions between partners.

Outcome

The end result of converting inputs through practices, processes, systems, projects, products and services to fulfill a need. The Department of Education, Science and Technology refers to outcomes as being the benefits that will be achieved once research outputs are utilized by end--users.

Output

The interim result or product of converting inputs through practices, processes, systems, products and services in order to achieve a specific outcome and fulfill a need. The Department of Education, Science and Technology refers to outputs as being tangible items delivered such as gene markers, diagnostic tests etc.

Partnership

Interdependent (business--like) relationships between people for a specific purpose involving clear rights, roles and responsibilities

Performance

The level of achievement as measured against a specific criterion or indicator.

Process

A set and sequence of interconnected steps, activities, tools and resources to achieve specific outputs and outcomes

Profit Driver= increase in the price of animals, increase throughput and decrease input costs

Research

A process of inquiry leading to new knowledge and/or technology.

Research and development

A tightly coupled process of research and development of new practices, processes, systems, products and/or services to achieve specific outcomes in the workplace, market place or community.

Research outputs

Knowledge, information packages, publications, new technologies or techniques, policy analyses, databases, standards, benchmarks

Strategy

A systematic, long term plan or course of action designed to achieve specific outcomes, and to deal with uncertain future circumstances which would impact on the achievement of the outcomes.

Sustainable

Capable of being sustained. Being able to continue into the future. Cost, energy and resource expenditure does not exceed the benefits, value and returns. In terms of projects, the continued achievement of outcomes continues after the project finishes.

Sustainable Improvement and Innovation (SI&I)

Sustainable Improvement and Innovation (SI&I) is a project system model that is designed to achieve, and sustain the quality of, target outcomes, improvements and innovations in regions, industries and organisations, while identifying and reducing negative short and long term, local and global consequences of the project

System

A set of interconnected, interacting, interrelated and interdependent parts or elements that form a distinct, complex and unified whole that has a specific purpose. The removal or failure of one part may incapacitate the entity as a whole.

Target

A set level of achievement/performance for which to aim.

Technology

Development and application of tools, machines, materials and processes that help to address needs and problems. A technology consist of two essential components: a “hardware” aspect, consisting of tools, materials and mechanisms that embody the technology, and a “software’ aspect, consisting of the information base or process in which the tool is embedded so that it can be more easily integrated and applied in a management system.

Technology throughput

The number of different technologies or innovations developed and integrated into businesses and industry use per unit time

Tool

An instrument that makes achieving outcomes more effective and easier

Training

Acquiring knowledge and skills to use specific processes, tools, technologies, systems and methodologies to improve performance.

Understanding

Comprehending and appreciating the nature, meaning and significance of something

Utilization

The term used by the Department of Education, Science and Technology to mean the take-up and implementation of research outputs and outcomes by industry and other users.

APPENDICES

Appendix 1: Demographics and Decision to Do CI & I or Not

INTRODUCTION

We are conducting a study on the catfish industry in order to apply Continuous Improvement and Innovation methodology. Your response in the questionnaire will assist us in identifying farmers that are willing to partake in the study.

1. RESPONDANT PROFILE

1.1 Respondent's demographic information

Gender	Male	☐	Female	☐
Age	16-21	☐	22-30	☐
	41-50	☐	51-60	☐
			older	☐
Home language (please specify)				
Highest education qualification	Primary	☐	Secondary	☐
	Matric	☐	Tertiary	☐

Please indicate with an "X" or specify home language

2. COMPANY/PROJECT PROFILE

2.1 Company/Project registration

Pty Ltd	Closed	Sole trader	cooperative	Trust	Government
	cooperation				facility
Other (please specify)					

Please indicate with an "X" or specify registration

2.2 How many years has the company / project been in operation?

<1	1-5	6-10	11-15	16-20	21-25	>25

Please indicate answer with an "X"

2.3 What is source of water supply

Stream/river/dam	borehole	Municipal/tap	spring

2.4 What type of production system do you use?

Earthen ponds	Recirculating	Concrete ponds	Raceways	Cages
	system			
Other (please specify)				

Please indicate answer with an "X" or specify other production system

2.5 What species do you farm?

African Catfish	Bass
Rainbow trout	Marron
Ornamental fish (various)	Waterblommetjies
Koi carp	Yellowfish
Gold fish	tilapia
Other (please specify)	

Please indicate answer with an "X" or specify other species farmed

2.6 If you chose more than one species above, your project is involved in polyculture, give reasons why?

2.7 How would you describe the scale of your operations?

Commercial / industrial production (> R5m p.a. turnover)	Small-scale commercial (< R5m p.a. turnover)	/S	Community project / cooperative

Other (please specify)

Please indicate answer with "X" or specify scale of operations.

2.8 Please indicate your current sources of financing

Domestic Investment and Loans	Foreign investment	Foreign aid	Government Assistance	Private Capital

3. ENTERPRISE VALUE CHAIN

3.1 Which business processes are included within your company's / project's operations?

Spawning	Fry rearing/ Weaning	Grading
Grow out	Processing	Packing
Distribution	Other (please specify)	

Please indicate answer with "X" or specify business process

3.2 Is your company /project operating at full capacity (100%)? If no, please indicate percentage capacity utilization for production:

10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Please indicate answer with "X"

4. MARKETS

4.1 Which market channels do you use?

Channel
Direct to consumers
Wholesalers
Restaurants/ hotels
Processors
Supermarkets
Exporter
Other (please specify)

4.2 Do you sell your product immediately after harvest and/ or do you employ some form of processing

Form of product	Circle the answer

Live/ whole freshly killed	Yes / No
Some form of processing and value adding	Yes / No

4.3 How is the price of your product determined?

Options

Producer sets price

Auction

Bargain and negotiate with buyer

Other (specify)

4.4 Do you undertake any specific marketing activities to increase sales?

Yes / No / Sometimes

4.5 If the answer is yes, what type of marketing activities do you undertake?

4.5 Does government/ public sector agencies play any role in linking you, or your sub-sector, to markets?

Yes/ No / Don't know

4.6 If the answer is yes, what type of activities did government take to link you to markets?

5. EMPLOYMENT

5.1 What are your past, current and future year-on-year *permanent* employment trends per skill level* and historical racial classification**? (A permanent employee works full-time for the company / project).

Year	Professional				Skilled				Middle service				Semi-skilled				Unskilled				Total
	B	C	I	W	B	C	I	W	B	C	I	W	B	C	I	W	B	C	I	W	
2016																					
5015																					
2014																					
2013																					1

Please indicate number of employees per category per year.

* Definitions: **Professional** = upper management, scientist; **Skilled** = technicians, artisans; middle services, **Semi-skilled** = secondary, some secondary education, **Unskilled** = no formal training.

** As per Statistics South Africa categories: B = Black South Africans, C = Colored, I = Indian, and W = White

5.2 What are your past, current and future year-on-year *temporary* employment trends per skill level and historical racial classification? (A temporary employee works for the company / project on a part-time basis or as per seasonal requirements, e.g. harvesting).

Year	Professional				Skilled				Middle service				Semi-skilled				Unskilled				Total
	B	C	I	W	B	C	I	W	B	C	I	W	B	C	I	W	B	C	I	W	
2016																					
5015																					
2014																					
2013																					

Please indicate number of employees per category per year

6. DECISION TO DO CONTINUOUS IMPROVEMENT & INNOVATION OR NOT

6.1 Do you want to continually improve and innovate your practices and performances (Processes, Products & Services)? Yes /.. No

If your answer is No

Do you want to improve where necessary? Yes / ...No

6.2 Do you want to work in a high performance team and take responsibility for focusing on what makes a real difference? Yes / No

If your answer is No

Do you want to work mainly on your own? Yes / No

6.3 Do you want to meet every 60, 90, 180, 360 days prepared to report, focus thinking and take effective action for impact on performance? Yes / No

If your answer is No

Do you want to work in a team/ on your own and report on regular basis? Yes / No

6.4 Please take time to go through the following benefits if your answers were Yes:

Benefits:

Team work; Thinking stimulated; Challenge of assumptions; Range of ideas generated; Specific ideas developed; Specific actions developed; Support for action-taking; Learning faster than competitors; Creativity supported by network of network, Costs (Time, Effort & \$); To meet every 60, 90, 180, 360 days; To fulfill a role

6.5 If your answers from the above table were No, please continue to answer the questions in the following table

Please take time to go through the following risks:

Costs of not doing:

No support for focus

No success to ideas

No support for CI & I

No buying power

7. BASELINE QUESTIONS

Area	Questions
Current thinking about improvement and innovation	1. Do you have an interest in collaborating in a project that improves and innovates in your business and life? 2. Are you happy with our definitions of improvement and innovation 3. How do you achieve improvement and innovation
Rate of improvement and innovation	1. How many improvement do you think you achieve in a week, month, year, and fiveyears? 2. How much time do you dedicate to improvement and innovation in a week, month, year, and five years?
Project vision and mission	Are you interested in what this project has to offer? Have you been offered a mechanism for achieving improvement and innovations before? This is my suggested role: " To be a coach and referee in this research" Are you OK with my role?

Introduction to CI & I process	Played the CI&I process game Do you think the CI & I process is logical What value do you see in having a clear process for achieving improvements and innovations
Assessment of Opportunity	1. What do you think of the opportunity of being involved in this specific project? 2. What score would you give the opportunity? • Would you like to be involved?

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the sessions from the beginning of cycle 1 to the end of cycle 3, and to be actively involved by sharing openly and freely and give feedback frequently and regularly when required.

I have received a signed copy of the informed consent agreement.

Participant Signature.....Date.....

Researcher's signature.....Date.....

SMARTT Goal Tool

Context (vision, mission, need, problem or opportunity, boundaries):

Draft goal:

SMARTT – specific, measureable, achievable, relevant, targeted, timeframed

Specific Be clear about exactly what is going to be achieved	
Measurable How will you assess whether the goal has been achieved?	
Achievable Check that the goal is realistic, even though it may be challenging	
Relevant Is the goal directly related to a need problem or opportunity?	
Targeted This is the level of performance you are aiming for.	
Timeframed When will the goal be achieved by?	

SMARTT goal:

Key terms:

Appendix 2.2: Impact and Influence Tool

Step 3 – Selection Priorities

Impact and Influence Tool

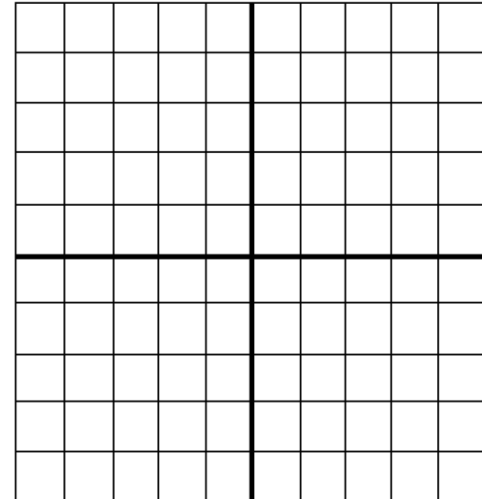
Focus:

.....

.....

No.	Opportunities	Impact	Influence
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

IMPACT: What level of impact will this opportunity have on the goal



INFLUENCE: What is my personal influence over whether the opportunity will be successfully implemented?

Appendix 2.3: Eight Dimension Bar Graph

Step 3—Select Priorities

Eight Dimensions Tool (Bar Graph Version)

Name:

Date:

Total Scores				
Opportunity A		Opportunity B		
Scores for +ve dimensions	Scores for -ve dimensions	Scores for +ve dimensions	Scores for -ve dimensions	
Benefit	Cost	Benefit	Cost	
Cost of not doing	Risk	Cost of not doing	Risk	
Ease	Time	Ease	Time	
Motivation	Term	Motivation	Term	
Total	Total	Total	Total	

Benefit = Expected value from implementing the opportunity
Cost of not doing = Undesirable consequences if the opportunity is not implemented
Ease = How easy it will be to implement the opportunity
Motivation = Enthusiasm for implementing the opportunity

Cost = Resources (other than time) needed to implement the opportunity
Risk = Likelihood of undesirable consequences as result of implementing the opportunity
Time = Length of time needed to implement the opportunity
Term = Length of time between implementing the opportunity and seeing the benefits

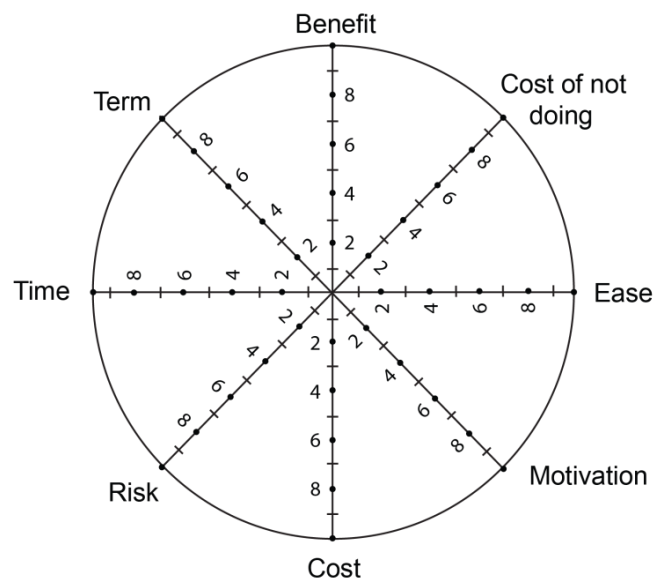
(1= low; 10 = high)

Appendix 2.4: Eight Dimension Pinwheel Version Tool

Step 3 Select Priorities

Eight Dimensions Tool (Pinwheel Version)

Name:
Date:



Cost = Resources (other than time) needed to implement the opportunity
Risk = Likelihood of undesirable consequences as a result of implementing the opportunity
Time = Length of time needed to implement the opportunity
Term = Length of time between implementing the opportunity and seeing the benefit

Benefit = Expected value from implementing the opportunity
Cost of not doing = Undesirable consequences if the opportunity not implement
Ease = How easy it will be to implement the opportunity
Motivation = Enthusiasm for implementing the opportunity

(1 = low; 10 = high)

Appendix 2.5: Action Design Tool

Action Design Tool

Name Date

SMARTT Goal:		
.....		
CSFs Critical Success Factors <i>To achieve the goal it is critical to have</i>	KPIs Key Performance Indicators <i>I will know the CSF is in place when</i>	KAs Key Actions <i>The key things it is necessary to do are</i>
1.	■ ■	■ ■ ■
2.	■ ■	■ ■ ■
3.	■ ■	■ ■ ■
4.	■ ■	■ ■ ■
5.	■ ■	■ ■ ■
6.	■ ■	■ ■ ■

Appendix 2.6: Action Design Including a Calendar

Step 4 - Design Action

Action Design Tool Including a Calendar

CSFs	KPIs	KAs	Roles	Resources	Month											
					J	F	M	A	M	J	J	A	S	O	N	D
1.	•	1.	1.													
2.	•	1.	1.													
3.	•	1.	1.													
4.	•	1.	1.													
5.	•	1.	1.													
6.	•	2.	2.													
7.	•	3.	3.													
8.	•	4.	4.													

Appendix 2.7: Action Monitoring and Support Tool

Step 5 - Action Taking

Action Monitoring & Support

Name..... Date.....

Goal				
.....				
.....				
CSFs Critical Success Factors	KPIs Key Performance Indicators	KAs Key Actions	Results of Actions What actions have I implemented? What affects are the actions having? Have any blocks or problems arisen?	Support Needed What support do I need to keep implementing my action design?

Appendix 2.8: Result Assessment

Step 6 - Assess Results

Results Assessment Tool

Name..... Date.....

Goal				
.....				
.....				
CSFs Critical Success Factors	KPIs Key Performance Indicators	KAs Key Actions	Results of Actions What results did I achieve? What worked well, and what didn't achieve the results I was targeting?	Support Needed What support do I need to achieve results over the next 180 days?

Appendix 2.9: OQIO Tool for Supporting Reporting

Step 6 - Assess Results

OQIO Tool for Supporting Reporting

Focus To offer.....encouraging, supportive and useful, observation, questions, ideas about Date

..... From

Observations	Question	Ideas	Opportunities
Create supportive observation to foster ✓ Recognition & encouragement ✓ Communication & mutual understanding ✓ Thinking about connections between needs targets, actions, methods & results	Create supportive questions to ✓ Stimulate thinking about assumptions ✓ Draw connections between needs, targets, actions, methods & results ✓ Think about what will have impact	Create supportive ideas for possible ✓ Impact and value ✓ Improvement ✓ Innovation ✓ Motivation	Synthesise opportunities for achieving ✓ Impact & value ✓ Improvement ✓ Innovation ✓ Motivation

Appendix 2.10: Six Thinking Hat Tool

Black Hat	Yellow Hat	White Hat	Red Hat	Green Hat	Blue Hat
<i>Logic negatives, Devil's advocate, why it won't work</i>	<i>Logical Positives, optimistic, constructive</i>	<i>Pure facts, data, figures and information</i>	<i>Emotions and feelings, hunches and intuition</i>	<i>Creative, provocative, go beyond the obvious</i>	<i>Summaries, overviews, thinking about the thinking generated by other hats</i>

Appendix 3: Project description of interested people for CI & I cycle 1

Project	Research partner ID	Business description
1	Disaneng DS 01, 02, 03 & 04	Breeding, growing and processing catfish in a Recirculating Aquaculture System
2	Tladinga TD 05, 06, 07, 08 & 09	Farming crops & selling to Spar. Stocked catfish and tilapia in the earthen ponds
3	Masibambane MB 10, 11, 12, 13, 14, 15, 16, 17 & 18	Farming with crops and poultry & selling to community. They stocked tilapia & catfish in earthen ponds
4	Gilmo GM 19, 20 & 21	Farming with poultry & horticulture. Farm with tilapia & carp in earthen ponds & sells to the community
5	Master Denzel MD 22	Farming catfish, carp & tilapia in earthen ponds
6	Mthaiza MT 23, 24 & 25	Commercial Sugar cane farming. Stocked catfish, tilapia & Carp in irrigation dams fitted with water canal
7	Jubelly JB 26, 27, 28 & 29	Farming with crops and piggery. Stocked tilapia. Catfish & kilimintjies came with the river floods in earthen ponds
8	Tshaundi Tshelwala TT 30	Farming with catfish in concrete ponds
9	Makhura MK 31	Farms with crops. Owns entertainment park. Stocked tilapia & catfish in earthen pond
10	Chikhudini F CF 32	Farms with catfish in earthen ponds
11	Nemutamba NT 33	Farms with catfish in earthen ponds
12	Tshitakhole RL TRL 34	Farms with catfish & tilapia in earthen ponds. The

		community purchase the fish when they reached market size
13	Alianapo AN 35	Farms with tilapia in earthen ponds
14	Funyufunyu FF 36, 68 & 73	Secured a piece of land from tribal authority and interested in farming with catfish
15	Ukhadzilito UK37	Farms with tilapia in aqua dam plastic pond. Involved in a lot of DIY temporary jobs
16	Fharanani FR 38	Involved in piggery farming. Farms with tilapia in a concrete pond
17	Mudau MA 39	Farms with tilapia in aqua dam plastic pond
18	Khumbula Trust KT 40	Plant seedlings and sells to the community. Farms with catfish in earthen ponds
19	Karoo Catch KC 41, 42 & 69	Commercial catfish business. Owns catfish processing plant and sells to commercial market
20	Catfish Supreme CS43	Commercial catfish business in recirculating aquaculture systems
21	Phetwane PT 44, 45, 46, 47, 48 & 49	Farming with cotton and crops. Farms with catfish, tilapia and carp in irrigation dams
22	Ludlow LL 50	Farming with catfish in Recirculating, Aquaculture System
23	Lephoi LP 51, 52 53, 54, 55 & 56	Farming with catfish in Recirculating Aquaculture System
24	Garipe Dam GD 57, 58 & 59	Farming with catfish & carp in earthen ponds
25	One Vision OV 60, 61, 62	Farming with catfish in the Recirculating Aquaculture System
26	Gotswametsing Project GMP 63, 64, 65	Farming with catfish in Recirculating Aquaculture System
27	Booiteko Fisheries BF 66 & - 67	Farming with catfish in Recirculating Aquaculture System
28	Letlaka Agricultural LA 70	Farming with catfish in Recirculating Aquaculture System
29	Nemutamba NM 71	Farming tilapia in ponds & selling
30	Hungweni Trading HT 72	Farming with catfish & tilapia in ponds

Appendix 4: Opportunities generated and taken further in cycle 1

Research partner	Opportunities assessed	Opportunities taken further
Karoo Catch (KC)	1.1. Secure off-take for all products at required price 1.2. Active market liaison to fit product to market 1.3. Establish accredited facilities to process products 1.4. Develop and implement quality management systems 1.5. Appoint qualified and experienced management team 1.5. Plan Continuous Performance Development (CPD) of all staff 1.6. Access reliable finance timeously 1.7. Ensure sufficient water quality and quantity 1.8. Ensure cost effective product distribution options 1.9. Ensure cost effective and reliable feed supply 1.10. Maintain and improve genetics of our stock	1.1. Secure off-take for all products at required price 1.2. Active market liaison to fit product to market 1.3. Establish accredited facilities to process products 1.4. Develop and implement quality management systems 1.5. Appoint qualified and experienced management team 1.5. Plan Continuous Performance Development (CPD) of all staff 1.6. Access reliable finance timeously 1.7. Ensure sufficient water quality and quantity 1.8. Ensure cost effective product distribution options 1.9. Ensure cost effective and reliable feed supply 1.10. Maintain and improve genetics of our stock
Tladinga (TD)	1.1. Lack of electricity 1.2. Additional fish ponds 1.3. Quality fish feed 1.4. Improving record keeping skills 1.5. Predation by birds and land animals 1.6. Shortage of labor 1.7. Lack of finances 1.8. Lack of financial information 1.9. Improving record keeping skills	1.14. Lack of training/skills

	1.10. Lack of aquaculture expertise 1.11. Not having equipments 1.12. Not having market access 1.13. Lack of processing house 1.14. Lack of training/skills	
Phetwane (PT)	1.1. Increase market 1. Prevent predation 1.3. Fix inlet and outlet pipes 1.4. Purchasing protective clothing 1.5. Obtain harvesting equipments 1.6 improve technical skills 1.7. Improve communication skills 1.8. Improve security 1.9. Improve water exchange 1.10. Obtain water quality equipments 1.11. Constructing processing house 1.12. Construct cold room 1.13. Build recirculating aquaculturesystem 1.14 Prevent fish escape 1.15. Improve technical skills	1.1. Increase market access 1.3. Fix inlet/outlet pipes 1.9. Improve water exchange
Alianapo (AN)	1.1. Increase market access 1.2. Increase food availability 1.3. Increase farming space 1.4. Use of natural things 1.5. Increase number of catfish 1.6. Increase equipment 1.7. Preventing predation by birds 1.8. Increase market access	1.2. Increase food availability
Chikhudini F(CF)	1.1. Removing frogs 1.2. increasing water availability 1.3. Obtain equipments 1.4. Increase market access	1.4. Increase market access

Funyufuny u(FF)	1.1. Increase fish food 1.2. Increase fingerlings 1.3. Decreasing variable costs 1.4. Increasing water access 1.5. Increase equipments	1.1. Increase fish food
Fharanani FR	1.1. Increase fish food 1.2. Fencing 1.3. Preventing predation 1.4. Lack of water	1.1. Increase fish food
Tshaundi Tshelwala (TT)	1.1. Removing frogs 1.2. Increase water access 1.3. Construct ponds 1.4. Obtain equipments 1.5. Obtain fish nets 1.6. increasing fish food 1.7. Increase market access	1.2. Increase water access 1.3. Increasing ponds
Makhura (MK)	1.1. Removing frogs 1.2. Increase water access 1.3. Increasing fish food 1.4. Increasing equipment 1.5. Market access 1.6. Prevent theft 1.7. Prevent predation	1.6. Prevent theft 1.7. Prevent predation
Mudau (MA)	1.1. Increase fish food 1.2. Creating storage 1.3. Breeding catfish fingerlings 1.4. Obtaining finance	1.1. Increase fish food 1.3. Breeding catfish fingerlings
Nemutamba(NT)	1.1. Increasing fish food 1.2. Strengthening pond wall 1.3. Preventing Theft 1.4. Install fence around the business 1.5. Covering ponds 1.6. Hiring security guard 1.7. Improve market access	1.1. Increasing fish food 1.3. Preventing Theft

Ukhadzilito (UK)	1.1. Increasing fish food	1.1. Increasing fish food
	1.2. Improving number of ponds	
	1.3. Water access	
	1.4. Prevent predation	
	1.5. Increase market access	
	1.6. Netting fish	
	1.7. Remove frogs	
TshitakholeR L(TRL)	1.1. Increasing water access	1.1. Increasing water access
	1.2. Constructing ponds	
	1.3. Obtaining harvesting equipments	
	1.4. Obtain funding	
	1.5. Improve market access	
	1.6. Installing a security fence	
	1.7. increase fish food	
Boiteko Fisheries (BF)	1.1. Increase number of fish	1.8. Increase number of tools
	1.2. Market access	
	1.3. Improve communication skills	
	1.4. Technical skills	
	1.5. Increase water access	
	1.6. reduce mortalities	
	1.7. Increase number of harvesting equipments	
	1.8. Increase number of tools	
	1.9. Constructing slaughter house	
Gariep Dam (GD)	1.1. Market access	1.2. Obtain harvesting equipments
	1.2. Obtain harvesting equipments	
	1.3. Obtaining harvesting nets	
	1.4. Obtain grass cutter	
	1.5. Obtain protective clothing	
	1.6. Improve management skills	
Gotswametsin gProject (GMP)	1.1. Installing solar	1.2. Obtain diesel
	1.2. Obtain diesel	1.4. Market access
	1.3. Increase number of fish	1.6. Improve technical skills
	1.4. Market access	
	1.5. Obtain harvesting equipments	
	1.6. Improve technical skills	

Lephoi (LP)	1.1. Improving fish growth	1.1. Improving fish growth
	1.2. Installing solar	1.4. Improve technical skills
	1.3. Water access	
	1.4. Improve technical skills	
	1.5. Obtain fish	
	1.6. Obtain vehicle and boat	
	1.7. Abattoir construction	
	1.8. Improve technical skills	
Ludlow (LL)	1.1. Improve electricity	1.1. Improve electricity
	1.2. Increase product knowledge	
	1.3. Improve transparency between farmers and implementers	
	1.4. market access	
	1.5. Establishing processing facility	
	1.6. Obtain funding	
	1.7. Improve communication	
Jubelly (JB)	1.1. Increase number of nets	1.1. Increase number of nets
	1.2. Increase fish food	1.5. Market access
	1.3. Obtain protective clothing	
	1.4. Obtain equipments	
	1.5. Market access	
	1.6. Obtain aquaculture training	
Hungweni (HT)	1.1. Preventing theft	1.1. Preventing theft
	1.2. Prevent predation	
	1.3. Reduce nitrogenous substances	
	1.4. Improve technical skills	
	1.5. Reduce feed waste	
	1.6. Improvise	
	1.7. Destroy invader plants	
Gilmo (GM)	1.1. Water access	1.1. Water access
	1.2. Increase ponds	1.5. Prepare additional ponds
	1.3. Additional ponds	
	1.4. Obtaining more equipments	
	1.5. Prepare additional ponds	
	1.6. Covering ponds with liner	

Master Denzel (MD)	1.1. Improve water access 1.2. Improve capita 1.3. Improve security 1.4. Install pond liners 1.5. Prepare additional ponds 1.6. Obtain more implements	1.3. Improve security
Masibambisane (MB)	1.1. Increase water access 1.2. Increase farming 1.3. Market access 1.4. Increase fish 1.5. Increase fish food	1.1. Increase water access 1.3. Market access
Mthaiza (MT)	1.1. Increase water access 1.2. Increase fish food 1.3. Increase security 1.4. Increase market 1.5. Prepare additional ponds	1.1. Increase water access 1.2. Increase market
Catfish Supreme (CS)	1.1. Influence the permitting system 1.2. Import broodstock 1.3. Ensure live food production 1.4. Improve electrical works 1.5. Upgrade production system	1.1. Influence the permittingsystem
Disaneng (DS)	1.1. Improve low system performance 1.2. Fixing trapping of electricity 1.3. Retain system bacterial count 1.4. Improve aeration 1.5. Improve late feed supply 1.6. Fix fish system vortex 1.7. Improve water circulation pressure 1.8. Improve fish growth to reach market size on time	1.1. Improve low system performance 1.2. Fixing trapping of electricity

Appendix 5: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs), action implemented and support for Free State Province

Project number		CSFs	KPIs	KAs	Action Implemented	Support
LP project	Improve technical skills	Trainer	Report that has details of the trainer, email confirmation	Contact training center manager to organize training	Approached district agricultural manager to assist training, the response was partners were already trained	District agriculture manager will organize other types of training for partners.
		Fish for practical	Email confirmation	Confirm With the training center if the fish was available for training	District agricultural manager also indicated that partners attended fish practicals	None
		Training equipment and manual	Email confirmation	Confirm if training equipment would be available	Partners have aquaculture manuals From the previous training	None

	Money to Call the trainer	Donation agreement	Donation would come from the project to buy airtime and stationery	Not complete d	None
	Accommoda tion and meals	Email confirmation	Confirm with the training manager	Not complete d	None
Obtain market access	Advertising In shops through pamphlets	Pamphlet	Liaised with extension Officer to connect you with graphic designer from the Departmen t nt. Search for advertising g space in retail shops	Not completed, few member attended the session	None
	Advertising in billboards	Confirmation from Department	Raise funds to advertise the project on bill board	Not completed	Members must meet
	Transport	Meeting minutes	To hire transport,	The initial service	Make follow- ups with extension

				and search for local market opportunities	provider was mandated to install advertising billboard and he did not do it until the contract was terminated	officer
BF project	Increase number of tools	Money	Bank statement, Cash slip	Go to the bank and obtain statement and apply for grants at the department	Not implemented	Issues with members on cooperative certificate that hindered all the activities
		Quotations	Quotations document	Ask for the quotation at the store	Not implemented	To solve project admin issues
		Transport	Public transport Cash slip	Check availability of funds to use public transport	Not implemented	To solve project admin issues
		Enquiries in the shop	Pamphlets	Ask for the net; pamphlet	Not implemented	To solve project admin issues
		Phone	Call logs	Obtain contact details from the store to call	Not implemented	To solve project admin issues
OV project	Obtain market access	Target market	Report	To search for possible restaurant	Feeding schemes, factionalism &	Approach the ward councilor to supply fish

			s, wholesale rs, retailers, feeding schemes, prisons, military base, hospitals	nepotism; Restaurant s prefer hake and tilapia; Prison you have to sign a contract to get approval to supply fish; Liaised with community members and other neighbouri ng towns	to schools Compile a proposal
	Skills	Certificate/attendance register	Enquiring and organizing training with Rhodes and local training and breeding center to train on catfish	Not implemented	We need support from our Director and also from our extension officers from Department of Agriculture
	Survey	Survey	Design the market survey and submit to project, offer training of conducting a	The questionnaire were designed and awaiting approval by ethics committee at the University	None

		survey				
GD project	Obtain market access	Advertising	Billboards, pamphlets, leaflets	Design the pamphlets	Approached a graphic design to implement logos and a website and he required payment	Funds to pay graphic designer
		Survey	Survey document	Researcher will design the survey submit to the project and train before use,	Researcher designed the survey researcher Have submitted to the University for approval	Questionnaire administration training
		Appointment	Email confirmation	Make a meeting with the official to request for assistance to search on all the possible wholesaler and retailers around Free State, make a list, contact details	We went to town and discussed with Chinese wholesaler shops about buying our fish. They said they were still small, they wanted to buy big ones, maybe 50 or 70g. We drained the pond to catch the carps. Catfish was still small	Transportation
		Transport	Confirm with official	Check if they can pick fish from the	Confirmed with the manager by having	None

			center, Organize private transport to deliver the fish	a meeting with her, She said we must talk to the scientist to confirm the transport	
	Containers and scales	Hatchery assetform	Purchase equipmen t	Containers and scales were available at the hatchery free of charge	None
	Packaging material	Cash slip	Check quotation for paper plates and plastic wrap	No paper plates in town We found plastic wraps	None
	Stationery	Record book	An A4 notebook will be donated to the project by the member	A4 book was donated	None
	Project internet registration	Registration confirmation	Check with extensio n officers about how to register your project	Not implement ed	None
	Knives, Scissors, pliers and chopping board	Cash slip	Obtain quotation s for knives andpliers	No action implement- ed	Obtain quotations from DO It Yourself (DYI) and hardware stores

GMP project	Trainer	Email confirmation	Official will find project trainer and ask quotations Compile an email to request if they train farmers	Not implemented	No support
	Training Venue	Venue confirmation	Center might host the training	Not implemented	No support
	Advertise	advert	Design advert request shop manager to advertise on the internet and social media	Not implemented	No support
	Marketing skills	Attendance register	Receive survey skills training	In progress	Cooperative members support each other
	Personnel	Meeting minutes, budgeting and bank statements	To assign cooperative members to task, draw up a budget, raise the money and allocate the funds	Not implemented	No support
	Transport	Invoice	Organize	Not Implemented	No support

LL project	Get the plant operational			transport		
		Equipments, packaging materials and stationery	Invoice, asset register	Draw up the budget, raise the money and purchase the materials	Not implemented	No support
		Finances	Budget allocation	Arrange a meeting	Not implemented	No support
		Trainees	Confirmation letter	Confirm availability of coop members	Not implemented	No support
		Contact info: Member of Executive Committee (MEC) Agriculture	When I have the details and contacts saved	Research on the internet, call and confirm	Obtained contact details for MEC	No support
		The proper name and description of project	Email confirmation from district manager	Call aquaculture district manager and request the info via email	Not implemented	No support
		Identifying and expressing relevant issues	The letter	Compile the letter	Not implemented	No support
		"the letter" to be reviewed	Finalized by researcher and emailed back	Email to researcher	Not implemented	No support
		Engaging other members of	Receiving copies of their letter	Request their letter	Not implemented	No support

the project to
do the same

Appendix 6: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Mudau MA, Ukhadzilito UK, Fharanani FR and TshitakholeRL TRL projects Cycle 1

	Opportunities	CSFs	KPIs	KAs
MA; UL;FR;TRL, CF F & , F AN	Increase	Grinding mill	Cash	Search on the internet for
	alternative		slip/quotation	Suppliers and contact
	food for catfish	Chicken dung	Cash slip/ quotation	them Request poultry farmers Locally and obtain quotations
		Traditional brewery	Quotation	Request local farmers and obtain quotations
		Earthworms	Signed agreement	Request local farmers and obtain quotations Conduct an experiment to assess growth of catfish Fed earthworms and tilapia
		Kikuyu grass carp fish	Cash slip/ Quotation	Request local farmers and obtain quotations
		Chicken Intestines	Quotations/slip	Visit stores and ask for quotation
		Mixture o f sunflower & maize meal	Word of mouth	Request local farmers and obtain quotations
		Pig-waste	Word of mouth	Request local farmers And obtain quotations Ask community
		Cow-dung	Word of mouth	Request local farmers and obtain quotations.
		Fig tree fruit	Photo of fruit	Request local farmers and obtain quotations.
		Mulberry	Photo of fruit	Request local farmers and obtain quotations
		Chicken meat	Quotation	Obtain quotes from

TT & project	AN	Increase water availability	Water license	right	Water license procedure, permission from traditional leaders	stores	
						Obtain permission from the chief. Extension officer assistance to consult with Department of Water Affairs (DWA)	
MK project		Prevent predation	fish	Fencing materials and measure the ponds with distance measuring tape	Record pond measurements, quotations	Borehole	
						Quotation for borehole Distance measurement, Referrals	
						Obtain quotation from borehole drillers. Ask contacts from those who already drilled water	
NT project		Improve security in the project		Fencing materials	Quotation and buy	Water surveyor	
						Quotation from surveyors	
						Obtain quotation from water surveyors	
						Trap machine	
						Quotation from suppliers	
						Construct trap machine and obtain quotation of material	
						Hail net	
						Quotations	
						Search quotations of hailnet from stores and on the internet	
						Security guard	
						Job advertisement	
						Hire a security guard	
						Security alarm	
						Quotation	
						Obtain quotation from stores	
						Razor wire	
						Quotation	
						Obtain quotation from stores	
						Sport light	
						Solar sport light	
						Obtain quotation from	

Appendix 7: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Mpumalanga Province

Project number	Opportunities	CSFs	KPIs	KAs
GM, MB & MT project	Improve water availability	Drilling machine and driller	Quotations, Delivery note	Contact the driller and obtain quotation for equipments
		Water pump	Quotation, cash slip, deliverynote	Obtain quotation From hardware stores
		Pipe and installation tank	Quotation, cash slip, deliverynote	Obtain quotation From hardware stores
		Water assessment	Report	Conduct water assessment
		Water license	Water license certificate	Liaise with Department of Water Affairs
MB project		Concrete, cement and sand to build rain water harvesting dam	Cash slip	Obtain quotation for sand and cement
HT project	Prevent wastage	Trained workforce	Attendance register, training programme	Liaise with aquaculture unit in the Department of Agriculture
	Prevent theft	Proper fencing	Quotations/cash slip	Quotations from suppliers of fencing materials
		Night watch	Employment	Advertise for

			man	contract	CV, conduct interviews
			Alarm system	Quotations	Installation of the alarm system, report from security company
			Night lights	Quotation/cash slip	Proof of installation from electrician
KT & MD project	Prevent escape	fish	Engineering assessment report' hire security guards	Assessment report Employment contract	Request from Department of Agriculture for engineering assistance Request for private engineers locally Advertise and employ security guard
KT project	Purchase equipment		Fence, brick force, shovel, wire, cement, river sand and other tools	Quotation/slips	Request quotations from hardware stores
			List of stores that sell fish equipment	Quotation/cash slip	Obtain a list of fish stores and contact them for a quotation
MD project	Purchase harvesting equipments		Search for quotation stores from	Quotations	Search For equipment quotations stress
MB project	Increase capital		Apply for funding at Small Enterprise Development	Email, approval, application form, visitor register	Visit SEDA to search for funding

		Agency (SEDA)		
		Apply for loan at Land bank	Application form, visitor register	Visit Land Bank to apply for a loan
		Searching for sponsor	Visitor register	Search for information of possible organisations that could sponsor the fish farming business
		Contact department of Agriculture	Visitor register	Enquire from Department of Agriculture for the type of assistance they could offer
		Funding presentation to attract sponsors	Visitor register	Prepare a funding presentation to pitch at other companies
Improve market access	Market related fish selling price	Quotation	Search for market related fish selling price to determine project suitable price	
	Advertisement on radio and also create business cards	Confirmed radio slots; Business card	Liaise with radio stations for project advertisement Design business cards	
	Harvesting equipments	Quotations	Purchase harvesting equipments from fish stores	
	Market community survey	Questionnaire	Administer the market community questionnaire	

Appendix 8: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs) for Disaneng DS project

Project number	Opportunities	CSFs	KPIs	KAs
DS project	Improve low system performance	High water pressure for circulation	Not having fish wastes in the tanks When the water is balanced from all of the production tanks Pressure pump Quotations/ email confirmation Visitor's book	Liaise with initial system designerto obtain aquotation to fixthe system, travel and accommodation Replacing water pressure pump
	Improve aeration in tanks	Aeration in the production is high	Airstones Aeration tubes	Install airstones and aeration tubes in each tank Connection of the air-blowers
	Purchase fish tanks	Bigger production tanksto hold catfish	Tanks	Buy and Installthe tanks
	Heating thewater to keeptoptimal temperature	Keep optimal temperature throughout the year;	Less mortality Fish growth Thermometers Heat pumps	Heating the room temperature with heaters Heat the water with heat pumps Testing the water with test kits Taking measurements from the heat pump

	Increase bacteria in biofilters	To increase the bacterial count in the biofilters to minimize levels of ammonia	Printed sheet of laboratory results	Taking water sample to the Potchefstroom lab. Capture the water quality results in the data book
	Upgrade electricity	To increase voltage of electricity at the transformer and meter box	Agriculture quotations Proof of payment Minutes from Agriculture meetings	Obtain copy of the quotation from Agriculture Source
	Appoint system designer	To appoint aquaculture system designer (service provider)	Quotations from service provider Sign visitors book System assessment report	Enquire from local qualified engineers Appoint them and obtain a formal system assessment report
	Purchase vortex filters	Increase the number of vortex filters in the hatchery	New vortex filters Proof of payment	Buy and install new vortex filters
	Fish record keeping	Fish growth performance	Recorded weight and length of fish	Take measurement of fish growth monthly

Appendix 9: The Critical success Factors (CSFs), Key Performance Indicators (KPIs) and Key Actions (KAs), Action Implemented and Support needed for Tladinga and Phetwane Projects

	CSFs	KPIs	KAs	Action Implemented	Support needed
TD project	Reading training manuals	manual	Researcher will forward manual to TD5, copy manual, 'the Culture of catfish"	The researcher forwarded the copy of the manual to the project. Partners made copies and distributed amongst themselves. A meeting was held to give each other studying tasks. TD5 was responsible for fry production, TD6 studied breeding water conditions, TD 8 was studying fish nutrition	Attend a formal aquaculture technical training from experts and on-going
	Training by extension officer	Attendance register, assessment form	Researcher will Liaise with Agriculture College to offer training to partners	Researcher organized with Agriculture College trainer and she could not offer the training due to being on leave,	An alternative trainer will be sought

PT project	Practical breeding training	Attendance register/ Assessment form	Organize with extension officer to find out when is she breeding, Ask Extension Officer (EO) for transport to Turfloop breeding station,	Researcher have organized with aquaculture support from department of Agriculture and secured a date for breeding practical	Partners will arrange to attend the practical training a
	Training equipment	Proof of purchase/ borrowing agreement	Liaise with aquaculture manager to ask for nets and protective clothing	Nets were borrowed but couldn't be utilized on the dam because of the weather	The activity was on-going
	Training venue	Security daily register	Organize training venue	The training venue was organized and secured	Completed
	Record keeping Advertising	Books Post pamphlet sEmail confirmation	Meeting to access the record and update; design pamphlets, meeting to access the pamphlets Apply for funding Networking With funding organisations Observing the dams and requirements	No meeting held Applied for funding and published the name of the project on social media Lobby government / local municipality to ask for vehicles and equipment to market	Having data to contact them Need support from target customer and trade internationally Lobby/ negotiate training for technology

More fish Transport	Quotation and delivery notes; confirmation from extension	Email, liaise with localbreeding station regarding availability of catfish, extension officers	Breeding station has agreed to train us on how to breedcatfish	Transport cost to the breeding station
Market survey	Survey pamphlet sEmail	Compile a survey Process the fish at theproject	The questionnaire were designed awaiting approval from University	Partners would be trained on how to administer the questionnaire
Processing and harvesting equipment, fridge	Cash slips Quotations, cash slips	Request for harvesting and obtain quotations	Quotations obtained from hardware stores that dealt with gardening tools	Transportation to travel to a shop that sold materials in quantity for affordable price
ITC resources	Quotations, cash slip	Obtain quotation of laptop and stationery	The quotations cost was R45, 000 from one supermarket from other shops it was R14, 000	Request for funding to purchase the stationery. Sit as a committee and donate to buy some
Dirty water		Test the water	Tested the water	Government

			with a hand to test the cleanliness of the water. We must have record book and record the quality of the water	must help to purchase the water quality equipment
Inlet/outlet pipes	To fit inlet/outlet pipes	We can't drain the water because we are still ploughing, we can't get fish, and we can't have a meeting. The draining system is not working	Someone will check the sizes of the pipes To call a meeting, after we drain the water	

Appendix 10: Observations, Questions, Ideas and Opportunities in Phetwane (PT) and Gariepdam (GD)

Partner	Observations	Questions	Ideas	Opportunities
PT 43	Confidence, goodeye contact (PT46)	Did you get a response from the funder? Letter (PT45)	He must try other shops [PT46]	It will reduce unnecessary costs (PT46)
	Good confidence (PT47)	Have you never had an idea of the size of the pipe (PT47)	If estimate the pipe size (PT47)	none
	Free (PT44)	What did you do after realizing that sizes are needed (PT44)	He could have found the sizes and go back to the shop (PT44)	To reduce cost by obtaining quotation (PT44)
	Serious with his work, he understand his worker (PT48)		Groblersdal and find more	Go to the shop ask where there is less costs

			information (PT4)]	(PT48)
	Confident , eye contact, brave and straightforward (PT45)	How many Quotations have you done (PT45)	At least try to do three quotations (PT45)	At least try to do three quotations (PT45)
PT 46	Confidence, clear, eye contact (PT43)	Did you get a response from the funder? Does government agree to survey the project? How much did you use for data (PT43) Which platform did you advertise (PT48)	Don't give up Continue to ask for assistance to be able to succeed (PT43)	If you don't have transport he must talk to us to organize be patient (PT43)
	Confidence, Hardworking and dedicated (PT48)		Use method of electronic for advertisement to save pap er (PT48)	
	Confidence and understanding of his work (PT47)	Are you keeping record for administration (PT47)	To keep records of airtime Marketing to: social medi a (PT47)	
	Serious about his work, Dedicated (PT45)	Did you get response of the letter (PT45)	While writing the letters he must keep copies (PT45)	To bring more customers (PT45)
PT47	Confident, looks for passionate (PT46)	Did you get quotes at town only, or is it where you obtained them? (PT46)	Search on the internet to cut transport costs (PT46) Continue	Record keeping to maintain information (PT46)
	Confident, knows what he was doing (PT45)		o check on internet and the prices (PT45) Try again (PT44)	
	Knows what he was doing (PT44)	Did you come to talk to the committee about transport issue? (PT44)		
	Commitment, good work (PT48)	Your idea is it for you for your community? (PT48)	Don't get tired, you	Keep trying it is a mother of success (PT48)

			will rewarded once you are done	
Phetwane PT45	Presentation was good, confidence, commitment (PT43)	How is the water from his testing? Did he start to record quality of water What did he know water temperature is right for fish (PT43) What is the right temp for fish? Do you have a machine to check the water temperature, or what did you to check temperature? (PT46)	(PT48) Obtain a book (PT43) According s knowledge or fish it is important t o share with members t o increase awareness offish (PT46) Be careful with measurement to be done at the same time every day (PT44) Do something for Record keeping according to his knowledge (PT47) Keep n obtaining quotations (PT46)	Continue with his work as it a good work (PT43) Increase customers because of awareness (PT46) To keep increasing production and marketing (PT44) Your knowledge increase production and marketing (PT47) It help to compare the prices
PT 44	Energetic, commitment, reliable (PT46)	From the shops, did you get proof? (PT46)		

PT48	Hyperactive,(PT47)	Did you try other furniture shops for office equipment(PT47)	Try to find quotations from 1 store e.g. Makro to negotiate prices (PT47)	It will help the project to move forward (PT47)
	Confidence, efficient worker(PT46)	After experiencing the problem did you meet with the committee to discuss How long since the dams can't drain the water? How can we take action to this problem (PT46)	Please meet with the committee and brainstorm the solutions with the committee(PT46)	Trying harder is the fruit of success (PT46)
	Good understanding of his job (PT47)		Call a meeting to discuss the planning to solve the meetings (PT47)	
	Knowledgeable (PT44)	Which steps were taken after talking to the chairperson (PT44)	Continue to discuss the issue, resolution will come (PT44)	
	Confidence, responsibility(PT43)	What is the solution of the problem(PT43)	The meeting should have been taken place (PT43)	The meetings is important for project management to plan ahead (PT43)
	Knowledgeable, responsibility (PT45)	Did you speak to plumbing at the municipality to resolve the issue (PT45)	Keep on trying to take the project forward (PT45)	To increase market (PT45)

GM20	Imperative to the types of flowers planted since some consume a lot of water a nd Department of Water Affairs was eradicating some (MT24)	What was wrong with water pump (JB26); Was the pond covered with concrete at the bottom (MT23); What type of flowers wereplanted (MB11)	
JB26	Marketing can be done in a small magnitude by moving from door to door; money makes thing s move; surve y creates awareness of the type of community in order for a business to change tactics (JB26)	Where werebusiness stickerscreated (MB11); How was their business advertised(GM20);	Create a stand point at the mall for people to taste fish (JB26)
MB11	Plastics applied to cover ponds were torn by the sun (MB12); cooperatives could not contribute R20 000 require to erect a borehole (MB12)	How were the ponds cleaned if water came from spring (MT23); How many ponds and does fish survive in ponds (MB16)	
HT64	Knowledge of catfish breeding (HT64)		Experience in teaching people Agriculture via AgriSETA and currently willing to switch to fish (HT64)
CS43	Committed to other agricultural activities over fishfarming; noaquaculture personnel	inc	

(CS43)

DS01	Conflicts between service providers and Department of Agriculture impacts on operation and high costs of electricity to run a system (DS01); purchased items were not delivered to monitor water quality and trainings were organized ad hoc (DS03)			
GD57	None	None	We will go to hardware stores	Is to slaughter the fish
KC	Specific, Measurable, Achievable, Relevant, Targeted, Time-framed (SMARTT) focus too broad	5 % profitability of agro-processing business may not be relevant to small farmer, single e tunnel more appropriate	Focus on single aquaculture production unit for comparability	Develop a standard for a single unit of production to facilitate duplication

Appendix 11: Correlation between Weight and Depth of African catfish per week

		Depth _W0	De pt h_ W 1	De pt h_ W 2	De pt h_ W 3	Depth _W4	Depth _W5	Depth _W6	Depth _W7
Wei g ht_ W0	Pearson	-.127*	0.09	0.12	0.07	-.136*	-	0.025	0.032
	Correlation		2	4	7		0.002		
	Sig.	0.049	0.15	0.05	0.23	0.035	0.980	0.700	0.620
	(		4	4	5				
	2-tailed)								
Wei g ht_ W1	Covariance	-	0.21	0,57	0,29	-	-	0,062	0,061
		1.865	1	7	1	0,863	0,007		
	Pearson	-	.272	0.09	0.02	-	0.019	-0.046	-
	Correlation	.290**	*	9	0	0.035			0.097
	Sig.	0.001	0.00	0,12	0.75	0.585	0.773	0.481	0.132
Wei g ht_ W2	(		1	6	6				
	2-tailed)								
	Covariance	-	0.74	0.55	0.09	-	0.096	-0.135	-
		5.102	3	1	1	0.269			0.221
	Pearson	-	.183	.221	.127	0,001	0.033	.147*	0.118
Wei g ht_ W3	Correlation	.205**	*	*	*				
	Sig.	0.001	0.00	0.00	0.04	0.988	0.608	0.023	0.067
	(		4	1	9				
	2-tailed)								
	Covariance	-	0.49	1.21	0.57	0.007	0.170	0.432	0.266
Weig ht_W		3.581	7	9	3				
	Pearson	-.163*	0.04	.233	.173	0.098	.149*	.215**	.198**
	Correlation		5	*	*				
	Sig.	0.012	0.49	0.00	0.00	0.130	0.02	0.001	0.002
	(		2	1	7		1		
Weigh t W3	2-tailed)								
	Covariance	-3.264	0.13	1.47	0.89	0.848	0.87	0.728	0.511
			9	6	6		5		
	Pearson	0.001	-	.186	.185	.191**	.244*	.280**	.446**
	Correlation		0,0	*	*		*		
Weig ht_W4			9	*	*				
	Sig.	0.988	0.13	0.00	0.00	0.003	0.00	0.001	0.001
	(		5	4	4		1		
	2-tailed)								

	Covariance	0.025	-0.380	1.481	1.205	2.081	1.800	1.190	1.454
Weig ht_W5	Pearson Correlation	.178**	-.146*	0.058	.138*	.144*	.350*	.383**	.549**
	Sig. (2-tailed)	0.006	0.024	0.372	0.032	0.026	0.001	0.001	0.001
	Covariance	6.071	-0.774	0.625	1.218	2.121	3.495	2.205	2.420
Weig ht_W6	Pearson Correlation	0.119	-.179*	0.061	0.099	.136*	.290*	.597**	.657**
	Sig. (2-tailed)	0.066	0.005	0.348	0.127	0.036	0.001	0.001	0.001
	Covariance	5.499	-1.289	0.889	1.178	2.708	3.928	4.650	3.923
Weig ht_W7	Pearson Correlation	.172**	-.128*	0.084	0.068	.139*	.291*	.452**	.857
	Sig. (2-tailed)	0.008	0.047	0.194	0.294	0.032	0.001	0.001	0.001
	Covariance	9.765	-1.133	1.508	0.996	3.395	4.831	4.323	6.276
	N		240	240	240	240	240	240	240

Appendix 12: Correlation between Weight of African catfish per week

		Weig ht_ W0	Weig ht_ W1	Weight _W2	Weight _W3	Weig ht_ W4	Weight _W5	Weig ht_ W6	Weig ht_ W7
Leng t h_W 0	Pearson	.740**	.537**	.303**	.297**	.236**	-0.069	-0.044	-
	Correlat ion								0.084
	Sig. (2- tailed)	0.001	0.001	0.001	0.001	0.001	0.288	0.494	0.193
	Covarian ce	2.065	1.797	1.004	1.131	1.132	-0.447	-0.390	- 0.910
Leng t h_W 1	Pearson	.428**	.750**	.479**	.380**	.266**	0.013	-0.087	-
	Correlat ion								0.047
	Sig. (2- tailed)	0.001	0.001	0.001	0.001	0.001	0.841	0.177	0.471
	Covarian ce	1.634	3.438	2.177	1.986	1.752	0.116	-1.054	- 0.690
Leng t h_W 2	Pearso n	0.043	0.055	.132*	.173**	0.094	0.056	0.068	0.052
	Correlat i on								
	Sig. (2- tailed)	0.508	0.392	0.041	0.007	0.146	0.384	0.295	0.419
	Covarian ce	1.385	2.144	5.067	7.613	5.229	4.235	6.896	6.534
Leng t h_W 3	Pearso n	.247**	.247**	.618**	.805**	.429**	.324**	.317**	.265**
	Correlat i on								
	Sig. (2- tailed)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

	Covariance	1.400	1.680	4.167	6.241	4.193	4.274	5.661	5.817
Length_W4	Pearson correlation	-0.094	-0.017	0.035	.134*	.228**	0.119	.142*	.144*
	Sig. (2-tailed)	0.146	0.789	0.589	0.037	0.001	0.065	0.028	0.026
Length_W5	Covariance	-2.396	-0.530	1.061	4.679	9.973	7.076	11.347	14.147
	Pearson Correlation	0.098	-0.014	.254**	.304**	.586**	.760**	.550**	.505*
	Sig. (2-tailed)	0.129	0.824	0.001	0.001	0.001	0.001	0.001	0.001
Length_W6	Covariance	0.709	-0.125	2.180	3.005	7.282	12.767	12.522	14.106
	Pearson Correlation	0.071	-0.030	.238**	.341**	.497**	.544**	.798**	.606*
	Sig. (2-tailed)	0.272	0.649	0.001	0.001	0.001	0.001	0.001	0.001
Length_W7	Covariance	0.610	-0.304	2.424	4.000	7.332	10.857	21.582	20.090
	Pearson Correlation	0.097	-0.020	.164*	.264**	.470**	.530**	.651**	.792*
	Sig. (2-tailed)	0.135	0.755	0.011	0.001	0.001	0.001	0.001	0.001
	Covariance	0.894	-0.224	1.798	3.336	7.473	11.390	18.944	28.294
	N	240	240	240	240	240	240	240	240

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Appendix 13: Correlation between Length and Depth of African catfish per week

		Length _W0	Lengt h_W1	Lengt h_W2	Lengt h_W3	Lengt h_W4	Lengt h_W5	Lengt h_W6	Lengt h_W7
Dept	Pearson	-.249**	-.348**	-0.120	-.132*	0.043	0.048	0.028	0.074
h_ W0	Correlati on								
	Sig.	0.001	0.001	0.063	0.040	0.512	0.463	0.666	0.254
	(2 - tailed)								
	Covarian ce	-1.395	-2.678	-7.811	- 1.511	2.178	0.690	0.483	1.373
De pt h_ W1	Pearson	.145*	.329**	0.002	0.086	-0.078	-.178**	- .221**	- .171**
	Correlat ion								
	Sig.	0.025	0.001	0.976	0.182	0.228	0.006	0.001	0.008
	(2 - tailed)								
De pt h_ W2	Covarian ce	0.126	0.394	0.019	0.154	-0.622	-0.403	- 0.592	- 0.494
	Pearson	0.044	0.119	.524**	.183**	-0.004	-0.001	0.024	0.026
	Correlat ion								
	Sig.	0.500	0.065	0.001	0.004	0.956	0.987	0.711	0.688
De pt h_ W3	(2 - tailed)								
	Covarian ce	0.078	0.290	10.74 1	0.662	-0.058	-0.005	0.131	0.153
	Pearso n	0.044	0.054	0.023	.258**	0.056	.181**	.15 9*	.134*
	Correlat i on								
	Sig.	0.499	0.404	0.727	0.001	0.387	0.005	0.013	0.038
	(2 - tailed)								
	Covarian ce	0.063	0.107	0.380	0.759	0.741	0.679	0.709	0.642

De pt h_ W4	Pearson Correlation Sig. (2- tailed) Covariance	-.195**	0.005	-0.018	0.105	.729**	.192**	.181**	.201*
Dept h_ W5	Pearson Correlation Sig. (2- tailed) Covariance	-0.034	0.047	0.007	.187**	0.068	0.119	.282**	.280*
De pt h_ W6	Pearson Correlation Sig. (2- tailed) Covariance	0.003	0.001	0.025	.337**	.140*	.492**	.662**	.592**
De pt h_ W7	Pearson Correlation Sig. (2- tailed) Covariance	-0.019	0.021	-0.013	.425**	.235**	.676**	.812**	.917**
	N	240	240	240	240	240	240	240	240

Appendix 14: Significance levels from descriptive statistics conducted in Eastern Cape, Free State, Limpopo, Mpumalanga and North West Provinces of South Africa

One-Sample Test

Test Value = 0

	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference
			One-Sided p	Two-Sided p		Lower
Provinces	9.836	29	.001	.001	3.167	2.51
Gender	16.858	29	.001	.001	1.167	1.03
Age	16.025	29	.001	.001	3.500	3.05
Language	13.614	29	.001	.001	4.900	4.16
Highest Qualification	11.000	29	.001	.001	2.567	2.09
Project Type	10.865	29	.001	.001	2.267	1.84
Years in operation	12.066	29	.001	.001	2.567	2.13
Source of water	15.211	29	.001	.001	2.500	2.16
Production Systems	11.298	29	.001	.001	2.467	2.02
Type of Species	7.757	29	.001	.001	3.800	2.80
Reasons for polyculture	15.701	29	.001	.001	5.867	5.10
Scale of operation	13.614	29	.001	.001	1.400	1.19
Source of financing	21.745	29	.001	.001	2.500	2.26
Process in operations	5.650	29	.001	.001	1.933	1.23
Market Channels Used	6.861	29	.001	.001	1.567	1.10
Type of Product sold	9.950	29	.001	.001	1.233	.98
Product Price determination	13.000	29	.001	.001	2.167	1.83
Marketing activities 1	13.260	29	.001	<.001	1.700	1.44
Government links to markets 1	15.456	29	.001	<.001	1.767	1.53
If yes, what type of marketing activities do you undertake	13.622	29	.001	<.001	6.800	5.78
If yes what type of government links	19.058	29	.001	<.001	4.033	3.60