Analysis of the 70:30 Higher Education Policy: Implications for Development in Ethiopia

by

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Declaration

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THOMAS ZENAWI August 2026

Abstract

Ethiopia introduced a 70:30 policy for national development through Human Resources Development (HRD) in Science and Technology (S&T) in 2008/09 in line with the developmental state; however, this policy has yet to be studied. Thus, this study aims to evaluate the effect of Ethiopia's 70:30 policy on HRD and its implications for development using mixed designs, primary, and administrative data. The study adopted an embedded mixed-methods approach with a concurrent triangulation design. The researcher gathered primary and administrative quantitative datasets alongside qualitative key informant insights at the same time. Appropriate sampling and sample selection are critical for evaluating this research. Stratified sampling was employed to examine the enrolment in S&T and Social Sciences (SS) in the 1st, 2nd, and 3rd generations. A purposive sampling approach was employed to select key informants who have relevant experience with the policy and its effects. We gathered rich qualitative insights through key informant interviews and systematically analysed them in ATLAS.ti—moving from granular coding and sub coding to hyperlinked quotations and advanced network mapping to uncover complex relational patterns. Data verification was made and cross-verified through disparate sources like Educational Management Information System (EMIS), Education Statistics Annual Abstract (ESAA), Higher education Institutions (HEIs), National Educational Assessment and Examinations Agency (NEAEA), and the policy document. Data was recounted for accuracy and cross-verified by comparing alternative data sources to ensure the reliability. Primarily, an innovative and exploratory data analysis approach was employed to address the objective. First and foremost, Interrupted time series design (ITSD), Autoregressive Integral Moving Average (ARIMA), Regression Discontinuity Design (RDD), Difference-In-Differences (DID), Pearson correlation, multiple, and logistic regressions were used for quantitative analysis, accompanied by data and graphic visualisation with SPSS and Stata. These methods of analysis are suitable for policy evaluation, comparing the preintervention and postintervention periods via the

structural model. Findings indicate a less relevant policy, inefficient resources, ineffective implementation, and lack of quality education, resulting in limited outputs/outcomes, including low employability, S&T skillsets, low HRD, innovation, and inefficient HR. There is a mismatch between HR supply and demand and feeble university-industry linkage. S&T intends to improve education and employment opportunities to contribute to the country's industrial development and meet middle income; however, unrealised. Introducing a demand-driven alignment framework/theory of education policy, along with integrating S&T with SS curricula for inclusive innovation, education, HRD, and sustainable development is recommended.

Keywords: 70:30 macro and micro policies; Science and Technology versus Social Sciences; Human Resources Development; Students choices of fields of study versus policy placement; National Learning Assessment (NLA) and Entrance exam performance, Science, Technology, Engineering, Mathematics (STEM); Science, Technology, Engineering, Art and Mathematics (STEAM); innovation; policy implementation; employability; skill development; employment versus unemployment of graduates; relevance policy; implications for development.

Table of Contents

Acknowledgements 2
Declaration 3
Abstract 4
Table of Contents 6
List of Tables 9
List of Figures 10
Acronym 14
CHAPTER ONE 17
INTRODUCTION 17
1.1 Introduction and Background 17
1.1.1 Background Information of 70:30 Policy 17
1.1.2 Policy Context 21
1.2 Problem Statement 35
1.3 Research Question 40
1.4 Objective of Study 40
1.5 Assumptions, and Delimitations of the study 41
1.5.1. Research assumptions 41
1.5.2. Delimitations of the Study 41
1.6 Limitation of Study 42
1.7 Significance of the Study 43
1.8 Operational Definition 44
1.9 Organisation of Study 46
CHAPTER TWO 47
Review of Literature and Theoretical Framework 47
2.1 Introduction 47
2. 2. Implication of Development Theories for Higher Education 48
2.2.1 Neo-liberal Implication for Higher Education Development 48
2.2.2 The Developmental State Implication for Higher Education 53
2.2.3 Neo-classical Implication for Higher Education Development 57
2.2.4 The Endogenous Theory Implication for Higher Education 58
2.2.5 Human Capital Theory and its Implication for Economic 60
2.2.6 International Development and Influence on Higher Education 67
2.3 Education Theories and Their Implication for Development Policy 71
2.3.1 Education Theories and Implication for Higher Education Policy 71
2.3.2. Theories of Educational Philosophers and their Implication 72
2.3.3 Learning Theories and their Implication 74
2.4 Labour Market, Minimum Wage, and Skills Mismatch 75
Summary 78

CHAPTER THREE 80
The 70:30 Education Policy and Implications for Human Resources Development 80
3.1 Introduction 80
3.2 Education for Human Resource Development 80
3.2.1 Relevance of Education Policy for Human Resources 82
3.2.2 Relevance of Higher Education Policies on Science and Technology and Implication for Human Resources 87
3.2.2.1.2 STEM versus AHSS Implication 101
3.2.2.1.3 Students' interest and talent in STEM implications for relevant human resources development 102
3.2.3 Enrolment in Higher Education and Supply of Human Resources 103
3.2.4 The Role of Higher Education and its Implications 110
3.2.5 Employability of the Graduates 114
Summary 122
CHAPTER FOUR 123
Implications of the 70:30 Education Policy for Ethiopian Education System 123
4.1 Introduction 123
4.2. Higher Education Development in Ethiopia 124
4.2.1 Pro-Capital System and Higher Education in Ethiopia 124
4.2.2 Socialism System and Higher Education in Ethiopia 125
4.2.3 Developmental State and Higher Education in Ethiopia 127
4.3. National Policy, and Integration with 70:30 Policy 129
4.3.1 Growth and Transformation Plan and the 70:30 Policy 129
4.3.2 Education Sector Development Programme and the 70:30 Policy Implementation 130
4.3.3 The 70:30 Policy & implication for Ethiopian Education System 133
4.3.3.2 Relevance for Primary and Secondary School Education 135
Summary 146
CHAPTER FIVE 148
RESEARCH METHODOLOGY 148
5.1 Introduction 148
5.2. Research Paradigm and Approach 148
5.2.1 Research Paradigm 149
5.2.2 Methodological Approach of the Research 150
5.3 Rationale of the Research Methodology 151
5.4 Organisational and Statistical Sources of Data 154
5.5 Type of Research 155
5.6 Research Design 156
5.7 Sampling and Sample 162
5.7.1 Sampling 162
5.7.2 Sample 163

5.9 Data Collection Method....165
5.9.1 Existing and Administrative Statistical Data....165
5.9.2 Meta-Analysis and Secondary Data and Documents....165
5.9.3 Key Informant Interview....166
5.10 Data Analysis Methods and Techniques....168
5.10.3 Qualitative Data Analysis....188
5.11 Validity, Reliability, Rigour and Trustworthiness....190
5.12 Ethical Consideration....190
Summary....191
CHAPTER SIX....192
RESEARCH FINDINGS AND DATA ANALYSIS....192
6.1 Introduction....192
6.2 Findings and Quantitative Data Analysis....193
6.2.1 Characteristics of the Sample....193
6.2.3 Implementation of the 70:30 Policy in the HEIs in Ethiopia....201
6.2.3.1 The Enrolment Trend Analysis of Higher Education in line with the 70:30 Policy Implementation and its implications for the Gross Enrolment Ratio.....201
6.2.4 Output of 70:30 Policy in Supplying Human Resources to Economy....232
6.2.5 The Outcome of the 70:30 Policy Effect on the Employability of Graduates....240
6.3 Findings and Qualitative Data Analysis....250
6.3.1 Demographic Characteristics of the Interviewees....250
6.3.2 Relevance of 70:30 Policy for Human Resources Development....251
6.3.3 The Implementation of the 70:30 Policy in the HEIs in Ethiopia....256
6.3.4 The Output of the 70:30 Policy in Supplying Human Resource to Different Sectors of the Economy in Ethiopia....260
6.3.5 The Outcome of the 70:30 Policy Effect on the Employability of Graduates....266
6.4 Summary and Interpretation....272
CHAPTER SEVEN....276
Discussion....276
7.1 Introduction....276
7.1.1 Relevance of 70:30 Policy in Human Resource Development....276
7.1.2 Implementation of the 70:30 Policy in HEIs....280
7.1.3 Outputs of 70:30 Policy on different Sectors....286
7.1.4 Outcome of the 70:30 Policy on the Employability of Graduate....290
8.1 Introduction....296
8.2 Summary Findings....296
8.2.1 Relevance of 70:30 Policy in Human Resource Development....296
8.2.2 Implementation of the 70:30 Policy in the HEIs....298
8.2.4 Policy Outcome on Employability of Undergraduate Graduates....301
8.3 Policy Implications....304

8.3.2 Policy Implications for Gender Disparity and Inequity 309
8.3.3 The Micro Policy Implications 309
8.3.4 Policy Implications for Demand and Supply of Human Resources 311
8.3.5 Policy Implications for the Employability of Graduates 312
8.4 Contribution of this Study and its Implications 314
8.4.1 Contribution to Theory, Practice, and its Implications 315
8.4.3 Contribution to Knowledge, Policy, and Its Implications 320
8.4.4 Contribution to Science, Technology and Innovation 323
8.4.5 Contribution to Literature 325
8.4.6 Contribution to Methodological Approach 325
8.5 Recommendations for Policy and Practice 326
8.5.1 Policy Recommendations to the Government Practice 326
8.5.2 Recommendations to HEIs Practice 336
8.5.3 Recommendations for Private, Industrial Sectors and Employers 341
8.5.4. Recommendation for University-Industry, Labour-Market and School Linkage 342
8.6 Future Research 343
8.7 Conclusion 344

List of Tables

Table 1: Characteristics of the Sample of the Undergraduate and Postgraduate Enrolment in Government and Non-Government Universities (2003/04-2016/17) **191**
Table 2: Characteristics of the Sample of the Undergraduate and Postgraduate Enrolment in Government Universities (2003/04-2016/17) **192**
Table 3: characteristics of the sample of the undergraduate and postgraduate graduates from government universities (2003/04-2016/17) **193**
Table 4: Illustrates the Percentage of Macro-Policy of Regular Students Placed into Public Universities by the Government versus Selected Fields of Study by the Students and its Implication for HRD from 2011/12 to 2016/17 **197**
Table 5: Percentage of the Micro Policy of Regular Students Placed into Public University versus Select Fields of Study and its Implication for HRD from 2011/12 to 2016/17 **198**
Table 6: Coefficient of the Undergraduate Macro Policy of 70:30 **215**
Table 7: Coefficient of the Micro Policies Undergraduate Enrolment **216**
Table 8: Coefficient of the Macro Policy Postgraduate Enrolment **217**
Table 9: Coefficient of the Micro Policies Postgraduate Enrolment **218**
Table 10: RDD Model of S&T Policy Effect on Enrolment **221**
Table 11: RDD Model of SS Policy Effect on Enrolment **221**
Table 12: DID Results of Undergraduate Enrolment of Public & Private Universities Effect on Enrolment **225**
Table 13: DID Results of Undergraduate Enrolment of S&T Policy Effect on Enrolment **226**

Table 14: DID Results of Undergraduate Enrolment of SS Policy Effect on Enrolment **227**
Table 15: DID Results of Undergraduate Enrolment of E&T Policy Effect on Enrolment **228**
Table 16: DID Results of Undergraduate Enrolment of NCS Policy Effect on Enrolment. **228**
Table 17: DID Results of Undergraduate Enrolment of MHS Policy Effect on Enrolment. **229**
Table 18: DID Results of Undergraduate Enrolment of Anrs Policy Effect on Enrolment **231**
Table 19: DID Results of Undergraduate Enrolment of B&E Policy Effect on Enrolment **231**
Table 20: DID Results of Undergraduate Enrolment of SHS Policy Effect on Enrolment. **232**
Table 21: The macro and micro policy undergraduate graduate effect on employment/or unemployment in 2016 **241**
Table 22: A Cross-Tabulation of Employment Status by the Generation of Universities in 2015 **243**
Table 23: Fitted Binary Logistic Model to Assess the Effect of Policy on the Employment of Graduates **244**
Table 24: Fitted Multinomial Logistics Regression Model of the Policy Effect on Self-Employment and Time to Getting a Job. **246**
Table 25: Pearson Correlation between Graduate Employment Status and Field of Study Placement **250**

Annex Tables

Table 26: Sample Taken of Key Informant Interviews (KIIs) **389**
Table 27: Nationally Set Annual Intake Target for Macro and Micro Policies with Fields of Study **390**
Table 28: Government Academic Staff by Qualification, Sex, Citizenship and Micro Policy in 2014/15 **391**
Table 29: Demographic Characteristics of the Interviewees **392**
Table 30: Axum University Tracer Study on Micro Policies Undergraduate Graduates of Effect Employment and/or Unemployment **393**
Table 31: Students' Results of NEAEA Based on Gender and Bands/Micro Policies. **393**
Table 32: Diagnostic test for collinearity and autocorrelation **394**
Table 33: Models of time series of the macro and micro policies undergraduate effect on enrolment and graduate **394**
Table 34: parameter of macro and micro policies effect on enrolment and postgraduate **395**

List of Figures

Figure 1: Theoretical frameworks' implications for HE development.....56

Figure 2: STEAM & Innovation process & its implication for economic development 97
Figure 3: The Role of HE & implications & impacts.....112
Figure 4: Onion model of paradigm, research approach & design 149
Figure 5: Percentage of learners who have scored ≥50% & <50% on the Grade 12 entrance exam and admitted to a public university and its implications 197
Figure 6: HE enrolment ratio- 2003/04 & 2016/17.....202
Figure 7: Implementation of macro policy at public universities 206
Figure 8:Micro-enrolment policy implementation at public university 207
Figure 9: Macro policy -Postgraduate enrolment at public university.....214
Figure 10: Micro-policy postgraduate enrolment in public universities.....214
Figure 11: RDD of S & T policy Figure 12: RDD of SS effect 222
Figure 13: RDD of E & T policy Figure 14:RDD of NCS 224
Figure 15: RDD of MHS micro policy Fig 16:RDD ANRS micro policy 224
Figure 17: RDD of B & E Figure 18: RDD of micro policy.....225
Figure 19: RDD of S & T Figure 20: Enrolment postgraduate effect at cut-off 226
Figure 21: Implementation of macro policy undergraduate supplying HR.....233
Figure 22: Implementation of macro policy in supplying HR 234
Figure 23: Outcome of macro policy in postgraduate supply of HR 237
Figure 24: Output of Micro policy at postgraduate in supplying HR 238
Figure 25: Relevance indicators and placement policy for HRD 255
Figure 26: Implementation of policy on HEIs 257
Figure 27: Supply & demand of HR for sectors of economy 262
Figure 28: Effects of policy on HR development 264
Figure 29: Policy effect on employability.....269

Annex figures

Figure 30 Percentage of Postgraduate Enrolment Both Public & Private University by Gender **398**
Figure 31 Percentage of Undergraduate Enrolment Both Public & Private University by Gender **399**
Figure 32 Long-Term Trends Percentage of Postgraduate Enrolment in Government and Non- Government Universities by Gender **399**
Figure 33: Percentage of Undergraduate Enrolment in Government-University by S&T and Ss **400**
Figure 34: Percentage of Undergraduate Enrolment in Government-University by Gender in S&T and Ss **400**
Figure 35: Percentage of Undergraduate Enrolment in Government-University by Micro Policies **401**
Figure 36: Percentage of Undergraduate Enrolment in Government-University by Gender **402**
Figure 37: Share of Postgraduates Enrolment in Government-University by S&T & Ss **402**

Figure 38: Share of Postgraduates Enrolment in Government-University by S&T & SS in Terms of Gender **403**
Figure 39: Percentage of Undergraduate Graduates' Programmes in Government-University By S&T & Ss **403**
Figure 40: Percentage of Postgraduate Enrolment Programmes in Government-University by Micro Policies **404**
Figure 41 Percentage of Undergraduate Graduate in Government-University by Micro Policies **404**
Figure 42 Percentage of Undergraduate Graduate in Government by Gender **405**
Figure 43 Percentage of Postgraduate Graduate in Government-University by S&T and SS **405**
Figure 44: Percentage of Postgraduate Graduates in Government-University by S&T and SS **406**
Figure 45 Percentage of Postgraduate Graduates in Government-University by Micro Policies **406**
Figure 46 Percentage of Enrolment of Postgraduate Programme in Government-University By Generation **407**
Figure 47 Shows the ACF And Lag Number of E&T. **408**
Figure 48 Shows the Partial ACF and Lag Number of NCS **408**
Figure 49 Shows the ACF And Lag Number of MHS. **409**
Figure 50 Shows the ACF And Lag Number of B&E. **409**
Figure 51 Shows the ACF and Lag Number of ANRS412 **410**
Figure 52 Shows the ACF And Lag Number of B&E. **410**
Figure 53 Shows the Partial ACF And Lag Number of SS **411**
Figure 54 Shows the ACF And Lag Number of SS. **411**
Figure 55 Figure Shows Normal P-P Plot of S&T Regression Standardised Residual Dependent Variable (Enrolment). **412**
Figure 56 Shows the Scatter Plot of S&T Dependent Variable (Enrolment). **412**
Figure 57 Shows Normal P-P Plot of SS Regression Standardised Residual Dependent Variable (Enrolment). **413**
Figure 58 Shows Scatter Plot of SS Dependent Variable (Enrolment). **413**
Figure 59 Shows Normal P-P Plot of E&T Regression Standardised Residual Dependent Variable (Enrolment). **414**
Figure 60 Shows Scatter Plot Dependent Variable of E&T Dependent Variable (Enrolment). **414**
Figure 61 Shows Normal P-P Plot of Regression Standardised Residual of NCP Dependent Variable (Enrolment). **415**
Figure 62 Shows The Scatter Plot of NCS of Dependent Variable (Enrolment)…**415**
Figure 63 Shows the Norma P-P Plot ANRS Regression Standardised Residual of Dependent Variable (Enrolment). **416**
Figure 64 Shows the Scatter Plot of MHS of Dependent Variable (Enrolment). **416**
Figure 65 Shows the Normal P-P Plot of Regression Standardised Residual of ANRS of Dependent Variable (Enrolment). **417**

Figure 66 Shows the Scatter Plot of ANRS of Dependent Variable (Enrolment). **417**
Figure 67 Shows P-P Plot of B&E Regression Standardised Residual the Dependent Variable (Enrolment). **418**
Figure 68 Scatter Plot of B&E of the Dependent Variable (Enrolment). **418**
Figure 69 Shows P-P Plot of SHS of Regression Standardised Residual the Dependent Variable (Enrolment). **419**
Figure 70 Scatter Plot of SHS of the Dependent Variable (Enrolment) **419**
Figure 71 Hyperlinked Quotation of the Policy Relevance **420**
Figure 72 Hyperlinked Quotation of Implementation of the Policy **421**
Figure 73 Hyperlinked Quotation of Effect of the 70:30 Policy **422**

Acronym

ADB	**African Development Bank**
ADLI	Agricultural Development-Led Industrialisation
ADP	Amara Democratic Party
AHD	Africa Human Development
ANOVA	Analysis of Variance
ANRSs	Agriculture and Natural Resource Sciences
AHSS	Arts, Humanities and Social Sciences
AI	Artificial Intelligence
ARIMA	Autoregressive Integral Moving Average
B&E	Business and Economics
CGRE	Climate Resilient Green Economy
CIPP	Context, Input, Process, and Product
CSMASEE	Centre for Strengthening Mathematics & Science Education in Ethiopia
DID	Difference-In-Difference
EBR	Ethiopian Business Review
EGSCE	Ethiopian General Secondary School Certificate Examination
EHE	Ethiopian Higher Education
EMIS	Educational Management Information System
EPRDF	Ethiopian People Revolutionary Democratic Front
ESM	Exponential Smoothing Model
ESAA	Education Statistic Annual Abstract
ESDP	Education Sector Development Programme
E&T	Engineering and Technology
ETP	Education and Training Policy
FDRE	Federal Democratic Republic of Ethiopia
GATT	General Agreement on Tariffs and Trade
GEQUAEP	General Education Quality Assurance and Examinations Agency
GER	Gross Enrolment Rate/Ratio

FNG	Federal Negarit Gazeta
GTP	Growth and Transformation Plan
HCT	Human Capital Theory
HDI	Human Development Index
HE	Higher Education
HEP	Higher Education Policy
HEIs	Higher Education Institutions
HES	Higher Education System
HERQA	Higher Education Relevance and Quality Agency
HESC	Higher Education Strategy Centre
HR	Human Resources
HCD	Human Capital Development
HRD	Human Resources Development
HRM	Human Resources Management
ICT	Information and Communication Technology
IoT	Internet of Things
KIIs	Key Informant Interviews
MDGs	Millennium Development Goals
MHS	Medicine and Health Sciences
MoE	Ministry of Education
MoFED	Ministry of Finance and Economic Development
MoH	Ministry of Health
MoI&T	Ministry of Information and Technology
MoS&T	Ministry of Science and Technology
NCS	Natural and Computational Sciences
NEAEA	National Educational Assessment and Examinations Agency
NEPSE	National Employment Policy and Strategy of Ethiopia
NLA	National Learning Assessment
NPC	National Planning Commission
NS	Natural Science

OECD	Organisational for Economic Cooperation and Development
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PPC	Preparatory Programme Complete
R&D	Research and Development
RDD	Regression Discontinuity Design
S&E	Science and Engineering
S&T	Science and Technology
STE	Signalling Theory of Education
SHS	Social and Humanity Sciences
SS	Social Sciences
SSH	Social Science and Humanities
STEAM	Science, Technology, Engineering, Arts and Mathematics
STEM	Science, Technology, Engineering, and Mathematics
STIP	Science, Technology and Innovation Policy
STM	Science, Technology and Mathematics
STME	Science, Technology and Mathematics Education
ITSD	Interrupted time series design
TVET	Technical and Vocational Education and Training
UNDP	United Nation Development Programme
UNESCO	United Nation Educational, Scientific, and Cultural Organisation
VIF	Variance Inflating Factor
WDR	World Development Report
WHO	World Health Organisation
WTO	World Trade Organisation

CHAPTER ONE

INTRODUCTION

1.1 Introduction and Background

This chapter provides a general introduction to the study based on contextual information—the 70:30 policy pertinent to the research issue. It outlines background information on the 70:30 policy and the policy's context—the rationale for this research and the reasons for the researcher to conduct a study based on the policy document and relevant literature. Additionally, it identifies the problem statement, seeking to uncover the motivations for undertaking this research. Moreover, it presents the research questions, objectives, scope, and significance of the study, along with operational and organisational elements, which serve as the foundation for this study.

1.1.1 Background Information of 70:30 Policy

Macro and micro policies: The 70:30 macro policy is a student placement policy in which 70% of public university admissions were allocated to S&T/STEM, while 30% of the entrance is in SS, as per the Ministry of Education (MoE, 2008). Within this framework, the macro policy includes micro policies. 70% of Higher Education (HE) enrolments were in S&T/STEM, including 40% of the annual student intake in Engineering and Technology (E&T), 20% in Natural and Computational Sciences (NCS), 5% in Medicine and Health Sciences (MHS), and 5% in Agriculture and Natural Resources Sciences (ANRS), The rest 30% were in SS, including 20% in Business and Economics (B&E), and 10% in Social and Humanities Sciences (SHS) (MoE, 2008) in each year since 2008/09. The ratio of allocated enrolment in the HEIs is considered not only in macro and micro policies, but also for each field of study, regardless of demand for students and the labour-market demand, and the matching of demand and supply of HR across different economic sectors. This policy has been implemented under a frail university-industry linkage.

Purpose of the 70:30 policy and developmental state theory

The 70/30 policy was planned under the developmental state. From the point of view of the country's strategic plan to realise the Agricultural Development-Led Industrialisation (ADLI) economy through S&T HR. The purpose of the 70:30 policy is to transform from an agrarian economy to an industrial one through S&T/STEM, HR though this day STEAM education policy and curriculum emerged from lower school to HEIs, which has not been recognised. This momentous, comprehensive process of transformation of society and the state naturally also translates itself into a high demand for HRD and particularly for preparing large numbers of professionals with relevant knowledge and skills in diverse fields, where we have had so far only the barest of capabilities (MoE, 2008). In line with the developmental state, students were pushed into the S&T policy in public universities without their interest, capacity, and resources for industrial and manufacturing development. Hence, the study of these allocations-both macro and micro policies for HRD in economic transformation based on developmental state theory is essential, though nowadays the developmental state has been reaffirmed through the neo-developmental state.

Vision

Again, as with the Growth and Transformation Plan I (GTP I, 2010/11–2014/15) and the Education Sector Development Programme (ESDP IV, 2010/11–2014/15), the policy guidelines provided under the 2008/09 conversion plan emphasise the 70:30 policy, especially S&T development, as a significant drive to turn Ethiopia into a middle-income country by 2025 (MoE, 2015). To enhance access to HEIs in Ethiopia, the goal is to reach a Gross Enrolment Ratio (GER) of middle-income by 2025, ensuring 22% by 2025 (MoE, 2017), which remained unattainable amid political instability.

Mission

As stated in the 70:30 document, EHE has thus started to move purposefully on all the fronts that should together change its institutional landscape and bear positively on its mission: relevant and quality education, research/technology transfer, and community service (MoE, 2008). The conversion process is only one part of the comprehensive institutional transformation, which also encompasses curriculum review and development, as well as academic development processes. A university that accomplishes these processes with at least a fair success will surely position itself as a new, dynamic, and therefore modern institution of HEIs. Such institutions would execute their missions. Given this holistic and successful outcome, EHE would stand on its own feet and chart its future institutional course of development through intra-institutional and inter-institutional consultative processes. These would put the public universities in a position to partner fully with the government and the public in the execution of their public missions (MoE, 2008).

Strategy

The strategy and conversion plan focus on both the growth of annual intake and general enrolment, and the professional and programme balances of the growth. This is the government's strategy and plan, with a binding force on all public universities. The plan contains targets that each public institution has to achieve, which are distinguished as the national 70:30 policy and micro policies—levels at which universities aggregate data amenable to further analysis by institutions (MoE, 2008). The national development vision focuses on an industrialisation strategy that is based on the manufacturing sector and oriented towards exports. Ther strategy is intended to elaborate on issues related to approach, direction, and key tasks to achieve the desirable destination of a 70:30 undergraduate professional commingle and an appropriate expansion of the graduate programme (MoE, 2008). Given this, however, growing investment in S&T education is utterly indefensible today and for the next twenty to thirty years, even if it should make a heavy demand on the public treasury. Ensuring that each

public university develops its conversion plan bounded by the timeline and targets of the national plan, communicates the strategy and the plan to its academic staff, thus pursuing layered attitudinal outcome objectives, and establishes an appropriate organisation to ensure timely and appropriate execution of the plan (MoE, 2008).

Goal

The goal is and should remain to achieve a transformed institution in all its fundamental features: governance, managerial efficiency, academic quality of curricula, supply and professional development of academics, vision, and mission, and an experienced commingle of the undergraduate and graduate programmes. The conversion process must be pursued as one key element in the whole core process of institutional transformation (MoE, 2008). The primary goal of the 70:30 policy is to achieve a structural shift in the economy from agricultural dominance to industrial prominence.

Objective

The role of each public institution is, as a matter of immediate priority, to appropriately execute the professional commingle conversion plan within the timeline. The role of government, on the other hand, is to assist each institution financially to affect the conversion based on actual needs as well as oversee, coordinate, and follow up on the implementation process. A joint implementation mechanism may need to be established to coordinate the implementation. This must be achieved with the speed that the conversion process demands. The urgent task is to achieve conversion based on the 70:30 ratios and its micro—policies and fields of study, as outlined in the academic development plan (MoE, 2008). Establishing at the level of each public university the current enrolment in the program to help determine the gap (surpluses and deficits), given the targets of the annual intake and the national objective of achieving the professional commingle at the level of bands (micro policies) and discipline (the outstanding tasks). It also involves determining the current supply of academic staff by qualification at each public university, by discipline and band (micro policies), and

the gap given conversion, including the new annual intake, increases or decreases in discipline.

1.1.2 Policy Context

The present educational policy began with the formulation of the Education and Training Policy (ETP) issued in 1994 by the MoE, and was followed by Proclamation No. 351/2003, which was another primary policy document to expand and reform HE in the country. In the early 1990s, the government identified the requirement for strengthened, oriented, and revitalised HRD as a key to the success of socio-economic policies and strategies. During the transitional period (1991-1994), the trained workforce and leaders encountered deficiencies at disparate levels within the new government structure. Free-market economic policies, an improved environment for private investments, and the relatively improved and steady growth of the economy, as well as openness to the world and the spread of Information and Communication Technologies (ICT), have required more personnel with HE and training (Yizengaw, 2005). The intellectual group included many Ethiopians, intelligent and the best, who entered professions, commenced businesses, and pursued HE in their new surroundings. All experienced firsthand virtues and issues of democratic governance and free-market capitalism (Loukeris, 2005). In 1994, the government devised decentralised educational development goals based on their objective conditions, identified objectives, and requirements. Since its introduction in 1994, Ethiopia has introduced numerous educational reforms to enhance access, quality, relevance, equity, and efficiency of education, thereby transforming the performance capacity of the economic sector, which had previously experienced civil strife and underdevelopment (ETP, 1994).

During the reigns of Emperor Haile Selassie and the Derg, Ethiopia had only two universities-Addis Ababa and Haramaya- and private HE was not allowed. However, public universities increased to 48 after the Derg, while private universities increased to ninety-eight by 2017. GER is one indicator of the development of HE. However, in the transitional government of 1991, the GER

for HE was a mere 1%, lower than the average rate of 3% in Sub-Saharan Africa (Yizengaw, 2003, 2005; Loukeris, 2005; World Bank & UNESCO Institute for Statistics, 2025). In 2008/09, the GER for HE in Ethiopia was 5.3% (Yigezu, 2013), which was below the rate of 6% in the Sub-Saharan region. The MoE report indicates that in 2015/16, 2016/17, and 2018, the Ethiopian GER of HE was only 9.4%, 10.2%, and 10.4%, respectively, which is extremely low and has implications for socio-economic development in the country. Thus, the country has a tiny skilled HRD, though a potential raw labour force. The challenges in the development of the country are limited to enrolment, quality, relevance, and equity, especially concerning gender and underserved or marginalised regions (Yizengaw, 2005). The need for qualified and relevant HR is one of the biggest challenges in Ethiopia's economic development. In the knowledge-based economy, education plays a fundamental role in economic development.

Ethiopian economic growth during the Haile Selassie period (1960–1974), the Derg (1975 to 1990), and the Ethiopian People's Revolutionary Democratic Front (EPRDF, 2003/04 to 2016/17) regimes averaged 3.7%, 1.6%, and 10.5%, respectively. GTP II, 2015/16–2019/20 aims to achieve an annual average real GDP growth rate of 11% with aggressive measures towards rapid industrialisation and structural transformation. Ethiopia was one of the fastest-growing economies recorded from 2003/04 to 2016/17. However, the role of HCD is uncertain Ethiopian Business Review, (EBR, 2018), and the contribution of human capital to economic growth is also undetermined. Today, Ethiopia is in a state of crisis, war, and political instability, having experienced sluggish and unpredictable economic growth, and HCD

Ethiopia is the second-most populous country in Africa, with an estimated population of approximately 107 million in 2016/17 and about 130 million in 2025. This shows that Ethiopia has the second-largest labour force in Africa, comprising a sizeable proportion of young and/or youth. However, the labour force is raw labour, not equipped with innovative technologies, with limited S&T, and relying on skilled human capital. Human capital is the accumulation of abilities, skills,

and knowledge of HRs and their contribution to economic growth. Labour supply is one factor contributing to development. However, the unemployment rate is one challenge among HEI undergraduates. It has negative implications for the country's political stability. Ethiopia's knowledge economy is too low; for example, in 2018, Ethiopia's Human Development Index (HDI) score was 0.38, the lowest (World Bank, 2018). If the nation requires tangible economic and social transformation, this part of the population needs to be hugely involved. This generation (young and youth) must strive to construct their future, discover, and harness their talent through education. This segment of society can be a powerful development engine if only provided with the skills, knowledge, and relevant HR, especially in S&T. Unless the youth are highly skilled through quality and relevant education, the unemployment rate will be high. i.e., if the education institutions produce highly competent HRs, low- and/or semi-skilled and middle-technology will replace and displace the workforce in the future. The growing skill gaps will stunt economic growth, with far-reaching social and political repercussions, International Commission on Financing Global Education Opportunity (ICFGEO, 2017).

In 2003/04, PPC introduced the first-year courses of the HEIs to cover the preparatory programme (preparatory school) before they joined the university. PPC is a new programme introduced and implemented in Ethiopia. Thus, students finishing their general secondary education complete two years of PPC to be admitted into the nation's HEIs. In 2008, a new 70:30 policy was implemented. The policy was changed without a policy study and analysis.

Following the 1991 political shift, Ethiopia changed policies to expand HES. With the transition policy presence, several strategies were reformed to meet qualified HR needs. HES underwent series of reforms, including the 1994 ETP, PPC (2003/04), and the 70:30 policy (2008/09). Thus, HES must be well developed to achieve development by diffusing S&T into society, as stated in the Ethiopian Transitional Period (ETP, 1994).

In 2008/09, Ethiopia introduced a new 70:30 Higher Education Policy (HEP) for national development. Each macro and micro policy intends to supply HRs for industrial development and the labour force for each sector in Ethiopia. Each micro policy has its field of study. The Ethiopian government has focused on STEM education. For example, this is the setting of the target of the 70:30 policy (Belay et al., 2016). However, Ethiopia still needs to introduce contemporary STEAM education, which is contemporary and crucial for inclusive education, creativity, and innovation.

Over the past decade, Ethiopia has experienced rapid and consistent growth as it works towards its goal of becoming a middle-income country by 2025. However, for this growth to be sustained and advanced, the country needs a well-trained and relevant workforce. To achieve this, the government has adopted the 70:30 HEP and implementation strategy to transform from an agrarian economy to an industrial one. In line with the 70:30 HEP, new S&T institutions have been established. It has invested in expanding the campus setup and student enrolment to produce knowledgeable, skilled, and attitudinally mature graduates who can competently address the developmental requirements and challenges of the country.

Ethiopia has strived to transform its educational system to accord with the requirements of 21st-century educational systems that play roles in transforming socio-economic systems, particularly the industrialisation process; however, the current government has an ambiguous ideology, which makes it perplexing to implement the policy and its goal. In line with this, GTP and the Education Sector Development Programme (ESDP IV, 2010/11–2014/15) aim for the ratio of S&T to SS to reach 70:30 (MoE, 2010) to realise the vision of industrial development.

Analysis of development paths through manufacturing and other industrial sectors supports a skill commingle in favour of S&T; as a result, as in ESDP IV (2010/11–2014/15), the programme commingles of 70:30 for S&T versus SS has been maintained. The emphasis on S&T is consistent with the national

development policy of growth and transformation. The goal is to bring about structural changes from an agrarian to an industrial economy and accelerate national development. Additionally, special efforts have improved the literacy and numeracy level of the population and produced capable university graduates who serve the industry (MoE, 2017).

Ethiopia's prospects for constructing a knowledge economy and propelling its economic growth hinge on the availability of a sufficient stock of national expertise in these fields of study produced by HEIs (Shebeshi et al., 2009). Technology institutes strengthened innovative technology universities established to implement the policy. The government emphasises S&T, which is considered consistent with national development policies like GTP, and its goal is to achieve structural changes from an agrarian economy to an industrial economy (MoFED, 2015). The extent to which universities can produce graduates with marketable skills is a significant factor. It enhances their research capacities for technological innovation, with its implications for economic growth. The 70:30 policy implementation needs to be studied by considering the results reported in the study and empirical evidence in the global literature (Shebeshi et al., 2009). The education role and research and S&T are essential catalysts towards creating the mindset necessary for national development and ensuring a Climate Resilient Green Economy (CRGE) that serves as a driving force for the realisation of the nation's long-term vision (MoFED, 2010).

The significance of HE in accelerating development and catching up with the rest of the world through industrialisation is evident in the experiences of the Southeast Asian developmental states (countries), in which Ethiopia models its developmental blueprint (Woldegiyorgis, 2015). Such sustained economic growth demands highly qualified and competent professionals in Science, Technology, and Mathematics (STM) (Belay et al., 2016). The government's expansion of HE is related to its 70:30 policy to realise this vision. However, Shebeshi et al. (2009) claimed that a 70:30 professionals commingle requires meticulous situational analysis and study. The revised HE Proclamation No.650 translates the

education policy into specific HE requirements and guides its implementation in the Federal Negarit Gazeta (FNG, 2009). Moreover, S&T universities and institutes were established to accentuate the new initiative of the 70:30 policy. Understanding the interests of the political and administrative branches is essential.

According to the United Nations Development Programme (UNDP), educational attainment is one measurement for human development, particularly the combination of primary, secondary, and tertiary enrolment ratios (one-third weight), i.e., combined enrolment ratio (0% to 100%). Ethiopia has planned to achieve at least 22% GER of HE to reach a middle-income category in 2025, although it would not achieve this with its progress (10.2% in 2016/17 and 10.4% in 2017/18).

In Ethiopia, the GTP for sped up and Sustainable Development to End Poverty Plan for sped up and Sustainable Development to End Poverty (PASDEP) was put in place with due emphasis on employment creation and economic growth through various strategies. Education helps to attain these development goals through qualified and relevant HR for each economic and social sector, and the application of S&T and innovations. It is imperative to recognise the value of HR for economic development and national existence (EBR, 2018). The skills for employment gained in HEIs establish the link between economic growth and poverty reduction by facilitating people experiencing poverty to generate income. The education sector is to provide capable citizens with core literacy and numeracy skills and the middle and higher-level capacities required by the emerging productive sectors. However, the sector has a gap, especially in providing quality education at higher institutions. Hence, education is a priority in the capacity-building strategy and economic development implemented through the ESDPs. The government launched the ESDP IV (2010/11–2014/15) as a capacity-building programme (aiming to ease poverty through the development of required human capital for the sustained economic development of the country) (MoE, 2010). The reforms and capacity-building strategy focus on

creating countrywide sustainable HR capacity responsive to changing circumstances.

The future and present knowledge economy centres on our human capital; however, quality HE has required an undeniable value service. Enhancing access to HE has increasingly become one priority for the government of Ethiopia. Hence, new HEIs have been investing in expanding campus infrastructure and student enrolment aimed at producing knowledgeable, skilful, and attitudinally mature graduates who can address the developmental requirements and challenges of the country (FNG, 2009). According to MoFED (2010), the role of education and research and S&T as a critical catalyst towards creating the mindset is necessary for national development and ensuring a CRGE that serves as a driving force for realising the nation's long-term vision. Borjas (1996) argues that breadwinners are unemployed for many reasons, and policymakers usually worry more about some types of unemployment than others. Policymakers should be meticulous about the skills required, employment opportunities, and how universities can help students develop these skills.

In line with the developmental state model, Ethiopia planned disparate national development programmes, plans, and strategies like ADLI, GTPS, ESDPS, and CRGE. The 70:30 policy has been in line with these programmes and plans. According to the government plan (MoFED, 2015), the enrolment of undergraduates in HE (regular government programme) was planned to increase the graduation rate to 95% by 2020 in the GTP II (2015/16–2019/20) in line with the 70:30 policy. The initial phase of GTP I, ESDP IV and I (2010/11–2014/15), which spanned five years from 2010 to 11 to 2014/15, was completed, and GTP II and ESDP V (2015/16–2019/20) were subsequently implemented in accordance with the 70:30 policy. ESDP (2010/11–2014/15) and ESDP (2015/16–2019/20) have continued to focus on increasing the enrolment, retention, and performance of female students, including girls from pastoralist and agro-pastoralist groups, with attention to their participation in S&T. Ethiopia has prioritised STEM intake (70% target) (Tareke, 2024; Tegegn, 2024);

however, STEM has unclear structure and at desk level. The effect of the policy and HEIs' supply of HR in S&T and innovation requires an investigation. Graduates' scientific knowledge and skills, and their creativity and innovation skills, are a requirement for economic development.

With the 70:30 HEP, hundreds of thousands of enrolments and graduates have been at disparate HE levels. Programmes like ESDP III (2005/06–2009/10) and GTPI and ESDP IV (2010/11–2014/15) had been completed, and GTP II and ESDP (2015/16, 2019/20) were implemented. The effect of the 70:30 policy has hardly been studied to guide decisionmakers and policymakers. There is a need to analyse the policy effect of macro and micro policies on the employability of graduates. Policy documents have recognised the government's development agenda, specifically the poverty reduction programme. and the goal to become a middle-income country. These cannot be realised with a low level of skilled HR (Yigezu, 2013).

As the gender composition is like the population number, the effect of the policy on gender enrolment requires evaluation because gender enrolment is one aspect of development. Although the sex ratio estimated in Ethiopia is almost identical, there is a wide gender disparity in the enrolment of female students in HE, with female enrolment extremely low compared to males in both undergraduates and postgraduates. ESDP IV (2010/11) and ESDP V (2015/16–2019/20) programmes provided special attention to girls' general participation in HE and S&T.

An educated and well-trained workforce is critical in meeting industrial requirements. The development of innovative technologies is forcing educational programmes to keep pace with the knowledge and skills demanded in today's cut-throat market. More than a degree might be required to guarantee a job because employers in many sectors often seek work-ready graduates with transparent evidence of skills. By identifying the employment profile of graduates,

universities must equip students with knowledge, skills, and competence, including. S&T and innovation to remain competitive in the labour market.

Borjas (1996) argues that a cutthroat market equilibrium equates the supply of breadwinners with the demand for workers. Unemployment arises when there is an imbalance between the supply and demand of HR. According to Michael and Stephen (2011), employment opportunities are determined by educational demand and supply. The quality versus quantity of rapid expansion of HE in Ethiopia is one challenge. This may have implications for the quality and skill of graduates. Thus, it requires understanding to inform decisionmakers and policymakers to observe the shift of the mass of the Higher Education System (HES) as the principal mechanism of supplying knowledgeable and skilled workers. Employers and graduates claimed the skills and employment opportunities, respectively.

Ensuring economic development without providing practical, quality, and relevant education in the country is unthinkable. Integrating quality with the economic development plan has paramount importance. The rapid and continued expansion of HEIs, in line with the policy of 70:30, particularly in S&T subject areas, aimed first to serve the high-skilled labour requirements of the economy and second to increase opportunities in education and employment for graduates throughout the country. The underlying assumption is that, upon completion of their respective study programmes, graduates should have the required knowledge and skills to compete, meet market demand/employers' requirements and secure jobs. The goal of the internal quality assurance of HEIs is to have a culture of quality care that ensures that quality is a focus of all the activities of the institution at all levels and incorporated into the everyday work of the entire institutional community (Relevance and Quality Agency, Higher Education Relevance and Quality Agency (HERQA, 2014). Because of the 70:30 professional commingles, undergraduates increased more than threefold, without structural concomitant and resource improvement in the universities (Shebeshi et al., 2009). The increase in enrolment in graduate programmes is in line with

the 70:30 HEP. Is this expansion in line with the 70:30 policy for access compromising quality? This concern is worth investigating as the rapid expansion of HE has taken place in the country despite the need for more well-qualified and experienced staff and limited resources, which can affect the existing system.

The ability of graduates of HEIs to contribute credible quotas to disparate socio-economic employability and development practically depends on how well they are taught in the HEIs (Kwapong et al., 2015). The government HEIs 70:30 policy has its principal role in implementing policy to produce relevant HRs who will contribute and speed up the development of the country's requirements for study. Considering the 70:30 policy, the Ethiopian public universities senate showed that 75% of their staff time is spent on teaching, and the remaining 25% goes to research and community service. HEIs, therefore, have a role in implementing the 70:30 policy.

It is a timely research issue because of the ambiguous policy and employability skills of the graduates, and it involves undertaking research and consultation with disparate stakeholders to contribute to the subsector HEIs' development policy. HEP is one of the thematic areas of the research for a roadmap for the next fifteen years, from 2020 to 21 up to 2030. The 70/30 policy is one of the arguable issues in the research areas. Still, the government remains ambiguous about the policy because of the relevant questions in macro and micro policies in supplying HR to disparate sectors of the economy. Employability includes skills and employment opportunities of graduates as one of the relevant aspects of the policy, and HEIs supply relevant HR. There is a contradiction between placing students because of the policy and students' choice of fields of study, which has implications for HRD.

Knowledge creation, synthesis, and dissemination are critical in constructing a CRGE, placing higher institutions at the centre of strategic national development. The focus of research in any institution shall be primarily on promoting the relevance and quality of education and on the country's developmental issues,

focusing on technology transfer (FNG, 2009). Critical misalignment exists between the research output from research institutes, the type of curricula, and the skill endowments of graduates from universities, against the immediate skill requirements of the industry.

Universities must produce internationally employable and competent graduates; they must contribute to their country's development. Therefore, Ethiopia is investing more in the budget for education and has shown a mushrooming of expanding higher institutions, setting infrastructures, and enrolment capacities. It is essential to have a highly competent HR capable of assimilating and applying advanced knowledge, technology, and innovation to realise the objective of industrialisation.

It is assumed that education with science and mathematics as its components determines the prosperity and welfare of the people and the nation (Belay et al., 2016). The policy also adopted the recommendations outlined in the 2009 HE Proclamation, which called for policy and structural changes in the sector. According to MoE (2015), the goal of the HEIs' priority programme is to produce competent graduates with appropriate knowledge, skills, and attitudes in diverse fields of study.

The 70/30 policy has also been in the Technical and Vocational Education and Training (TVET) programme, i.e., 70% of students joined S&T, and 30% in SS. Studies have shown that the principle 70:30 is good, but it could have a limitation in implementation because of the need for more cooperation between industries. Industries lack a skilled labour force, and the policy has not met its purpose for industrial development. Education in Natural Science (NS) and SSs for secondary schools is also considering the 70:30 policy.

As Woldegiyorgis (2015) claimed, countries transformed from agricultural to advanced industrial economies and moved from relying more on primary education to advancing HE. Rapidly improving the quality, productivity, and competitiveness of agriculture and manufacturing industries; accelerating human

capital development and technological capacity construction; and ensuring its sustainability (MoE, 2017) can achieve the productive capacity and efficiency of the economy. Accelerating industry and manufacturing without transforming the initial agriculture sector is arduous (EBR, 2019). For Ethiopia to continue its path toward rapid economic growth and ensure a progressive economy for the future, a workforce of scientifically and technologically literate people is required (Belay et al., 2016).

The revitalisation and reinforcement of initiatives for applying the 70:30 admission policy at HEIs is considering STEM education as part of the GTP II and ESDP V (2015/16–2019/20). However, STEAM, crucial for innovation and creativity, has yet to be introduced. Students' initiatives and attitudes toward mathematics and NS are important at the primary and secondary school levels (NPC, 2016). The government planned an economic transformation that needed to be attained through S&T and HR innovation as an instrument. Ethiopian education provided special attention to the economic transformation from ADLI by assisting the manufacturing sector by supplying the required professionals and problem-solving technological innovations. The Ethiopian government introduced the 70:30 policy to ensure economic transformation. In addition, sustainable economic growth demands highly qualified and competent professionals in the S&T. S&T is considered more for economic and industrial development; however, SS is for social, political, democratic, and cultural development. The implications of SS for democratic, political, humanitarian, cultural, and social development are pertinent to any country and require further research. Cutting the B&E and SHS enrolment has implications for business and economic management.

Does the 70:30 policy support the view of turning Ethiopia into a middle-income country by 2025 by providing relevant, professional, and skilled HR for disparate sectors of the economy, especially to transform from agriculture to industry? In Ethiopia, education is central to the government's policies to achieve middle-income country status. For example, the government sets the direction for HEP of 70:30 to develop highly qualified, motivated, and innovative HRs to produce

and transfer advanced and relevant knowledge for ADLI economics and poverty reduction to turn Ethiopia into a middle-income country by 2025.

In line with the 70:30 policy, to what extent does the HEI supply skilled and qualified HRs in S&T and innovation to realise the vision? This needs assessment is crucial for designing and implementing improved future strategies, such as the GTP and ESDP roadmap. If the HEIs cannot produce skilled HRs, Ethiopia's development in poverty reduction, particularly towards achieving the vision of becoming a middle-income country by 2025, could not be supported by low-level skills and low-productive HR. The new policy of 70:30 may require further contributions to the middle-income countries by 2025 if the 70:30 policy of HE cannot supply qualified and skilled HRs. Efforts must meet the intended goal of the 70:30 professional mix to satisfy the labour demand. The rapid and continued expansion of HEIs in line with the policy of 70:30 also aimed first to serve the high-skilled labour requirements of the economy for industrial growth and second to increase education and employment opportunities for graduates throughout the country.

The government's rationale for introducing the 70:30 policy is based on the belief that S&T is the engine of development. However, this becomes critical if graduates require more professional expertise to contribute to national development (Shebeshi et al., 2009). The 70:30 policy supported the strategic policy aim of linking directly to and contributing to various national development programmes and plans, such as ESDP III (2005/06 to 2009/10), GTP I, ESDP IV (2010/11–2014/15), GTPII, and ESDP V (2015/16–2019/20) and CGRE (2010/11, 2014/15). The Proclamation 650/2009 mandated HE HERQA to ensure the quality of HEIs. However, all universities have identical missions aimed at preparing graduates for an internationally competitive and/or cut-throat market, equipping them with the skills and competencies necessary to contribute to transforming the Ethiopian socio-economic landscape; this may have implications for innovation. The 70:30 policy has been under implementation in Ethiopia with the allocation of resources (HRs, materials, infrastructure, and

budgets) since 2008/09; the implementation and the role of HEIs in executing the policy have yet to be studied. Policy decisions often require reliable research findings. Educational research plays a significant role in providing information for decision-making regarding educational policy. Hence, at this stage, it is time to analyse and evaluate the implementation of the 70:30 macro policy and its micro policy by the HEIs in supplying HRs with S&T and innovation. Research is, therefore, intended to evaluate the 70:30 policy and to understand its implications for HRD in Ethiopia, particularly the extent to which universities adequately prepare skilled graduates in S&T and innovation for the world of work for disparate sectors of the economy.

Ethiopia's approach to economic policymaking has embodied a developmental state since 2005. In line with this, the 70:30 policy reform aims to train high-quality HRs with technical skills and scientific knowledge to develop the capacity for enhancing research and technology at the national level (NPC, 2016). Within this developmental state, the role of HE in supplying skilled HR, improving productivity through learning from others, adapting technologies to local contexts, and fostering innovative ideas is central to the national development strategy (Woldegiyorgis, 2015). Ethiopia has also developed the GTP II (2015/16–2019/20), built upon sector policies, strategies, and programmes to realise the vision of becoming a lower-middle-income country and achieving United Nations (UN) Sustainable Development Goals (SDGs) by 2025 (MoE, 2017). The 70:30 policy aims to support the development plan by linking and contributing to the goals stated in GTP I, CGRE, and ESDP IV (2010/11–2014/15), along with GTP II, and ESDP V (2015/16–2019/20). Thus, education helps to achieve these development goals through S&T and innovations in line with the 70:30, which is the basis of STEM and limited Arts, Humanities, and Social Sciences (AHSS); HEIs must supply qualified and relevant HRs; however, they have yet to fully embrace STEAM education to cater to the diverse sectors of the country's economy. In line with the developmental state, students were pushed into the S&T policy without their interest in industrial and manufacturing development; however, this has not been studied in Ethiopia. Particularly, the absence of policy

Monitoring and Evaluation (M&E) before, during, and after the policy's implementation raises concerns about its effect on HRD**.** Initially, the question is, what are the implications of the 70:30 policy for development, particularly for HRD in Ethiopia?

1.2 Problem Statement

A broad problem statement of the study is as follows: In 2008/09, Ethiopia introduced and adopted a new 70:30 policy admission quota that encompasses macro and micro policies as well as fields of study. The process of societal and state transformation naturally requires a high-level of HRD for professionals with relevant knowledge and skills across diverse fields, especially in S&T (MoE, 2008). In line with the developmental state, the goal of the 70:30 policy is to transform Ethiopia from an agriculture-based economy to an industrialised one through S&T and innovation HR; however, the implications and impacts of this policy for Ethiopia's development, particularly HRD, remain largely undetermined. Hence, exploring the role of the developmental state with a 70:30 state-led policy admission for HRD and its implications for development in Ethiopia is essential.

The problem statement could be further stated as a sub—problem: There is a lack of transparency regarding how much the 70:30 policy in HE has contributed to supplying skilled HR in S&T and innovation for various sectors of the country's economy. With a 70:30 policy, HEIs have provided HR for all sectors of the country's economy, primarily through the 70% S&T policy, which aims to supply HR for industrial development. Hence, graduates must be equipped with innovative S&T skills to achieve this. However, HEIs face challenging dual-cut-throat market responsibilities of producing adequate graduates (who possess desirable qualities, competence, and skills) to ensure their employability. Another issue is equipping students with relevant skills and knowledge of S&T in HEIs for their future employment markets. The United Nations Educational, Scientific, and Cultural Organisation (UNESCO) noted that assessment studies must focus on how graduates use the skills and investigate whether they secured employment within six months of completing their course (UNESCO, 2012). However, the

employability of graduates under the 70:30 policy has yet to be studied comprehensively.

Macro policies tend to favour enrolment in S&T/STEM over SS/AHSS, including six micro policies without conducting prior ex-ante and subsequent ex-post evaluations, thereby raising questions about their relevance to supplying HR for each economic sector. Evaluating these needs is critical to determine if the shift to S&T/STEM-focused state-led university admissions has fostered HRD for industrialisation since 2008/09. One key workforce requirement and approach in the analysis is examining the current labour force structure across economic sectors (Jhingan, 2015). In STEM, particularly for E&T, the researcher observed that the country's industry could absorb only a portion of the 40% of graduates in the E&T domain. About 80% of Ethiopia's population lives in rural areas, dependent on agriculture, with emerging industrial growth. Yet, government policy allocates only 5% of students to university programmes in agriculture. Conversely, many students studying other fields do not align with their real-life backgrounds, particularly those from rural areas. The World Bank standard ratio of extension workers to farmers is 1:800 (Benor et al., 1984), and the Food and Agriculture Organisation (FAO) recommends that one extension agent serve a maximum of one thousand (1:1000) farm families in developing countries (FAO, 1997). The 5% allocation for MHS also seems low, given that providing health services to over 107 million people in 2017 and projected 130 million in 2025 requires a sufficient supply of HR in the country's health sector. The World Health Organisation (WHO) recommends 2.3 health workers per 1,000 population, and the Ministry of Health (MoH, 2016) advocates for at least one nurse per 5,000 people. Additionally, 20% of students are assigned to NSC, including prospective teachers for all educational institutions, regardless of their study choices or interests in teaching careers and/or professions.

Investment in SS/AHSS has been reduced to 30% (comprising 10% of SHS and 20% of B&E components), leading to limited enrolment that has policy implications for democracy, business, political, social development, and

innovation. This policy quota was set without considering student and labour-market demands. Student placement often underestimates individual talents and preferences and admits students to HEIs with deficient performance on the National Learning Assessment (NLA) or entrance exams, especially in STEM, where students frequently demonstrate a low foundation in mathematics and science. Hence, an evaluation study is needed to determine whether these allocations address HR demand and supply as well as their relevance to HRD objectives.

Not only do students enrol in HEIs without their demands/choice of fields of study being met, but the government also planned and established a policy quota in advance for each macro and micro policy, and field of study, without considering the supply and demand of HR planning and projection. However, recent literature, including theories in education and the philosophy of education, for example, curiosity-pragmatism (UNISA, 2018), and career guidelines (Argyropoulou & Kaliris, 2018)-demonstrates that every student possesses preferences that encompass interest, ability, and professional self-selection, and unique talents relevant to various fields of study, especially in STEM in the HEIs (Maltese & Cooper, 2017; Subotnik et al., 2010; Ziegler et al., 2017). Likewise, literature suggests that individuals have an aptitude and talent for a type of work and social role (Oxford University, 2017). Maintaining an equilibrium of demand and supply of HR is another issue (Borjas, 1996), especially in S&T (NPC, 2016).

Policy analysis involves evaluating the implementation and impact of existing policies (ex-post analysis) and new policies (ex-ante analysis). However, the policy has not been processed, nor has it been evaluated, for its effect on HRD and its implications for national development, as evaluation is one fundamental process/stage of policy formulation. Particularly, the 70:30 policy has not been evaluated through empirical studies, either as an ex-ante or an ex-post evaluation study. An ex-ante evaluation has not been conducted before the policy's implementation to find out the needs and potential of the target groups (students' demand and interests) as well as the demands of employers, the labour market,

and industry demands, which raises a question regarding the relevance of the policy. No study has investigated the policy to assess the feasibility and potential effects of both macro and micro policies on the target groups and the supply of HR to various economic sectors. An ex-post evaluation study has also not been conducted to assess the implementation of the 70:30 policy and its impacts. No empirical evidence exists on whether the policy meets HRD needs for industrialisation, aligns with students' interests, and possesses the foundation for advanced S&T in HE, or aligns with labour-market demands. Therefore, to what extent does the policy address these critical issues that influence HRD in S&T and its implications for development?

Since the introduction of the 70:30 policy, several studies have examined the quality of education, pedagogical aspects, curriculum, NLA, entrance exams in HEIs, and resource availability in Ethiopian HEIs (e.g., Nega, 2009; Leka, 2009; Asgedom, 2009; Shebeshi et al., 2009; validations, 2009; Yimam, 2009; Semela, 2011; Ashcroft & Rayner, 2011; Kahsay, 2012; Geda, 2014; Woldegiyorgis, 2015; Molla & Cuthbert, 2016; MoE, 2017; Lake, 2019). However, not only has the policy mechanism itself remained unstudied, but these researchers and the MoE (2017) have also explicitly questioned whether the 70:30 HE intake strategy warrants further investigation. Though these studies provide important insights into the education system in general, they did not pay attention to the policy's contribution to labour-market outcomes, supply and demand of HR, and national development objectives. Thus, the broader developmental implications of the policy for development remain underexplored.

The main research gap in current literature is the absolute lack of an empirical policy and integrated evaluation framework spanning inputs, implementation processes, and outputs. Relatedly, there is a lack of a framework that addresses how this enforced macro and micro quotas influence the interconnected issues of graduate employability, gender equity, and labour-market demand. Consequently, a significant research gap remains unaddressed, particularly in policy evaluation, with empirical and knowledge gaps concerning

the implications and effectiveness of the 70:30 policy in Ethiopia. Hence, evaluation research on the implementation of the 70:30 policy in HEIs and its implications for HRD has yet to be conducted/studied.

The government, institutions, or individuals have not deliberately evaluated the policy. There are no systematic M&E on the policy indicators (inputs, implementation, outputs, outcomes, and impacts) using evaluation criteria (relevance, efficiency, effectiveness, impact, and sustainability), nor on their implications and impacts for HRD and its implications for development in Ethiopia. Since Ethiopia has a nearly balanced sex ratio (with females slightly more numerous), and because the 70:30 policy particularly emphasises female enrolment in HEIs-especially in S&T-it is crucial to assess how the policy has affected gender equity in enrolment and graduation.

Overall, understanding the relationship between the 70:30 policy and its outcomes require an evaluation of its design, implementation, and results. Concerns about policy relevance, student choices (labour-market and industry demands), graduate employability, and the admission of students below academic thresholds raise questions about the policy's effect on HRD. This research is the first and timely effort to conduct a national and ex-post evaluation of these policy indicators using evaluation criteria, examining their effects on HRD and their implications for development in Ethiopia.

According to UNESCO (2015), policymakers should be critiqued for failing to use research findings when developing policies. Similarly, the 70:30 policy needs to be evaluated through research-based studies and evidence. However, the policy has been implemented in public HEIs without prior (ex-ante) or subsequent (ex-post) evaluation studies. Therefore, an ex-post evaluation study was conducted to assess the implementation of the 70:30 policy in HEIs and to understand its outcomes and effects on HRD, particularly in S&T versus SS, and its implications for development in Ethiopia.

1.3 Research Question

The policy evaluation and comparative design culminate in a research question that addresses subsidiary questions and their implications. The research questions were employed for qualitative and quantitative methods. A quantitative research question was formulated for the quantitative-causal-comparative analysis to investigate the cause and effect of the policy.

Main research question

What is the relevance, implementation, and effect of the 70:30 policy on HRD in Ethiopia?

Subsidiary Questions

This study seeks to address the following subsidiary questions raised:

- What is the relevance of Ethiopia's 70:30 policy for HRD?
- To what extent has the 70:30 policy been implemented in accordance with its objectives in the HEIs in Ethiopia?
- To what extent has the 70:30 policy contributed to supplying human resources for various sectors of Ethiopia's economy?
- What is the outcome-effect of the policy on the employability of graduates?

1.4 Objective of Study

To evaluate through a study the implementation and effect of the 70:30 policy on HRD and its implications for development in Ethiopia.

Sub-objectives

- To assess the relevance of the 70:30 policy in HRD.
- To investigate the implementation of the 70:30 policy in HEIs in Ethiopia.
- To analyse the output of the 70:30 policy in supplying HR to various sectors of the economy.
- To explore the outcome of the 70:30 policy on the employability of graduates

1.5 Assumptions, and Delimitations of the study

1.5.1. Research assumptions

The study operates under the assumption that:

- Students and the labour-market demands, and NLA and/or entrance exam of HEIs assessment performance are the assumption of the relevance of the policy.
- The macro policy S&T versus SS and its micro policies placement for HRD and implications for industrial development in Ethiopia
- The core time-series enrolment and graduation datasets obtained from the MoE reflect the macro-level implementation trends of the 70:30 quota.
- The diverse stakeholders interviewed provided the objective, dependable, and experientially accurate accounts of the policy's structural impacts
- The immediate labour-market absorption and graduate employment metrics serve as a valid baseline indicator for evaluating the overall effectiveness and sustainability of the state-led HRD strategy.

1.5.2. Delimitations of the Study

The study is delimited to evaluating the implementation of the 70:30 macro policy and corresponding micro-policies implementation in HEIs and their implications for Ethiopia's HRD, especially in S&T. The analysis considers the policy indicators and their evaluation criteria, including the placement policy (input) and its relevance (the relevant student recruitment and their performance on the NLA and the entrance exams of HEIs), policy implementation in the HEIs (effectiveness and efficiency), the outputs/graduates of the policy (effectiveness), and the outcome concerning employability of the graduates and the direct/short term impact of the policy (encompassing the employed, unemployed and skills and/or equipping in S&T skillsets of the graduates) as well as the self-employment of graduates (sustainability) as a measure of policy effectiveness.

The quantitative method assesses the population enrolment, graduation, and the extent to which the policy has addressed cross-cutting issues (gender equity),

particularly regarding the enrolment and graduation rates within gender mainstreaming. Additionally, public, and private universities and their enrolments are analysed through time series and econometric models. A meta-analysis (including alumni and tracer studies) was collected and reviewed to examine the policy's effect on graduate employability for further discussion. The longitudinal study's time series (enrolment in the HEIs) includes data from the baseline period of 1998/99 to 2007/08, and the policy follow-up data from 2008/09 to 2016/17. For the qualitative method, different stakeholders participated from the national, federal, and institutional levels, including beneficiaries, institutions, professional associations, HR units across different economic sectors, government ministries and agencies, policy practitioners, implementers, and employers of the graduates.

1.6 Limitation of Study

One of the limitations of this study is the scarcity of relevant research material and literature concerning the 70/30 implementation policy and its effect on HRD and implications for development. The 70:30 policy ratio is unique to Ethiopia, and the existing literature on it is limited, inconsistent, and lacks depth. There has not yet been a comprehensive study on the policy itself, which is compounded by a lack of awareness and experience in this area. Additionally, issues such as inconsistent institutional reporting, poor data quality, and missing data in university enrolment figures, for example, reports of identical data from the MoE for the academic years 2012/13 and 2013/14-highlight significant data reliability concerns. These challenges required extensive efforts in multi-source triangulation, data cleaning, cross-validation, and error correction. After 2018, access to data and reporting gaps further complicated the analysis, partly due to political sensitivity and lack of institutionalisation. These access barriers and political sensitivities required careful relationship-building, establishing rapport and ethical handling. The researcher also encountered difficulty scheduling interviews, which was addressed through scheduling flexibility and a targeted field strategy (utilising both face-to-face and email communication). Furthermore,

the fragmentation of policy documentation necessitated meticulous retrieval and cross-checking. The absence of tracer studies in private universities and the lack of comprehensive labour-market data posed additional difficulties. For instance, data on employment outcomes for private university graduates are unavailable, making it challenging to conduct a thorough impact evaluation comparing private and public universities. Only the immediate or short-term effects of the policy on graduate employment and unemployment are observable, with positive and negative impacts, respectively. Due to a lack of data and the limited duration of the policy, at the time of data gathering, the long-term effects could not be assessed in this study, which limits definitive conclusions regarding long-term implications for development. Furthermore, the original data for alumni and tracer studies originate from disparate university sources, and the sampling process can be complex when aggregating results to apply advanced analytical methods concerning the policy's effects on unemployment and employment.

1.7 Significance of the Study

This study has important implications for HRD, S&T, innovation, and sustainable development. Policymakers and the government require solid evidence for policy development, evaluation, and effective implementation. The government must produce policy evidence that supports the improvement of existing policies. Therefore, the researcher aimed to provide insights into the effects of the 70:30 policy on HRD in S&T and its implications for economic growth and development. This study offers valuable insights that can guide policymakers, implementers, planners, practitioners, researchers, and government bodies on the execution and outcomes of the 70:30 policy and its impact on HRD, particularly in S&T and innovation. The thesis presents a timely analysis of the current HEP to inform reform and strategy in education policies to address present and future challenges for HRD in S&T/STEM versus STEAM education and its implications for economic development. Additionally, it discusses pedagogic versus andragogic approaches and curriculum implications for HEIs.The purpose of scientific research is problem-solving. Therefore, the researcher offers workable

solutions and recommendations to address these issues. The thesis can guide policymakers, government entities, stakeholders, implementers, planners, researchers, and practitioners in initiating policy discussions about the implications of STEM versus AHSS, STEM versus STEAM, and S&T versus SS for HRD, innovation, as well as social, technological, and economic development. It can also open doors for further comprehensive research in both macro and micro policies.

1.8 Operational Definition

70:30 macro policy "The policy is to achieve an annual intake distribution of students of 70:30 in favour of science and technology over the social science and humanity (MoE, 2008, p.10)**.** Operationally, the 70:30 policy is a student placement mechanism where 70% of university admissions are in S&T, and 30% of the entrance is allocated to SS.

Micro policies and fields of study: There shall be six bands (micro policies) in the HES, covering the whole spectrum of the necessary disciplines: "Engineering and Technology (40% of annual intake of students), Natural and Computational Science (20% of the total students), MHS (5% of the total), Agriculture and Natural Resources (5% of the total students), B&E (20% of the total students), and Social Sciences and Humanities (10% of the total students) (MoE, 2008, p. 10)**.**" Implemented in each year since 2008/09.

Science and Technology (S&T): Science involves the systematic and scientific acquisition of knowledge through education and training, while technology is the application of knowledge for efficient work. Science is all about understanding, whereas technology is applying and utilising knowledge (Smith, 2015). Science is a system of acquiring knowledge through scientific methods involving observation, identification, description, experimental investigation, and the theoretical explanation of phenomena, supported by case studies, applied technology, narratives, and persuasive strategies. Concurrently, the Perth Declaration on S&T education of 2007 expresses concern about the state of S&T education worldwide and calls on governments to respond to any suggestions for

establishing the structural conditions for their improved practice (Fensham, 2008).

Science, Technology, Engineering, and Mathematics (STEM) Education: This study discusses a national policy aimed at encouraging students to enrol in STEM education at primary and higher levels. STEM, in this study is learning and/or work within the STEM fields, including initial learning at school before entering specific disciplines and in HE (Marginson et al., 2013). S&T refers to STEM.

Science, Technology, Engineering, Arts, and Mathematics (STEAM) Education: A study on trans disciplinary fields of study on STEAM. STEAM includes the liberal arts and humanities in STEM education Education and Communication Technology, 2015). STEAM is a trans disciplinary approach to arts, humanities, and STEM studies, and the policy context in which universities operate and play, but they have limitations (Clarke, 2019).

Human Resources Development (HRD) is the process of educating and training individuals to acquire the necessary skills, knowledge, attitudes, and capabilities. This is done to supply HR to various economic sectors and meet their current and future needs, thereby achieving their goals. It encompasses training, recruitment, performance, skills, and career development. HRD is multidimensional and has many implications for different aspects of economic growth and development, such as the economy, education, employment, industry and manufacturing, health, agriculture, politics, and S&T, which directly impacts with respect to the quality of life and the nation with sustainable growth and generating by the correct utilisation and administration of a country's assets and resources (Boni et al., 2013). Human resources play an active role, whereas capital and natural resources play a passive role in economic development.

Implications for development: Ethiopia introduced a 70:30 policy for national development, particularly for industry and manufacturing initiatives through HRD, especially S&T (MoE, 2008/09, p. 11). Educational policy analysis and evaluation need to understand its implications for development. Bitzer (2009) claimed that policy analysis is a form of evaluative research employed to improve the practical

policy implications (both positive and negative) of a policy-oriented programme, while Johnson & Christensen (2017) reason that evaluation research is conducted on education policy for practical implications on development.

1.9 Organisation of Study

The thesis is organised into eight chapters. Chapter One introduces the study. Chapter Two discusses the literature and theoretical framework, while Chapter Three reviews the implications of the 70:30 policy for HRD. Chapter Four reviews the literature on Ethiopia's 70:30 policy, its implications for the Ethiopian education system, its alignment with the national development plan, and the policy's relevance. Chapter Five presents research methodology applied to evaluate the policy. Chapter Six presents the data analysis, divided into four parts based on the study's intended objectives. Quantitative data analysis is conducted, followed by the qualitative data analysis and synthesis of findings. The first part scrutinises the evidence concerning the findings and data analysis regarding the relevance of the 70:30 policy for HRD, especially in S&T in Ethiopia. The second section analyses the extent to which the 70:30 policy has achieved its objectives in the HEIs. The third section evaluates the outputs of the 70:30 policy in supplying HR to disparate sectors of the economy in Ethiopia. The final section presents the outcome effects of the 70:30 policy on the employability of graduates. Chapter Seven presents the discussion. It compares the empirical findings of this study with the existing literature, theoretical foundations, and the broader academic discourse surrounding the policy's implementation, alongside historical university tracer data. Chapter Eight summarises the main findings, policy implications, the original contributions of this study, recommendations for policy and practice, directions for future research, and the final conclusions drawn.

CHAPTER TWO

Review of Literature and Theoretical Framework

2.1 Introduction

The preceding chapter provided the foundational aspects of the study. This chapter introduces the theoretical framework and literature review, discussing the key development theories and practices that underpin progress in the educational sphere. Establishing a robust theoretical framework and literature base has been central for the advancement of higher education (HE), serving as a critical foundation for its ongoing development. The chapter discusses the various theoretical perspectives and implications for HE, including neo-liberal, developmental state, neo-classical, and endogenous growth theories. It also explores the implications of Human Capital Theory (HCT) for economic growth and the influence of international development organisations on HE. Additionally, this chapter reviews educational theories, considering their implications for HE and discusses the contribution of educational philosophers to learning.

These frameworks are compared and categorised based on their analytical utility. Because of its alignment with state-led administrative planning, the Developmental State Paradigm serves as the dominant framework in this thesis. To analyse supply- side institutional outputs and labour dynamics, HCT and Endogenous Growth Theory are partially applied. Conversely, Neo-liberalism and Classical Dependency frameworks are critically evaluated. However, they have been rejected as dominant lenses. This is because they fail to account for the command-directed enrolment quotas.

2. 2. Implication of Development Theories for Higher Education

The advancement of theoretical frameworks in HE is crucial for economic growth. Specifically, theories of development and education form the foundation for the HE advancements discussed in the subsequent sections.

2.2.1 Neo-liberal Implication for Higher Education Development

Neo-liberalism has significant implications for development by limiting the state's role, as discussed in this section. Within the neo-liberal line of thought, the question about the contributions of HE to economic growth has long been dominated by the debate about the superiority of private versus public returns to investment in higher education (Woldgiyorgies, 2015). As an industry, the proponents of market liberalisation view HE as yielding potentially good returns on private investments (Geda, 2014). Studies indicate that neo-liberalism introduces three major trends in HE: privatisation, commercialisation, and corporatisation (Gasser, 2024). In contrast, a market economy in HE does not necessarily advocate ideological privatisation but depends on competitive supply and demand within a regulated environment (Abu Alhaija, 2024). This free-market paradigm stands in direct structural opposition to the Dominant State model applied in this study.

Neo-liberal policies call for liberalisation, decentralisation, and a reduction in social spending (Molla, 2014). Schools would accept the neo-liberal tag, although none carry the name liberally. Education can be public, private, or a professional commingle. The reduction of public spending and the robust alignment of HE with economic productivity have a considerable impact on the role of the state in dealing with the issue of inequality in HE (Molla, 2013). Liberalisation involves the adoption of market-oriented policies by HEIs and the application of decentralisation in institutional management. However, traditional centralisation sometimes stems from the liberalisation struggles in the colonial era that created movements based on socialist centralising ideologies (Ashcroft & Rayner, 2011).

In liberal market economies, where there is a deficiency in redistribution of wealth to public schooling and a deficiency in social insurance, the middle and the upper-middle classes tend to self-insure by attaining a high level of general education, generally through private institutions such as universities (Vally & Motala, 2014). While the notion of the opportunity to select a valuable life is central, the individual was not viewed as a freely choosing subject when evaluating the neo-liberal paradigm and the social dimensions of choice (Bozalek & Leibowitz, 2013).

Neo-liberal policies have continued to reshape HE (Gasser, 2024), but they frequently create dangerous academic labour conditions and widen equity gaps (Munyaradzi, 2024; Ndlovu & Woldegiyorgis, 2024). This shift has also increased the prevalence of tuition fee models, performance-based funding, and reduced academic autonomy (Gasser, 2024). In a market economy, HE functions as a competitive service industry, framing students as consumers and institutions as providers within a commodified education sector (Abu Alhaija, 2024). A market economy emphasises economic freedom with private ownership, supply and demand, and high competition as the key operational mechanisms. Consequently, this thesis rejects pure Neo-liberalism as its analytical foundation. By administratively allocating student populations regardless of competitive consumer choice, the 70: 30 policies completely bypass the market mechanism.

Modernisation theory and its successors in neo-liberalism originate from structural-functionalist social and neo-classical economic theories (Coetzee et al., 2001). The goal of liberalism was a free society; however, this is compromised when economic development diminishes that freedom (Roskin et al., 1991). Neo-liberalism allows individuals to be entrepreneurial and skills-free within free markets and free trade without government intervention. Neo-liberal criticism has focused on state-driven policies towards industrialisation (Trib et al., 2010). The implication of neo-liberalism for education, especially STEM, has limited democratic development. The current education system in the US is rooted in neo-liberalism. The neo-liberal perspective on economic development goes back

to work of the economists Friedrich Hayek and Milton Friedman (Szirmai, 2015). Free-market adherents, neo-liberals, and adherents to the Washington Consensus would assert that state incumbents and politicians are invariably inefficient, partial, and corrupt in developing situations (Coetzee et al., 2001). To Ball (2007), neo-liberalism was a dominant political-economic ideology worldwide and framed many of the current education policy notions (Verger et al., 2012).

The neo-liberal school of thought tends to be perceived as being more associated with the status quo, favouring the market position of the more powerful developed market economies and the transnational corporations, which increasingly dominate the global economy (Tribe et al., 2010). Neo-liberalism has consequences for job insecurity, the concentration of wealth among a few business and political elites, and structural inequality. This market focus links directly to Job Market Signalling Theory when expressed in microeconomic terms. In other words, credentials are selection mechanisms for employers. Challenges posed by neo-liberalism, spurred new debates about a future 'Post-Neoliberalism.' This is reflected, at one level, in the rise of popular resistance, expressed as opposition to capitalism and growing inequality, as evidenced by movements such as the Occupy Movement and the Arab Spring. However, with the rise of what is referred to as the "New Right" in the 1980s, there was a return to calls for a strongly market-driven approach, which is referred to as neo-liberalism-a new form of liberal free-market policy. In general, liberalism is the belief in free markets, and neo-liberalism is more than a belief in free trade. Because of the GFC in 2008, the global economy witnessed a resurgence of state intervention, and the developmental state model has been followed widely in Asia, Latin America, and Africa. In the sphere of economics, the 1944 Bretton Woods Conference in New Hampshire, USA, led to the creation of three key international institutions aimed at promoting stable economic growth within a capitalist system: the International Monetary Fund (IMF), the World Bank, and the General Agreement on Tariffs and Trade (GATT).

Neo-Marxist theories of underdevelopment have been constructed on the tradition and theories of imperialism (Szirmai, 2015). Classic liberalism expelled the government from the marketplace, and modern liberalism brought it back to protect people from the unfair economic system (Roskin et al., 1991). Marx remarks that political economy commences from labour (Browning, 2016). Marx's development theory has an effect not only on inequality, but also on the systematic exploitation of labour. Poverty reduction comes through economic growth, it increases the demand for the labour skills of the poor (Burnel et al., 2017). Labourers require relevant skills (Biao, 2014). A structural imbalance occurs when these skills do not match the demands of the industry-this is best analysed by the skills Mismatch theory. Hall and Soskice (2001), in their work on ‘varieties’ of capitalism, distinguish between two main models of political economy in Western countries: liberal market economies, which operate more closely to the unfettered free-market economic model-for instance, the US, UK, Australia, and Canada-and coordinated market economies. These perspectives emphasise that neither global structures nor domestic institutions can fully explain development outcomes. Instead, economic development and poverty reduction result from the interaction between global economic relations, state policies, labour-market institutions, and workers' ability to acquire relevant skills. This has important implications for enhancing employability. Human capital is critical for economic growth, which leads to broad-based development and poverty reduction. Coordinated market economies are regulated by state intervention-for example, Denmark, Norway, and Sweden (Vally & Motala, 2014). About half of the world's labourers operate within historically centrally planned economies, as seen in Russia, China, and India today. Developmental paradigms can be categorised into merchant capitalism, cut-throat market capitalism (the early phase of industrial capitalism), organisational capitalism (industrial capitalism), and advanced capitalism (globalisation) (Knox et al., 2008). Labour and human capital are among the factors of production. These structural transitions highlight the critical role of Demand-supply labour dynamics theories.

Attending the possibilities of human capital, neo-liberals view these capacities as extending to genetic engineering, agency, and frames of politics as historical and related to governmental technologies (Browning, 2016). Burnel et al. (2017) argue that some countries need to protect and construct the assets of low-income people, particularly their human capital. The neo-liberal discourse has been fundamental to the human capital discourse since the 1970s (Vally & Motala, 2014).

A core of the middle-class educated population consists of highly mobile professionals in all countries to varying degrees and scales (who have become agents in the neo-liberal world through their pursuit of middle-class values and aspirations), which often links them with the middle class in other countries (Potter et al., 2018). For instance, Vally & Motala (2014) assert that in liberal market economies, or economies dominated by informal markets, one of the most critical initiatives to improve the alignment between the education system and labour markets is the standardisation of qualifications. It was attempted in the UK in the 1980s with the National Vocational Qualification (NVQ) framework. Challenges imposed by neo-liberalism, particularly concerning the causes and consequences of the GFC in 2008, have empowered new debates about a future "post-neoliberalism" (Potter et al., 2018).

Marx demonstrates that humanity develops as its productive capacity increases, and capitalism contributes to human development by enabling sharp increases in productivity techniques; however, capitalism limits the capacity of human beings to express themselves in free and cooperative ways (Browining, 2016). Marxist theory may overstate the extent to which capitalism inevitably suppresses human freedom and social inequity, complicating the relationship between human development and productivity beyond what Marx originally envisaged. In advanced countries, capitalism generates an economic surplus, whereas in penurious countries, the surplus is transferred to rich countries by monopolistic firms (Szirmai, 2015). One of the challenges faced by penurious countries is brain

drain, which refers to the emigration of highly skilled and educated individuals seeking better opportunities outside their home country. Capitalist penetration in developing countries thus leads to a distorted form of capitalism-namely, dependent capitalism. The impact of labour on education and training came into focus in the 1960s, when notions about the quality and quantity of skills and productivity became important (Vally & Motala, 2014). In America, neo-liberals understand human capital as giving rise to income streams, recognising how parents actively promote the capital of their offspring and limit the number of offspring to maximise their capital (Browning, 2016).

2.2.2 The Developmental State Implication for Higher Education

The developmental state has a pivotal role in advancing HE through state intervention. The developmental state takes more direct control over economic management and development than is seen in a neo-liberal state (Potter et al., 2018). Likewise, the education system, and universities, are regulated. In a developmental state, resources-whether human or material-are a vital component of infrastructural power (Fritz & Menocal, 2006). Higher education institutions (HEIs) are expected to serve national purposes, creating an environment and spreading values that are crucial in constructing stability (Woldegiyorgis, 2015).

In the developmental state, the education system is under the direction of the state (Abe, 2006). The East Asian developmental states coordinated an upgrade of industrial development alongside the expansion of the national education systems (Abe, 2006). To disclose the rapid economic development of the East Asian states, investment in education is a crucial factor (Abe, 2006). Labour-intensive manufacturing and industries formed the basis of education in Asian countries. In Southeast Asia, state investment at the tertiary level was limited, primarily targeting critical areas such as Science and Engineering (S&E); today, they invest more in S&E, following models like Japan and Singapore. Furthermore, East Asian countries exercised the developmental state and

education system under an authoritarian government system, which has implications for their democratic development. Moreover, they focused on STEM education and limited AHSS, which has implications for social, humanitarian, and democratic development.

The developmental states intervened at various stages of development to modify the national education systems (Abe, 2006). Southeast Asian countries have reviewed their education systems to enhance their global competence in the marketplace (Mok, 2006). Developmental states have been efficiently distributing and allocating resources; therefore, they invest optimally in critical areas that are the basis of industrialisation, such as education (Marwala, 2006). The primary objective of a state driven HE policy is to produce the skilled human capital for structural transformation (Abe, 2006). Neo-developmentalist (state-led) models use universities as tools for industrial growth. For example, China's HEI policy combines human capital ideas with a discourse focused on building socialism, as noted in Higher Education (HE, 2024). In Latin American countries, left-wing parties have embraced "neo-developmentalism," which is linked to the notion of the "developmental state" (Potter et al., 2018). Brazil, Russia, India, China, and South Africa (BRICS) bloc supports the developmental state model in preference to the Western Neo-liberal one. Similarly, the developmental state model has used in various parts of the world to override mechanisms across various sectors, including Asia, Latin America, and Africa. In a command economy, HES remain under government control, determining admissions, curricula, and institutional missions to align with industrial and ideological objectives (Martin, 1998). These factors are also common in developmental states, where state-led admissions and skill formation aim to serve industry (Abe, 2006; Ashton et al., 2001); however, institutional independence coexists at certain levels, albeit limited,) to achieve national development goals, focusing on coordinated growth and knowledge-driven development (HE, 2024). The mixed-economy model features a shared responsibility for HE funds between the public and private sectors (Mixed Economy Group, 2025).

A mixed economy blends both government regulation and Private freedom, whereas a command economy has high government control, including government-owned resources, central planning, but no competition. The mixed-economy model distributes the responsibility for financing HEIs between the state and private actors, including the public-private sector. Unlike a command economy, where the government controls resources, planning, and service provision, a mixed economy combines market mechanisms with state intervention. The effectiveness of this approach relies on finding a trade-off between market incentives and government regulation, ensuring both efficiency and equity in HE provision. This implies that a mixed-economy model is often more effective for financing HE than a command economy, as it can mobilise resources from both the public and private sectors. However, while private participation may alleviate fiscal pressure on governments and increase educational opportunities, it can also create barriers to access if appropriate regulatory and financial support mechanisms are lacking. Thus, the key policy challenge lies not in deciding whether HE should be publicly or privately funded, but in how governments can trade off efficiency, quality, and equity within a mixed-financing framework. The implications of neo-liberal and developmental state models affect the dynamics between the private and public sectors in HEI development. Latin America, such as Bolivia, Ecuador and Argentina, left-wing victories have encouraged thinking about neo-developmentalism, linked to the notion of the developmental state (Potter et al., 2018). There has been a reaction to what is deemed as excessive marketisation, leading to the formation of pacts between states, labour and business, with the state playing a stronger role in the economy, in poverty alleviation, the management of exports, and the enhancement of citizenship rights.

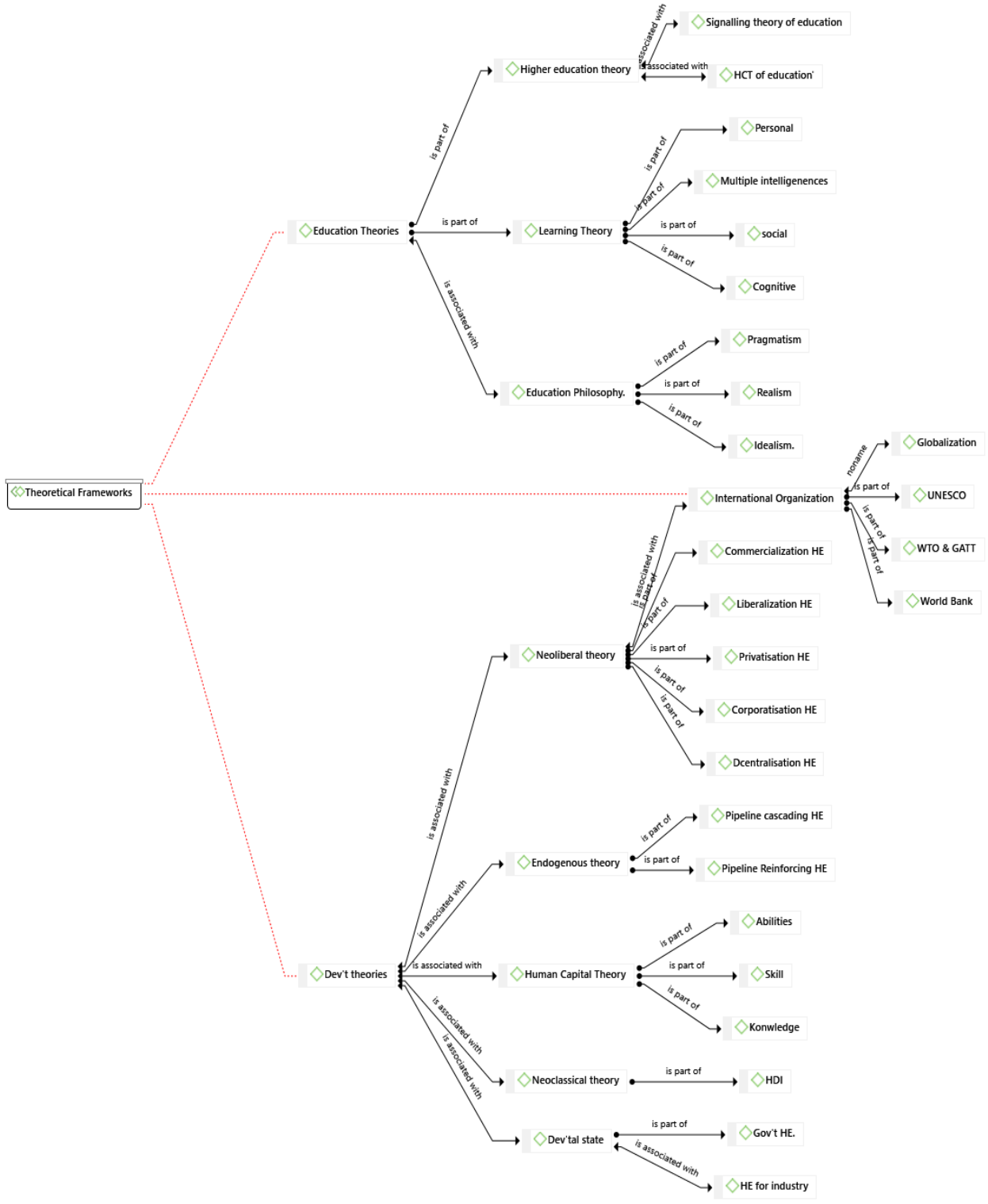


Figure 1: Theoretical frameworks' implications for HE development

Author's work using ATLAS.ti 8

Figure 1 outlines the theoretical frameworks of the development theories reviewed in each section and their implications for HEIs' development. This figure presents the development theories and practices that form the basis for progress in the HE spheres. The creation and development of a theoretical framework have been vital for the advancement of HE and serve as the foundation for its development, as reviewed in each section.

2.2.3 Neo-classical Implication for Higher Education Development

HCT takes neo-classical microeconomics as its point of departure and focuses on the costs and benefits of education in a country (Szirmai, 2015). One of the major neo-classical inputs in production is human capital. According to neo-classical theory, education realises the market as the most efficient basic framework for education and training (Abe, 2006). This perspective countered the classical economists' idea that labour was simply a homogeneous category, arguing instead for a rethinking of the concept of capital to include skills and knowledge, which had the potential to produce yields on capital investment (Vally & Motala, 2014). The classical theory's implications for total employment-specifically the assumed absence of involuntary unemployment-are a feature of a capitalist economy. In line with neo-classical economic theory, greater labour productivity results in higher incomes for categories of employees (Szirmai, 2015). Solow (1956) demonstrates the relationship between knowledge generation and economic growth and development within the neo-classical growth model (Karlsson & Zhang, 2001). Neo-classical emphasises the role of human capital accumulation and focuses on a neo-classical model that features a structural transformation from agriculture to manufacturing. Furthermore, neo-classical theory seeks to explain technological change as a product of deliberate human effort. The newer iterations of neo-classical theory pay special attention to investments in knowledge, Research and Development (R&D), technology, and schooling (Szirmai, 2015). Classical and neo-classical economic logics within HEP continue to emphasise HCT and rate-of-return efficiency analyses, which underpin most growth-oriented education reforms (HE, 2024).

HDI is one of the prominent macro-development frameworks established before the end of the 20th century (Biao, 2014). As Todaro & Smith (2012) note, knowledge, as measured by a weighted average of adult literacy (counting for two-thirds) and the gross school enrolment ratio combined primary, secondary, and tertiary enrolment ratios (counting for one-third), is among the core indicators of the HDI. HDI ranks countries into four groups: low HDI (0.0 to 0.499), medium HDI (0.50 to 0.799), high HDI (0.80 to 0.90), and very high HDI (0.90 to 1.0) (Todaro & Smith, 2015). Nowadays, the tertiary enrolment ratio is one of the indicators of HDI. The HDI measures development through the extent to which a society may have schooled its population, the national standard of living, and the national longevity index to which the society may have provided lifelong learning for its people (Biao, 2014). S&T in development is one of the essential lacunae in classical theory. However, modern applications have visualised the vital impact that S&T had on the rapid economic development of the now-developed nations (Jhingan, 2012). Neo-classical economic theories of growth analyse the relationships between the growth of inputs, including capital, land, labour, technology, and the growth of output (Szirmai, 2015). Neo-classical economic theorists argue that when resources, technologies, and preferences align logically and sensibly, a society can develop sustainably (Biao, 2014). As Szirmai (2015) points out, the neo-classical theory does not focus explicitly on developing countries. Foucault (1990) understands and identifies a distinctive American idiom of new liberalism that reveals a concern with developing human capital, a theme that classical economists tend to have neglected (Browning, 2016).

2.2.4 The Endogenous Theory Implication for Higher Education

In Endogenous Growth Theory (EGT), a critical role attaches to the access to knowledge of the productivity of human capital employed in R&D (Karlsson & Zhang, 2001). Capital includes human capital as the driving force behind economic growth (Grossman & Helpman, 1994). Technological transfer, meanwhile, is assumed to increase the productivity and efficiency of the economy, leading to sustained economic growth, and one aspect of endogenous

growth is innovation and the development of innovative technology (Oketch et al., 2014). EGT claims that technological, R&D, physical, and human capital investments are subject to increasing returns due to spillover effects through which firms profit from each other's investments (Szirmai, 2015). Provided the assumption in EGT that new knowledge (Karlsson & Zhang, 2001) is the driving force behind economic growth. This theory serves as a model of the education workforce pipeline and offers a framework for endogenous professionalisation, wherein ever-higher degree attainment is essential (Ghaffarzadegan et al., 2018). The dynamic interdependence between human capital accumulations involves regional divisions of labour, a unique price structure under perfect economic competition, and government intervention in Higher Education (HE) (Karlsson & Zhang, 2001). Indigenous growth frameworks challenge neo-liberal models by restating local epistemologies, cultural relevance, and collective forms of knowledge production in universities (Makokotlela & Gumbo, 2025). Integrating indigenous knowledge into HE curricula enhances student wellbeing in STEM education and promote relevant teaching methods (Yazidi & Rijal, 2024; Makokotlela & Gumbo, 2025). The application of EGT in degree attainment has two significant mechanisms rooted in the education system that led to the growth in degree attainment: the Pipeline Cascading Effect and the Pipeline Reinforcing Effect (Ghaffarzadegan et al., 2018). The same authors contend that the model demonstrates that these mechanisms magnify the effects of short-term recessions or technological changes and create long-term waves of mismatch between workforce and jobs.

The implication of the theory is degree inflation, magnified pressures on those with lower degrees, underemployment, and job market mismatch and inefficiency (Ghaffarzadegan et al., 2018). This theory also has implications for HRD, as investment in capital and education creates technological advances (Szirmai, 2015). Industrial countries have been undergoing fundamental changes for a couple of decades, affecting R&D, the educational achievement of the labour force, the rate of technological change, and the rapid expansion of knowledge

industries and their raw material, new knowledge (Karlsson & Zhang, 2001). Profit-seeking investments in knowledge are critical in the long-run growth process and the models of endogenous technological progress (Grossman & Helpman, 1994). Assuming that universities are the main actors in the knowledge generation process (Karlsson & Zhang, 2001), one could interpret the knowledge sector in endogenous growth models as an aggregation of all universities in the economy.

2.2.5 Human Capital Theory and its Implication for Economic

Becker (1964) initially developed HCT, and it focuses on education and training (Szirmai, 2015). Workers have a set of skills developed by education and training that generates a stock of productive capital. In the 1960s, the notion of HCT came into its own. It established itself as an area of academic study even though it remained an adjunct of labour economics (Vally & Motala, 2014) and at the micro-level of neo-classical economics (Szirmai, 2015). Scholars assert that behavioural economics has contributed to a shift in focus from macro issues (e.g., unemployment). HCT is both microeconomics and macroeconomics, providing an additional justification for increased efforts in education (Szirmai, 2015).

Different authors, human capital refers to the accumulated skills that affect labour force productivity (Greenwood & Holt, 2010), the abilities, skills, and knowledge of workers (Romer, 1996), the productive investment in people, especially regarding the skills and values (Todaro & Smith, 2015), an accumulation of investments in people (Mankiw, 2012), the collective value of the capabilities, knowledge, skills, life experience, and motivation of an organisational workforce (Mathis et al., 2014), skills accumulated over time, notably through schooling-post-school training and education (Fourie & Burger, 2015), the most critical determinant of economic success around the world (ICFGEO, 2017), and the process of acquiring and increasing the number of people who have the skills, education, and experience critical for the economic and political development of a country (Jhingan, 2015). Human capital-health, skills, knowledge, and experience-is what people need to thrive (World Bank, 2026).

Human capital affects economic development if complementary factors such as capital investment, technology, and growth-enhancing institutions are in place (Szirmai, 2015). Jansolstad et al. (2012) agreed that capital and natural resources are passive factors of production; human beings are the active agents who accumulate capital, exploit natural resources, construct social, economic, and political organisations, and carry forward national development. Human beings are the sources of economic activity. Population studies are essential for planning the overall socio-economic development of a country. The human population is also the productive force and creator of material wealth. Focusing on people and productivity is the most effective strategy for increasing economic growth and quality of life (Greenwood & Holt, 2010).

HCT has been a dominant paradigm informing this pathway (e, g., Becker, 1965; Schultz, 1961), as cited in Oketch et al. (2014). More recent work focuses on endogenous growth (Lucas, 1988; Romer, 1986), endogenous development (Hu, 2008; McMahon, 2009; McMahon & Oketch, 2013) and the development of capabilities (Boni & Walker, 2013; Sen, 1999, as cited in Oketch et al., 2014). Oketch et al. (2014) also provide important insights into how tertiary education graduates contribute to growth and development. However, without significant investment in health care, education, and on-the-job learning, low- and middle-income countries will continue to fall behind (World Bank, 2026).

A better-educated workforce is likely to be more productive. If society's stock of human capital is more productive, overall living standards tend to be higher (Mankiw et al., 2018). However, in today's rapidly changing world, a good education must prepare students to develop new skills and adjust to new knowledge if development is to be sustainable (Greenwood & Holt, 2010). Nowadays, there has been a significant transformation in the analysis of economic growth and development, giving greater recognition to the role of human capital. No country has ever achieved sustained periods of economic growth or significant reductions in poverty without investing in human capital

(World Bank, 2026). The development of human capital through HE is a requisite component (Lee, 2012). Human Resource Development (HRD) occurs not only within HEIs, but also through workplace training and experiential learning, which have not been adequately considered. The HCT lies unstated and needs to be acknowledged behind policy discourse and research in this area (Vally & Motala, 2014). There is a requirement to acknowledge the importance of human capital in economic development. Wealth comes from people and their productivity (Greenwood & Holt, 2010).

Marginson et al. (2013) argue that the STEM economic policy agenda is required to enhance the general quality of the supply of human capital to enlarge the high-skilled group capable of research, commercialise innovation, and effectively respond to technological change (Clarke, 2019). Human capital, social capital, identity capital, and psychological capital are highly valued and promoted by holistic Science, Technology, Engineering, Arts, and Mathematics (STEAM) approaches nowadays (Garza, 2019). Underdeveloped HR is an obstacle to economic development in underdeveloped countries. Countries need more people who possess the critical skills and knowledge required for all-around development of their economies. Surplus labour is considerable due to the need for more skills. Underdeveloped HR leads to low labour productivity.

The essential type of human capital is education (Mankiw, 2012). Expenditure on education can be an investment in human capital, i.e., the people's ability to be productive (Fourie & Burger, 2015). However, in contemporary society, HE is presented globally as the arena for turning a country into a cut-throat market and dynamic knowledge-based economy capable of combining economic growth with greater social cohesion and the public good (Walker, 2013). Human capital is the economic knowledge, and skills workers acquire through education, training, and experience (Mankiw et al., 2018). The insatiable thirst for economic growth and human capital outcomes drives education policy. Knowledge in the human capital model has become the currency of power (Walker, 2013). An investment in

education is tied to a specific person, and this linkage is made in human capital (Mankiw, 2012). Education and training contribute to workers' stock of knowledge and skills that make them productive (Brue et al., 2014). Although education, training, and experience are less tangible than bulldozers and buildings, human capital is like physical capital in many ways. Human capital raises a nation's ability to produce goods and services (Mankiw et al., 2018). A person with an HE qualification earns a higher salary because skill development increases a person's stock of human capital, increasing that person's productive potential (Barker, 2015).

Alongside an efficient and effective Information and Communications Technology (ICT) system, developing human capital is central to sustaining this new economy and is increasingly vital to Higher Education Development (HED) (Ashcroft & Rayner, 2011). With the world's low-skilled jobs most susceptible to automation, developing economies are at greater peril of technology-induced unemployment (ICFGEO, 2017). Vally and Motala (2014) agreed that the workplace is more technological, including new and improved machines that have often replaced (and displaced) people in the workplace. Likewise, technology has reduced the amount of labour required (Mankiw et al., 2018).

Estimating the future workforce requirements is the most challenging task for planners and policymakers (Jhingan, 2015). Argyropoulou & Kaliris (2018) agreed that the future labour market would be unpredictable because the economic, political, environmental, social, and other parameters that influence it are not easily foreseeable. Similarly, the Ministry of Education (MoE, 2008) of Ethiopia noted that human resource planning is far more convoluted than predicting the market values of rare commodities. Population studies yield knowledge essential for planning, particularly by the government, in health, education, housing, social security, employment, and environmental preservation. Workforce development is a long-term process, and the country's requirements must be estimated one or two decades in advance (Jhingan, 2015).

There is a robust focus on the role of education in economic development (Harber & Mncube, 2012). Thus, human capital remains philosophically and normatively wedded to observing people initially as engines of economic productivity. Hence, educated people must become economic producers, consumer citizens, and entrepreneurial selves (Walker, 2013). A tiny country with no natural resources, like Singapore, has become one of the most developed countries in Asia primarily because of its robust emphasis on developing HR and continuously making significant investments in human capital. Similarly, Japan is not well endowed with natural resources; however, the Japanese have successfully developed HRs in S&T to achieve its economic wealth. HCD is critical to any country's growth and poverty reduction strategy (G20 Seoul, 2010). The notion of development involves the construction of human capacities-the most basic of human capabilities are to lead long and healthy lives, to be knowledgeable, to have access to the resources required to achieve decent standards of living, and to be able to participate in the life of the community (Potter et al., 2018). Investing in human capital is education and on-the-job training (Brue et al., 2014). Human capital includes more than just education; course-bound and workplace workers continue accumulating job skills. The human population is necessary for development and socio-economic activities; for example, the population is the most crucial source of the labour force to produce productive economic sectors, such as agriculture, manufacturing and industry, teaching, health services, technology, etc. On the other hand, economic growth does not depend on the size of HRs but on their efficiency.

Previously, the most common classification of countries with low, lower-middle income, and upper-middle income was in terms of per capita income; however, nowadays, human capital is also one of the criteria. As Potter et al. (2018) note, human development is measured by life expectancy, educational attainment (adult literacy and combined primary, secondary, and tertiary enrolment), and adjusted income per capita in purchasing power parity of US Dollars. However, today, development has been conceptualised more broadly, such as human

development and an emphasis on quality of life (Burnel et al., 2017). Nations classified as having a high HDI in human development are mainly in the North or developed countries, such as the USA, Canada, Sweden, Japan, Switzerland, the United Kingdom, and New Zealand. Potter et al. (2018) note that those nations from the Global South with high scores are Hong Kong, Singapore, the Republic of Korea, Chile, the Bahamas, and the United Arab Emirates. Medium-level HDI includes Trinidad and Tobago, Venezuela, Romania, Peru, Sri Lanka, Jamaica, China, Egypt, and Namibia. Potter et al. (2018) demonstrate that Pakistan, Niger, Haiti, Tanzania, Senegal, Guinea, Rwanda, Sierra Leone, and Burundi return low HDI scores. A composite index criterion of HRD is based on human resource indicators and is grouped into four levels: underdeveloped, partially developed, semi-advanced, and advanced (Jhingan, 2015).

The literature on HE and development focuses primarily on the first pillar of tertiary education teaching (Oketch et al., 2014). Sometimes, individual earnings depend on the job they acquire, not personal characteristics (Vally & Motala, 2014), to measure productivity. Greenwood and Holt (2010) state that in today's rapidly changing world, a good education must prepare students to develop new skills and adjust to new knowledge development to be sustainable. In human capital, people's skills and capabilities are partly a product of their education, which makes them more productive (Burnel et al., 2017). Although there are disparate explanations of how human capital contributes to development, all rest on the assumption that graduates affect development outcomes (Oketch et al., 2014). It can develop human capacity in the workplace, enable innovative new products and ways of achieving goals, and create a range of services (Ashcroft & Rayner, 2011). Transformation or conversion in the direction of academic human capital in universities implicates the subject as only a speck of human capital, making incoherent the notion of engaged citizen (Oketch et al., 2014), an educated public, or education for public life. In the productive skill or human capital approach, the individual holding a job is the key to productivity.

As the dominant driver of HEP, human capital involves the notion that a university's education is an instrumental means to something else-human capital (Walker, 2013). HCTs argued that much of the unexplained increase in productivity, wages, and economic growth can be elucidated by investments in human capital (Vally & Motala, 2014). Thus, the capabilities approach provides a view of HE as ethical and instrumental, producing skills for economic development and being capable of critical thought and connection (Bozalek & Leibowitz, 2013). As Mankiw et al. (2018) argue, the human capital argument is willing to pay more for the highly educated because they have higher marginal products.

South Korea and Malaysia had adopted a policy of intake of university admission taking S&T careers, importing and adapting foreign technology through licensing, adapting, and in-house development expansion of vocational schools, heavy investment in R&D, improving the quality of science and mathematics education, and executing programmes like the Early Grade Reading Assessment (EGRA, 2010). In line with this, Ethiopia adopted the 70:30 (S&T) policy.

Just as economic growth is necessary for human development, human development is critical to economic growth (Rist, 2014). As people became more educated, developed more skills, and improved their reading and writing abilities, they became more productive. They had an improved ability to manage existing and new production techniques (Szirmai, 2015). The HDI is an aggregate measure of progress in three dimensions-health, education, and income (Borg, 2012).

Health and education in national production function as components of human capital, meaning productive investments embodied in persons (Michael & Stephen, 2015). According to Coetzee et al. (2001), development must be based on human well-being, the quality of human life, and esteem for human life. Human development is to enlarge people's choices to make development more

democratic and participatory (Rist, 2014). Production depends on labourers who are denied control over what happens in production and the products (Browning, 2016). At the same time, development has a direct role in human freedom, well-being, and quality of life. The development process is inseparable from the expansion of human capabilities, given its intrinsic and instrumental importance (Sen, 1996).

2.2.6 International Development and Influence on Higher Education

Global forces affecting HE, including mass enrolment and access privatisation, affordability, decentralisation and accountability, can be united through globalisation (Kandiko, 2010). One of the main trends in contemporary HE is how globalisation affects universities (Ashcroft & Rayner, 2011). The influence of globalisation on HE can be viewed through neo-liberal ideology, which encompasses ideologies of the market, new institutional economics based on cost-recovery and entrepreneurialism, accountability, and new managerialism (Kandiko, 2010). Globalisation has altered education policy, but we must specifically consider and study education policy. The political and economic aspects of globalisation dominate change to HE (Kandico, 2010). However, Ashcroft & Rayner (2011) argue that the asset of globalisation has tended to favour universities in more-developed countries- those who are dominant in determining 'what counts' as academic, respectively, and who have easier access to research journals and other indicators of status because of tradition and language. Zolfaghari et al. (2009) argue that the reasons for the internationalisation of HE is political, economic, academic, and socio-cultural. HEIs can take advantage of these synergies to cultivate and nurture STEAM through internationalisation (Garza, 2019).

Changes in the HEP, including international and global developments, have brought about reforms in the HES of the countries; however, these have no uniform effect on the HEP (Luijten-Lub et al., 2005). Internationalising the curriculum for STEAM must achieve global perspectives, intercultural

competence, and responsible global citizenship, as this learning outcome is a shared goal of STEAM (Garza, 2019). In today's changing world, the notion of the internationalisation of HE, especially in developing countries, has emerged from the globalisation of the education process (Zolfaghari et al., 2009). An attempt to monitor international initiatives and ensure quality is integral to the international HE environment (Gwakwa, 2016). The internationalisation of HE has caused a sweeping global shift of policies for governments and HEIs alike (Bernet, 2020). Internationalisation is an integration process that involves an international and intercultural dimension into institutional teaching, research, and service elements (Zolfaghari et al., 2009). One major trend related to reforming and restructuring emerging universities is adopting strategies along the Anglo-Saxon paradigm in internationalising universities in Asia to make the HES a more globally competitive market (Mok, 2007).

The knowledge economy is fostered by globalisation through research and advanced technology, educational investments, and a new openness to innovation (Ashcroft & Rayner, 2011). In the wake of globalisation, national governments and HEIs worldwide have embraced various internationalisation components to survive and thrive in a growing knowledge-based economy (Bernet, 2020). In the coming decades, technology, demographic change, and globalisation will reshape our world, becoming increasingly essential (ICFGEO, 2017). Governments emphasise the internationalisation of HE through international cooperation and exchange (Zolfaghari et al., 2009). The rise of the knowledge economy has generated new global infrastructures, and IT has profoundly impacted the economy. The popularity and prominence of IT have changed the nature of knowledge, subsequently restructuring HE, research, and learning (Mok, 2007). The ICT capacity enables students to access programmes and courses anywhere and at any time. Programme. Due to advances in technology, social, economic, and technological changes have made education training more crucial than ever.

Nowadays, ICT has a critical role in efficient education. Today's technologies are implemented through e-learning programmes, e-library, and the internet. Harnessing technology for teaching and learning offers immense opportunities to transform education at all levels (ICFGEO, 2017). Digital technology has created opportunities for digital education and digital learning. The role of ICT in education is positively related to development in that the proportion of the population of the most developed countries has attained HE levels that are higher than the population of developing countries. In 2000, tertiary enrolment in the least developed countries was about 3%. Universities in the developed world have moved away from relying heavily on books and face-to-face lecturing and have adopted modern ways of information dissemination, even though the delivery is online, which has an immense impact on cost and enrolment (Dunga, 2013). The change in the socio-economic context of the globalised economy has inevitably led to changes not only to the university sector but also to the school sector (Mok, 2007). The globalisation of HE has opened the doors to the sharing of knowledge and research and the competition for faculty and tuition-paying students (Bernet, 2020).

The World Trade Organisation (WTO) and the GATT, global institutions that form part of the contemporary development landscape, have implications for development processes and outcomes (Potter et al., 2018). GATT applies the free trade principles to HE, framing it as a service among others (Lorenz, 2005). The pressure to move education from a public service to a tradable service is embedded in the ideology of the WTO and GATT, whose purpose is to liberalise services in all sectors of the economy (Robertson et al. (2002) cited in Lynch 2006). Education is a commodity that has become normalised in policy and public universities (University College Dublin, 2006). From the neo-liberal, GATT point of view, the HE transformed into an international service that must be sold and bought from any international provider. The internationalisation of HE has caused a sweeping global shift of policies for governments and HEIs alike (Bernet, 2020). Education is one of the regulations of the WTO Services Agreement and limits

government regulation (Potter et al., 2018). In transnational national education, the government would have to relinquish its power to select new universities if it were to commit under GATT to placing no restrictions on market entry (Mok, 2006). The WTO and GATT erode the effective forms of democratic political control over HE (Lorenz, 2005). The Organisation for Economic Cooperation and Development (OECD) strongly criticised the role of education in servicing the economy and neglected its social and developmental responsibilities (University College Dublin, 2006). They consented to GATT as the government adopted "transnational education" as a policy to treat HE as a trade (Mok & Xu, 2008). The institutions exert influence on education policy in individual nation-states. A set of institutions comprising the IMF, World Bank, GATT, and WTO represents and administers free-market international capitalism after the Second World War (Knox et al., 2008).

Neo-liberalism is influencing many aspects of HE-its public charter with society, faculty roles and responsibilities, and the experiences of individual students (Kandiko, 2010). Creating global league tables for universities is symbolically the most potent indicator that market values have been incorporated into the university sector (Lynch, 2006). The neo-liberal economic policy for the HE subsector is marked by the growth of capitalist and corporate influence on African universities affected through globalisation, and the neo-liberal agenda of the last two decades has affected the independent and critical research capabilities (University of Oslo, 2002). For World Bank policymakers and others, the task of HE in Africa was to develop the specific skills that African countries required. Globalisation presents opportunities for sub-Saharan Africa; for example, it removes constraints on knowledge created by national boundaries by widening opportunities for research and collaboration between academics in disparate countries (Ashcroft & Rayner, 2011). In developing countries, the World Bank's influence on educational policy is significant. According to UNESCO, no country can ensure genuine endogenous and sustainable development without adequate HE and research institutions providing a critical mass of skilled and educated

people (Yizengaw, 2003). Neo-liberalism is the dominant political-economic ideology worldwide that frames current education policy notions (Verger et al., 2012). To assess the significance for Africa of the World Bank notions of the appropriate roles of HE, we explore World Bank policies on HE for Africa and their consequences (Samoff & Carroll, 2003). The concept of global skills makes the relationship between globalisation and the skills required to cope with it explicitly part of development education (CONCORD, 2014).

2.3 Education Theories and Their Implication for Development Policy

The theories of education, philosophy, and learning carry significant implications for HE development, as discussed in the following sections.

2.3.1 Education Theories and Implication for Higher Education Policy

The HCT view of education is that schooling raises workers' wages (Mankiw et al., 2013) because it makes them more productive. Although this view is widely accepted, economists have proposed the Signalling Theory of Education (STE), which focuses on firms using attainment as a way of sorting between high-ability and low-ability workers. Rorty, in 1979, deliberated on the education theory by pinpointing the distinction between the contributions of education to individuals' capacities and adopting the dominant ideology, which is improved and disclosed by the current theory (Dermas, 2016). However, Western education promotes Western culture and ideology in a school ethos without considering the local indigenous knowledge, especially in African countries. In the STE, schooling has no productivity benefit, but thinkers signal their innate productivity to employers through their willingness to spend years at school. HCT and STE disclose why workers who are more educated tend to earn more than less-educated workers. According to the human capital view, education makes workers more productive; however, according to the signalling view, education is correlated with natural ability (Mankiw et al., 2013). These two views have radically disparate predictions for the effects of policies that aim to increase educational attainment.

Increasing educational levels for all workers would raise all workers' productivity and wages; nevertheless, according to the STE, education does not enhance productivity, so raising all workers' educational levels would not affect wages. When people earn a university degree, they do not become more productive. They signal their ability to prospective employers because it is easier for high-ability people to earn a university degree than it is for low-ability people.

2.3.2. Theories of Educational Philosophers and their Implication

At the end of the 19th century, philosophical idealism was the predominant school of thought and did not rely on its correspondence with an external world (Oxford University, 2017). Pragmatist philosophy is the dominant school of thought. Philosophy and education mutually imply one another. UNISA (2018) noted that education is rooted in philosophical and political realities. Political philosophy can control the government of a country. All political and social ideologies must follow national ideologies (UNISA, 2018), as Plato proposed a political system, including primarily a system of socialisation and education that will distribute the benefits of this specialised knowledge among the citizens on an enormous scale (Oxford University, 2017). Socrates thought that the best for all human beings (Apology 38a) is now mature adults who have had exorbitant scientific and dialectical training (Oxford University, 2017). Developing countries should have relevant political and educational philosophies to determine relevant education.

Socrates' virtue is knowledge-appears intellectualist, hence a reason for the ascription of paradox to these doctrines. Socrates's various arts (technical) in support of the doctrine that knowledge of virtue is sufficient to make one virtuous have been questioned in their extension to morals and politics (Oxford University, 2017). Aristotle thought knowledge comes through experience. For Plato, education was more about discovering previously acquired knowledge.

For pragmatists, naturalists, and progressivists, learning is by doing (UNISA, 2018). For realism, knowledge can is acquired through experience (Oxford

University, 2017), which is self-realisation, and in existentialism, students are free to select from the available learning institutions.

For pragmatists and progressivists, learning is all about problem-solving so that our thinking advances by transforming poorly understood situations into things we can manage on a routine basis (UNISA, 2018). However, realism, for instance, human knowledge can is acquired through experience when we observe, hear, touch, or taste objects and their properties in the material world (Oxford University, 2017). Rousseau's education must provide souls with the means to form a national identity and direct their opinions and tastes in a patriotic way by inclination and necessity (Aviv University, 2000). Plato accepts the unique aptitude doctrine, according to which each person is born with a natural aptitude for an exceptional craft or type of work and social role (Oxford University, 2017), which is the principle of specialisation. Plato's "humanity was born with an innate knowledge of everything, and that learning was a process of unlocking the memories". According to Plato, education is according to one's talents and abilities. However, knowledge could only be gained by comparing it with what was already known and perceived. As a pragmatist, Dewey was especially fascinated by how learning could be guided through experiential actions, and their consequences could be the basis for producing knowledge (UNISA, 2018). One of the purposes of HE is to meet individuals' learning requirements and aspirations by developing their intellectual abilities and aptitudes throughout their lives (Lange, 2013). As a pragmatist, Dewey emphasised learning by doing; however, even more important was his core assumption that children had a natural degree of curiosity and that this should be the foundation of the teaching process (UNISA, 2018). Plato agrees that there is a political skill and that it can be taught; nonetheless argues that only a tiny minority can learn specialist expertise with the appropriate natural ability, and these people exclusively should control politics (Oxford University, 2017). When he first opens his eyes, an infant ought to observe the fatherland, and up to the day of his demise, he ought not to

observe anything else (Aviv University, 2000). These educational philosophies have implications for educational policy and curriculum development.

2.3.3 Learning Theories and their Implication

Learning theories are developed and employed, such as Visual, Auditory, Kinaesthetic (VAK) (MoE, 2011). Philosophical orientation determines any subsystem of education, and shapes curricula and pedagogy about learners' beliefs (Vally & Motala, 2014). Hook's educational theory-engaged pedagogy-has developed out of an interplay of anticolonial critical and feminist pedagogies and provided an engaging and powerful standpoint for interrogating biases in curricula that reinscribe systems of domination while simultaneously providing new ways to teach diverse groups of students (Subreenduth, 2013). Critical approaches to pedagogy are relevant to learners worldwide, not just those in high-income contexts. International policy has also often failed to consider the global context in which individual nations develop skills programmes for their citizens.

Andragogy is the science of teaching adults, while pedagogy is the science of teaching children. Andragogy is relevant for HE teaching strategies and curriculum. Andragogy is a learning theory for adult learners in HE (ElAmin, 2020); however, andragogy is little in literature and practice. Still, literature indicated little for andragogy, for example, very recently AI is a pedagogical disruptor (Chan & Colloton, 2024), but not considered andragogy. Recent learning theories of pedagogy have moved from teacher centred pedagogy approaches to more student-centred/learner-centred, child-centred, or active learning approaches. Less explicitly and sometimes more distantly, pedagogical approaches are informed through theories, for instance, behaviourism and social constructivism (University of Sussex, 2013). Not all learning outcomes require identical knowledge, skills, and attitudes to achieve (Coetzee et al., 2007). Further, Coetzee et al. (2007) noted that the taxonomy of learning domains is cognitive, affective, and psychomotor. The University of Sussex (2013) further outlines identity, citizenship, and agency. As per MoE

(2011), plan and think about how your methods match the requirements and interests of the full range of learners in the groups you teach. Increasing the number of students in STM and promoting sufficient and qualified graduates ready to pursue STM careers or advanced studies is critical to the country's rapidly growing economy (Belay et al., 2016). Education theories include the advent of technology and technological pedagogical content knowledge. These theories have implications for policy and curriculum development.

2.4 Labour Market, Minimum Wage, and Skills Mismatch

Shared labour pools, networks of specialised businesses to supply intermediate inputs, and the spread of knowledge and ideas that can accelerate innovation (World Bank, 2026). Labour-market segmentation is another issue in many developing countries. Labour markets are fragmented in formal versus informal employment, gender, and sector (Fields, 2011). By effectively flattening out the labour supply curve, a minimum wage law can simultaneously increase both wage and employment in a monopsonistic labour market (Lipsey & Chrystal, 2007). Effectiveness also depends on labour supply elasticity, or how willing and able workers are to shift into industries with higher wages, and whether spillovers are concentrated in industries that can absorb additional labour (World Bank, 2026). Availability of appropriate labour is another problem area faced by firms across country groups (Adarov, 2025). Participants in markets with asymmetric information will develop informal criteria for signalling information about these unseen characteristics. Technological advances, like automation, have eroded the competitive advantage of low-wage labour in global manufacturing (World Bank, 2026), particularly AI, which disadvantages and displaces the labour force. Workers and employers make decisions about wage levels, employment contracts, and job search strategies. These decisions are influenced by factors like labour-market conditions, skill levels, and individual preferences (Kahraman & Haktanır, 2024).

Availability of appropriate labour is another problem faced by firms across country groups (Adarov, 2025). Investment is instrumental for boosting productivity,

creating new jobs, and reducing poverty (Adarov, 2025); investment in Ethiopia is weakened for HCD and job creation. World Bank (2026) noted that the use of public inputs is particularly difficult to compare across countries because they do not involve a measurable fiscal cost. The four types of public inputs are industrial parks, skills development programmes, market access assistance, and quality infrastructure. The returns to past human capital investment are reflected in wages and create incentives for additional investment (Holla, Schady, & Silva, 2026). As competitive labour markets indicate that raising the wage that employers must pay leads to a reduction in the quantity of labour in demand and an increase in the quantity of labour that is supplied (Lipsey & Chrystal, 2007).

Long-lasting wage differentials arise from differences in skills and educational attainment; others arise from differences in age and sex (Lipsey & Chrystal, 2007). The purpose of Ethiopia's 70:30 higher education and TVET admission policy was to produce skilled STEM labour for burgeoning manufacturing and industrial development in Ethiopia (MoE, 2008). Employers disclose that low productivity and work culture among the graduates of the 70:30 policy are some of the challenges to the companies in the industrial park that prevent them from using their total capacity (EBR, 2017). Segmentation theory explains why women and youth work in low-wage, insecure work and face barriers to transitioning into higher-productivity positions. These theories justify analysis of skills gaps vis-a-vis investor standards (International Organisation for Standardisation [ISO] and digital certifications). Workers and employers make decisions about wage levels, employment contracts, and job search strategies; in Ethiopia, there is no minimum wage policy yet. The government reports on cheap labour to attract investors. These decisions are influenced by factors like labour-market conditions, skill levels, and individual preferences (Kahraman & Haktanır, 2024). When unions set wages for their members, they affect wages. The government can cause similar effects by setting minimum wages, which define the lowest rates that workers may legally be paid (Lipsey & Chrystal, 2007).

Wage differentials arise from the type of market in which labour is sold; different wages are likely to be produced by competitive markets, where there are many buyers and sellers, monopoly markets, in which unions control the supply, and markets in which there are so few employers that each has power to influence the outcome (Lipsey & Chrystal, 2007). The returns to past human capital investments are reflected in wages and create incentives for additional investment (Holla, Schady, & Silva, 2026). The characteristics of workers are hard to ascertain in advance, so labour-market practices evolve to cope with imperfect and asymmetric information. Efficient wages are above the minimum that would be required to hire a worker, thereby providing an incentive for the employee to perform well. In Ethiopia, companies in the industrial parks post vacancies daily, but the number of newly incoming labour force is limited (EBR, 2019); one reason is the minimum wage (EBR, 2017) and skill level. Selection and management procedures evolve to provide effective monitoring and incentive mechanisms. In Ethiopia, industrial parks, use the lower-level labour force instead of graduates of universities and TVET, as their main reason is lower pay. Others use machines that displace the labour force. Internal labour markets within firms are tournaments in which employees compete for promotion to more senior and better-paid jobs (Lipsey & Chrystal, 2007).

If labour were homogeneous, jobs all had the same non-financial characteristics, and the labour market were perfectly competitive, every person would earn the same income in equilibrium. Disequilibrium differentials in wages would arise whenever demand or supply curves shifted (Lipsey & Chrystal, 2007). In less than a decade, Ethiopia’s industrial parks have directly created 90,000 jobs-a meaningful share of new formal private-sector jobs but a small fraction of Ethiopia's rapidly growing labour force (The World Bank, 2022). However, in Ethiopia's industrial parks, over half of the workforce consists of inept women with lower education levels, leading to lower wages (EBR, 2017). Incomes vary with education (Lipsey & Chrystal, 2007). In Ethiopia, the World Bank (2022) reported that the employment created benefits predominantly for women aged

18–25, a group for which employment is typically associated with a range of positive societal and economic pillars, but which currently experiences nearly double the unemployment levels in the wider population (The World Bank, 2022). Incomes vary by sex, age, years on the job, type of job, and type of market in which labour is selling its services (Lipsey & Chrystal, 2007).

Why are women paid less than men?

Men and women differ significantly in their average educational qualifications and in labour market experiences because women spend between five and ten years out of the labour market raising children (Lipsey & Chrystal, 2007). The human capital differences, that is, differences in education levels and work experiences, are one of the reasons. There have been increases in female labour force participation in high-income countries, but slight change in low- and middle-income countries (World Bank, 2026).

Summary

This chapter reviewed different development theories related to HE. Neo-liberalism manifests in HE: privatisation, liberalisation, decentralisation, commercialisation, and corporatisation. The developmental state has emphasised infrastructure, human capital, and political commitment to industrial development. In Neo-liberalism, HE is based on principles of market competition, privatisation, university autonomy, and institutional autonomy; however, widened inequality. In developmental states, especially East Asia, admissions are guided by centralised state planning, including entrance into public universities using standardised national exams; learners choose their fields of study; admissions decisions are aligned with national economic goals; nevertheless, universities have limited autonomy. The main intention of education, especially HE, is to support industrial development in a developmental state. HDI and HCT are theories of neo-classicism. The neo-liberal and developmental states are antagonistic to each other, and both have limitations for democratic development. The neo-classical also has limitations for S&T

development. The tertiary enrolment ratio is one of the indicators of HDI. Endogenous growth theory in degree attainment depicts the mechanisms rooted in the education system. The influence of globalisation on HE is viewed as a neo-liberal ideology. The internationalisation of HE has caused a global shift of policies for governments and HEIs alike. Global forces affecting HE, including mass enrolment and issues of access, privatisation and affordability, decentralisation, and accountability, can be united through processes of globalisation.

Regarding the neo-liberal, GATT, and WTO points of view, HE has transformed into an international service that must be sold and bought from any international provider. IMF, World Bank, WTO, and GATT are instruments of capitalism. Human capital is the most critical determinant of economic success around the world. Estimating future workforce requirements is the most arduous task for planners and policymakers. According to the HCT view, education makes workers more productive; education correlates with natural ability. Theories of educational philosophers and learning theories have implications for educational policy and curriculum development. The study considered implementing the 70:30 policy in line with these theories. These theories have significant implications for the development of HCT and HE. Finally, labour, minimum wage and skill gap theories were discussed.

CHAPTER THREE

The 70:30 Education Policy and Implications for Human Resources Development

3.1 Introduction

The previous chapter discussed the implications of development theory and practices for HE development. This chapter discusses the implications of education and education policy for HRD, with a focus on the implications of HE for it. It reviews the implications of S&T versus SS for HRD. The chapter also considers the implications of students' interests and talents, as well as enrolment in HE and the supply of HRs, including STEM versus AHSS, and STEM versus STEAM, along with their implications. Furthermore, it reviews the role of HE and its implications for graduate employability. These thematic areas are critically evaluated using a structured policy analysis framework focused on three explicit dimensions. These dimensions are the systemic relevance of state-led supply-push enrolment inputs, the internal allocative efficiency of institutional resources, and the external effectiveness of labour-market absorption. This is because the researcher intends to systematically move this analysis beyond an aggregate descriptive policy report.

3.2 Education for Human Resource Development

The subsequent section will succinctly explore the implications of education for HRD. Educators argue that education is the fundamental basis for a nation's economic development World Development Report (WDR, 2017; Szirmai, 2015; Kwapong et al., 2015; Griffiths et al., 2012; Coetzee et al., 2007). A country can achieve sustainable economic development with substantial investment in human capital through education and training (for example, Mahajan, 2019; Woldegiyorgis, 2015; Jansolstad et al., 2012; Greenwood & Holt, 2010). WDR (2017) reported that they offer guidance on integrating education, learning, and skills with the drive to meet broader development challenges.

People should be central to the development process (According to Potter et al., 2018), a knowledge economy is developed around a more 'professional' (and thus educated) workforce (Jeff et al., 2010), the development of intellectual abilities-aptitudes provides the labour market with appropriate high-level skills and the creation, sharing, and evaluation of knowledge (Lange, 2013); developing countries have the challenge of brain drain (Mankiw et al., 2018; Szirmai, 2015). When analysed through a microeconomic perspective, this standard human capital assumption relies on a highly functioning market mechanism. In such scenarios, state investment linearly translates into industrial productivity. But, when institutional graduate supply operates independently of structural economic demand, this direct transmission path can become severely distorted.

Education is important for the country's economic and social development (Mahajan, 2019), cutting-edge technology (Michael & Stephen, 2011), and there cannot be meaningful development without education (Dunga, 2013). A country must develop the skills and knowledge of its people to utilise them in the national economy (Jansolstad et al., 2012). Many countries have natural resources; however, they need skilled HR. Globally, there are two trends: (1) the 2030 Agenda of the UN, adopted in 2015, with its 17 SDGs, and (2) education for sustainable development as the enablers of other SDGs. WDR (2017) contended that education can and must contribute to a new vision of sustainable global development.

Humanity develops as its productive capacity increases, and capitalism contributes to human development (Browning, 2016). The contribution to HRD is viewed as economic, political, social, and cultural development (Ntuthuko & Francois, 2016; Jansolstad et al., 2012; Haynes, 2008). Jeff et al. (2010) conclude that there is sufficient empirical data to question the prevailing orthodoxy that justifies expanding HEIs on the knowledge economy as a reality requiring an ever-increasing supply of graduates. Students' enrolment,

educational attainment, and financial and physical well-being are indicators of education development. Theoretical models feature human capital as a determinant of growth (WDR, 2017). This linear assumption highlights the need to evaluate the external effectiveness of such models. This is because unadjusted expansion of highly specialised graduates can outpace actual industrial absorption capacity.

3.2.1 Relevance of Education Policy for Human Resources

This section should be read with a discussion of the relevance of education policy for HRD. European Education Policy (EEP) related to EU strategic goals of economic growth, economic and social cohesion, knowledge-based economy, and competitiveness (Dumciuviene, 2014). Even though variations in the approaches and contexts result in more questions than answers, the education systems of Africa share common backgrounds historically, educationally, socially, politically, economically, and culturally (Gwakwa, 2016). Education contributes to economic development and quality of life. Knowledge development requires a new attitude to EEP, finding and combining new ways of supplying knowledge concerning other policies, too (Dumciuviene, 2014). Democracy accumulates human capital by providing well-functioning education systems for its population (Nutsen, 2010). Education is central to addressing the challenges of the economy of any nation or continent in the quest to achieve sustainable development and produce quality HRs (Ehile, 2016).

Education systems in developing countries were often copies of Western educational models (Szirmai, 2015), and the origin of modern education lies in the West (Asgedom, 2009). It has a deficiency value for Africans' insistence on the boundedness and invisible city of person and community; thus, what is taught in school is not based on or tied to the accumulated indigenous experience and wisdom of teaching of the ancestors (Asgedom, 2009). The education content, textbooks, and examination requirements were Western-oriented, i.e., little attention was paid to indigenous history, culture, and society (Szirmai, 2015). The

external country's school indicates that the ICF and World Bank shape many African countries' economic policies (Cheeseman, 2015), and formal policy statements are one source from the World Bank policy on HE in Africa (Samoff & Carroll, 2003). Ethiopian modern education is also moulded on Western education. It needs to study its impact. The researcher believes that education policy requires considering the country's culture, the real-life situation of the country's society, and the real-life of students.

It needs research evidence of the country's background, such as political, societal, economic, and cultural situations, as the basis of policy formulation. Though we are required to copy the education policy, at least a comparative study is required to observe the similarities between countries. As Winch said in 2013, national curricula design must be informed by philosophy and the broader socio-cultural, political, and economic context (UNISA, 2018). Democracy improves education policies (Nutsen, 2010).

Western culture did not enable us to develop our S&T (Asgedom, 2009). Developing countries face a challenge in providing education systems that are relevant to people's life situations and provide meaningful entry into the modern world of S&T (Szirmai, 2015). HE is in crisis internationally because we have missed the deepening level of convolution involved; this has affected the relevance and effectiveness of the policies we put in place (UNISA, 2018). Much of today's debate is centred on poverty reduction as the primary objective of development policy (Burnel et al., 2017).

Since the early 1970s, the debate on education policy has shifted in two directions: (1) as educational performance improved in developing countries, increased attention has been paid to achieving universal education, and (2) an emphasis on quantitative expansion has shifted to a focus on the content and quality of education (Szirmai, 2015). Education's role is not only in producing a quantity of graduates but also in developing qualified and productive HRs.

Economic vitality has much more to do with a high-quality education at every level than with low tax rates or subsidies (Greenwood & Holt, 2010). The university in a developing society must be committed to the people of that nation and their humanistic goals (Leka, 2009).

Despite the present speed of urbanisation worldwide, and even by 2015, some of these countries (like Uganda, Ethiopia, Burkina Faso, and Niger) have more than 70% living in rural areas, according to the UN's World Population Report 2004 (Jansolstad et al., 2012). The challenge for educationalists in developing countries is making education more relevant for rural children (Szirmai, 2015). Universities, where they existed, were usually located in large cities, notably the capital cities, and they received a disproportionate amount of funding; for example, in West Africa, the provision for HE was limited (Potter et al., 2018). Szirmai (2015) claims that one of the areas for improvement in education in developing countries is insufficient attention to emphasis. Human capital accumulation focuses on a neo-classical model that features structural transformation from agriculture to manufacturing.

The researcher also argues that although the backbone of Ethiopia's economy is agriculture, only 5% of students are placed in agriculture, and 40% of students are enrolled in E&T with emerging industries. Ethiopia has developed an ADLI strategy for its economic transformation. Ethiopia recently introduced a standalone 70:30 policy, which is uncommon (Belay et al., 2016). However, the backbone of the Ethiopian economy is agriculture, but policymakers need to pay more attention to it. Under the relevance dimension, this creates an explicit structural policy contradiction. Although macro-development plans like ADLI prioritise agricultural transformation, the 70:30 enrolment policy suppresses agricultural human resource development inputs to a minimal 5% threshold.

The 21st-century developments of globalisation (Lee & Vivarelli, 2006), cosmopolitanism (Moore, 2006), and neo-liberalism (Majhanovich, 2014) have had socio-economic and political impacts and posed challenges to nationalist

ideologies, as cited in (UNISA, 2018). The formulation and continuation of policy are grounded in research. Philosophy has a special relationship to knowledge, education, and research (UNISA, 2018). Education policy can be a significant instrument in promoting economic growth and, more recently, achieving a just distribution of economic rewards (Vally & Motala, 2014). The World Bank advised that education policy in decolonised Africa should focus on HR requirements (Samoff & Carroll, 2003). When the first reality of political independence swept through Africa in the 1960s, Africa's pioneer leaders endeavoured to make it transparent that education was to be a reliable instrument of development (Biao, 2014). However, little is available in the literature on what African countries are doing to regulate and improve HE quality, what has been the impact, and what priorities for capacity constructing are required (Jansolstad et al., 2012).

A fascinating aspect of studying public policy is the relationship between people and issues (Birkland, 2011). Borjas (1996) argues that policymakers usually worry more about unemployment. Policymakers need to pay attention to the policy's effects. In policy design, this dynamic reveals a mismatch between macro-planning targets and structural labour-market capacity. This leads to unintended friction in the domestic economy.

There is compelling evidence of the link between human capital and technology in rural non-market activities (Desalegn, 2018). Investing in education and S&T will assist in meeting development targets (De-PaulIkounga, 2016), and in the globalised 21st-century technology-dependent world (Jegede, 2016). The effects of HE on economic growth led to national development (Neamtu, 2014). The World Bank argued that though social and political demands press for the expansion of public tertiary enrolments, these must be balanced against the requirements to increase the relevance of education. This is an obstacle for nations seeking to join the knowledge economy (Shebeshi et al., 2009). Education has yet to value Africa's insistence on the boundlessness and

indivisibility of person and community (Asgedom, 2009). The university must become a primary tool for Africa's development in the new century (Leka, 2009).

There is a claim that scientists are translating their results for policymakers; nevertheless, future projections have had far less effect on policy than anticipated by the scientists (Heras, 2014). Policy formulation is the development of policy alternatives for dealing with issues on the public agenda; particularly, Borjas (1996) debates that unemployment creates a great deal of concern and that the policy that dominates the policy discussion is structured unemployment. Michael & Stephen (2011) point out that the amount of education demanded is derived from the demand for high-wage employment opportunities in the modern sector. According to Szirmai (2015), one of the main points of criticism of education in developing countries is the mismatch between education and the labour market. This structural misalignment brings the analytical focus directly to Skills Mismatch Theory.

Understanding how various interests react to disparate policies is essential to the public policy process (Birkland, 2011). Unlike primary and secondary education, attending college is not a requirement but a student's personal choice (Michael & Scott, 2013). Policymakers have the legal authority to engage in the formulation of public policy (Anderson, 2015). Once policies are implemented, experience with them and similar policies often changes the policy design (Birkland, 2011), even when the policy and goals are in place and operating. According to Borjas (1996), policy prescriptions for unemployment need to be revised to assist workers in finding jobs or retool workers' skills. Michael and Scott (2013) assert that it is becoming increasingly transparent that HE may be necessary for a wider range of careers and jobs than before. Policymakers have proposed, debated, and implemented it as a response to their concern over the quality of education (Michael & Scott, 2013). Policy concepts are not simply lifted from books, but from international experience and policy science. The 70:30 mechanism operates as a top-down administrative intervention. Particularly, when analysed through the framework of policy equity and efficiency. Besides, it completely overrides the

microeconomic variable of student choice. Further, it attempts to force institutional engineering output without a corresponding structural adjustment in the manufacturing sector labour absorption.

3.2.2 Relevance of Higher Education Policies on Science and Technology and Implication for Human Resources

Scholars engage in debates over the implications of HE policy on S&T versus SS, STEM versus STEAM, and STEM versus AHSS, along with the implications for HRD, which are discussed in the subsequent sections.

3.2.2.1 Science and Technology versus Social Science Implications

This section provides an overview of the debate on the implications of S&T versus SS among scholars. Enrolment in the higher level of education as a percentage of the age group 20 to 24, the percentage of students enrolled in scientific and technical faculties in a recent year, and the percentage of students enrolled in faculties of humanities, fine arts, and law in the identical year are among indicators of HRD (Jhingan, 2015). For HEIs of all concerns, it is how to identify and implement the core mission of the modern research university (Yarime et al., 2012). The curriculum should pay attention to technical subjects, NS, and less to the SS (Szirmai, 2015), and, at the university level, the agricultural, scientific, medical, and engineering faculties should expand while those of arts, humanities, and the law should be limited (Jhingan, 2015). Research institutes in natural and biological sciences, engineering, and agriculture were established to increase the country's capability of innovative S&T to meet its requirements (Jhingan, 2015). Education is oriented toward SS rather than technical, scientific, and agricultural disciplines (Szirmai, 2015). Interdisciplinary partnerships are an improved road (Ntuthuko & Francois, 2016) and focus on broader interdisciplinary applications of arts and sciences to focus on problem-solving (Madden et al., 2013).

This kind of debate highlights the fundamental tension between arbitrary administrative caps and actual cross-sectorial labour absorption. When

evaluated through the lens of policy effectiveness. In line with Skills Mismatch Theory, a state-mandated contraction of SSs assumes that market demand for technical graduates is infinite. The problem is that the policy merely converts underemployment in the arts into structural unemployment within S&T fields. But this is conditional to the domestic economy lacking the structural capacity to absorb these specialised inputs. SHS is a part of the research and innovation spectrum and must represent a separate and integrated part of any new research and innovation programme, national, European, and global (Leru Universities, 2013). The implication is that innovation has become more relevant for all scientific disciplines, not the humanities, where graduates have traditionally found work in public and non-profit organisations (Gulbrandsen & Aanstad, 2015). They must also introduce soft skills at the interface of physical sciences and SHS (Boni et al., 2013). We should accept the fact that no science or academic discipline is the development expert and, instead, call for a wiser and broader interaction among the many experts and change agents and their agencies who profess that they travel the development journey on behalf of the beneficiaries of development (Ntuthuko & Francois, 2016). In contrast, Gulbrandsen and Aanstad (2015) debate biases in academic and policy communities; the most important one is likely a techno economic perspective that only favours some types of innovation oriented. Yarime et al. (2012) argue that sustainability issues cut across diverse academic disciplines, ranging from the NS to the SS. Humanities-interdisciplinarity has become a central notion in the realm of sustainability science (Jhingan, 2015); there is a shortage of a highly educated professional workforce in all least developed countries, such as HRs, including scientists, engineers, doctors, agronomists, and veterinarians (Jhingan, 2012, 2015).

International reports identify the potential shortage of HRs in scientific professions and call for modernising science teaching in schools (European Commission (EC, 2011). HE is crucial to producing vital HRs for the socio-economic development of a nation (Szirmai, 2015; Yizengaw, 2003). However, HE holds the promise of contributing to social justice, development, and

democratic citizenship. This promise remains unrealised, and universities, instead, frequently continue to be a powerful mechanism of social exclusion and injustice (Leibowitz, 2013).

Art and design schools demonstrated how their curricula benefit the sciences (Madden et al., 2013). There needs to be more clarity between S&T versus SS implications for disparate fields of study. Scholars and government documents state that S&T is only for NS fields of study. They are classified as "S&T versus SS". Nonetheless, the fact is that all fields of study are sciences. Asgedom (2009) argues that a lack of conceptual clarity affects the curriculum's relevance. He argues that there needs to be clarity between S&T, which tends to identify science with natural fields of S&T, with products of NS, even though we have science in the SS, and technology can be a systematic and efficient method of accomplishing or producing something. Science involves the systematic utilisation of rigorous methods of inquiry to develop logical, self-consistent explanations of natural phenomena (Smith, 2015). As Asgedom (2009) noted, the classification of 70:30 could be between academic fields (NS and SS) and professional and vocational fields (SS and NS). This conceptual blurring directly threatens the internal allocative efficiency of higher education resources. Specifically, from a critical policy evaluation perspective. The reason is that administrative quotas based on rigid, misaligned disciplinary classifications fail to optimise the actual operational inputs needed for true technological innovation.

3.2.2.1.1 STEM Versus STEAM implication

This section provides an overview of the debates among scholars regarding STEM versus STEAM and its implications. Politicians, education leaders, and policymakers have called for a new emphasis on STEM from primary school to post-secondary education (Belay et al., 2016); however, STEAM is more recent. This has an implication for the 70:30 policy in Ethiopia in favour of S&T. Research to contribute to the knowledge economy is one of the reasons for focusing on the STEM discipline. STEM is a social imperative and a pressing economic issue (Timms et al., 2018). STEM or S&T policy is in human capital terms (Marginson

et al., 2013). Currently, however, a priority is to create a STEAM environment. 'A' in STEAM stands for all the arts and the SHS to form STEAM. STEAM is a cross-curricular collaboration (Land, 2013), as well as a policy. Such research can be a multi-disciplinary STEAM frontier that thrives under multi-disciplinary collaboration (Ludlow & Travis, 2019). Multi-disciplinary or STEAM specialists are more relevant for development. In Ethiopia, the focus remains on STEM without its structure, with no national STEAM policy. Roadmaps in Ethiopia highlight the expansion of STEM to achieve a 70:30 ratio (Ayele, 2022; Sebsibe, 2023). According to a policy analysis framework, this reveals a major structural contradiction. Ethiopia is executing a rigid supply-push enrolment mandate based on hard STEM quotas. However, it completely lacks the integrated curriculum framework, institutional capacity, or labour-market linkages. But studies show that these are necessary to transition from basic quantitative enrolment outputs to high-value innovation outcomes.

Thus, collaboration in STEAM usually means working together from disparate disciplines. For example, cities are envisioned through the phenomenological lenses of STEAM-framed avenues of engagement between literary, historical, cultural, computer scientists, and urban engineers (Travis, 2019). Likewise, engaged pluralism is born from the cross-pollination of STEAM-by positivistic and quantitative approaches (Travis, 2019). Most tangible products result from integrating information from multiple and diverse knowledge domains, requiring teamwork. Designing an app for the Apple iPhone requires, at a minimum, the ability to integrate software, art, math, gaming, English grammar, law, database management, finance, and interpersonal communication that goes into the application. Multidisciplinary STEAM is needed to address climate change. This fundamental restructuring of the economy and the workplace demands a new type of worker with a new skillset. As up-to-date literature demonstrates, HE innovation is shaped by Artificial Intelligence (AI) and digital platforms (OECD, 2023, 2024a; UNESCO, 2023). AI fosters collaboration across disciplines (Chan & Colloton, 2024).

Broader education policy, including periodic reviews of context-specific strategic frameworks, guidelines, plans, or documents on STEM, is a priority for developed countries and emerging economies (Maltese & Cooper, 2017). As Cooper's work in 2011 showed, the university or at least its STEM facilities, have become an essential component of the knowledge economy at the beginning of the 21st century (Vally & Motala, 2014). However, Jegede (2016) argues that infrastructure and equipment for STEM-based programmes are needed. The demands of S&T and innovation can be measured to create wealth. It requires strengthening HRD to build competence through training innovative people with particular attention to E&T and NS. This lack of physical capital directly undermines the policy's internal efficiency. The main reason is that trying to force 70% of the student population into resource-starved STEM programmes degrades the actual quality of human capital produced. Specifically, this is true when it is without commensurate laboratory infrastructure.

The STEAM programme will recruit during freshman advising, and the pool of candidates for the STEAM curriculum will be identified from participants in the course (Madden et al., 2013). The diverse ways of integrating the liberal arts into STEM course content mutually reshape humanities and scientific education (ECT, 2015). Innovations in STEAM education allow students to engage in science where creativity is relevant and humanistic. The push for the STEM platform derives from recent college graduates' lack of creativity and innovation (Land, 2013). Adding the arts into the STEM equation can reinvigorate the platform, providing opportunities for self-expression and personal connection that new generations crave (Land, 2013). In addition, an 'A' for art in STEAM; adding another 'M' for medicine to make a more comprehensive STEAM (Blockley, 2019). Professionals in the field of art education likewise have a stake in contributing to educational outcomes-creative and innovative students. Therefore, art educators must understand what STEAM means in their curricula (Khine & Areepattamannil, 2019).

Integrating the Arts into STEM offers the students the STEAM necessary for co-creation and co-learning, thus equipping them to address the social, educational, and ecological challenges facing societies. STEM to STEAM seeks to educate a workforce with creativity, communication skills, and flexibility by encouraging arts integration alignment across college and career readiness domains, arts education, and the academic core (Clarke, 2019). Multi-disciplinary is intended to foster creative thinking by combining the arts, humanities, and STEM fields (Madden et al., 2013). Traditionally, STEM degrees focus on convergent skills, whereas STEAM degrees focus on divergent skills (Land, 2013). Stroud and Baines (2019) view that traditional STEM understanding emphasises the theoretical understanding of solutions to real-world issues; however, within STEM education, the arts have always had a critical, thought-unheralded place. Thus, STEAM integrations and cross-pollinations are relevant. Integrating the arts, requiring students to think and write, and stimulating creative impulses can promptly dispel notions of ennui and assist in transforming STEM into a thoroughly contemporary STEAM (Stroud & Baines, 2019). STEM to STEAM with partnered studies, structured group problem solving, and the utilisation of established international education programmes (Madden et al., 2013). A STEAM education policy might aim to expand the educational foundation from elementary through tertiary levels, thereby producing graduates who are both creative and innovative for the workforce. HEIs can take these synergies to cultivate and nurture STEAM via internationalisation (Garza, 2019).

Recently, US STEAM has emerged in the policy domain (Clarke, 2019). STEM is a central preoccupation of policymakers across the world. For example, STEM-robust countries such as China, Taiwan, Korea, Finland, and Switzerland have developed strategic national STEM policy frameworks (Clarke, 2019). STEM fields are drivers of national development in knowledge economies (Yonezawa et al., 2016). STEAM will prepare liberal arts graduates with the skills required for a 21st-century knowledge-based economy, including learners' 21st-century skills and digital literacy (Khine & Areepattamannil, 2019; ECT, 2015; Land, 2013).

STEAM promotes digital skills. The skills are required not only in STEM but also in economic sectors (Marginson et al., 2013). Thus, enrolment in STEM disciplines is increasing globally at universities (University of the Western Cape, 2018). A team of STEAM faculty members examined existing literature on creativity and multi-disciplinary models in the industry, business, and education (Madden et al., 2013). In EU countries, there is an unmet demand for graduates in STEAM fields (Blockley, 2019). From a critical microeconomic perspective, this global demand underscores the importance of Job Market Signalling Theory. The degree loses its signalling power in the labour market if any state heavily prioritises quantitative degree production over real skills acquisition. The outcome is obviously structurally unemployable for graduates.

Since the late 1970s, China has led metronomic transformation and rapid advancements in S&T (Mok & Xu, 2008), and the economy in East and Southeast Asia is now globally cutthroat (Yonezawa et al., 2016). Reforms in STEM education have been particularly critical for Turkey's economic competitiveness (Corlu et al., 2014). The third capitalist industrial revolution has created a mutually reinforcing relationship between university researchers in the STEM disciplines and transnational corporations heavily dependent on the knowledge produced in the relevant research centres (Vally & Motala, 2014). China has an S&T strategy to transform the impoverished agricultural country into a wealthy nation. S&T continues to be critical to the Chinese economy, next to Japan (Belay et al., 2016). S&T may also contribute to the issues societies face today, for example, the manufacture of chemical and biological weapons (Walker, 2013). Japan's STEM education at school is significant for its current economy. Japan is distinguished in S&T research (Yonezawa et al., 2016). Research facilities in S&T resulted in far-reaching institutional changes, which paved the way for Japan's rapid progress (Jhingan, 2012).

The current policy approaches in the Irish context make it challenging for advocates of STEAM to develop the approach as a viable policy alternative

(Clarke, 2019). The policy emphasis on STEM in Ireland and its implications for STEAM. The South Korean programme for constructing participation and achievement in STEM has also incorporated STEAM (Marginson et al., 2013) as a successful STEAM policy. Exploring policy directions facilitates a closer analysis of the challenges STEAM initiatives face, securing mainstream policy support to become part of the policy (Clarke, 2019). In the 2000s, no private HEIs lured academics from Poland's universities, including in the fields of study-chemistry, physics, astronomy, and mathematics- the four fields of study ranked highest globally (Kwiek, 2012). On the contrary, the nature of the programmes in Cameroonian State universities stresses more SHS than STEM programmes (Tianxue & Guiake, 2019).

STEM economic policy agenda is predominantly driven by the requirement to enhance the general quality of supplying high-skilled skills, as well as to enhance the high-skilled group capable of research, innovation, and effective response to technological change (Clarke, 2019; Marginson et al., 2013). S&T continues to be of critical importance to the Chinese economy (Belay et al., 2016). China has one of the highest rates of STEM to non-STEM next to Japan in the world. Japan adopted policy initiatives aligned with education, especially in S&E, with the development of S&T and highly efficient HRs. For almost a century, more than 90% of Japanese STEM university academics have obtained their initial and doctoral degrees in Japan (Yonezawa et al., 2016). Korea is an example of a study-abroad system; however, in the 1980s, STEM academics began to obtain their doctoral degrees in Korea. Japan and South Korea achieved rapid economic growth within about ten years after increases in enrolment (Lee, 2012). Like Germany, investment in STEM education and research remains a priority through the economic crisis for its industrial economic development success. A high proportion of Japanese complete higher education, and a considerable proportion of them study S&T. In the 21st century, China has developed the largest S&T-focused HE in the world. The STEM goal of education in Turkey is also to raise a generation with innovative mindsets.

The Ethiopian 70:30 quota is imposed on a lagging manufacturing sector. This creates a demand-supply mismatch. This is because administrative supply pushes outpace actual structural labour-market capacity. Technology is at the heart of development (Kitaw, 2018); however, technology alone cannot create a secure society (Leru Universities, 2013). In Israel, S&T education is essential for developing scientific infrastructure. The government of Israel has a national curriculum to strengthen and improve learning and prepare the next generation of citizens for life in the techno-scientific age (Belay et al., 2016). Some Vietnamese universities have taken advantage of international funding sources to establish high S&T centres to improve the quality of training and research.

One of the roles of HE is the knowledge factory-the production of S&T and ideology (McCaffery, 2010). The literature indicates that in Africa, S&T needs to be comprehensively programmed. Strengthening HE and research in Africa is the agenda of 2063: gender issues, school feeding, ICT access, STEM teaching, and learning. In recent discussions, unless this question is addressed as a matter of urgent priority, then the current classist, elitist scholarship that floats on a sea of mediocrity will continue to be anchored practice (Vally & Motala, 2014). In Ethiopia, Belay et al. (2016) also assert that STEM guides the education sector on the HRs required to achieve the national goal of leading the country's rapid and demanding economic growth trajectory. Kenya has also introduced S&T education as essential for the country's socio-economic development. Another country, Mozambique, established the Ministry of HE, S&T in 2000 to coordinate the expansion of tertiary-level education and promote equity of access to HE (Ashcroft & Rayner, 2011). While institutional access to STEM programmes is widening, the retention and success of STEM undergraduate students remains a challenge (University of the Western Cape, 2018). Participation in education is not sufficient, but also ensures the knowledge, competence, and skills necessary to increase individuals' well-being and the prosperity of modern societies (OECD, 2017). A critical policy evaluation framework highlights a severe internal

efficiency gap in cross-national expansion. Widening aggregate enrolment inputs into STEM creates an operational bottleneck. This prevents educational institutions from producing functional development outcomes. This becomes truer when it happens without resolving student retention and qualitative learning resource constraints

Education should be more relevant to the needs of the labour market (Szirmai, 2015). Creating a workforce educated to be cut-throat in the 21st-century market has led to an emphasis on STEM. However, it is fair to claim that some arts and humanities scholars have been in a quandary, provoked, and discouraged in many countries when confronted with these demands and perhaps with the innovation concept itself (Gulbrandsen & Aanstad, 2015). They appear to find the term irrelevant to their professional activities.

In contrast, technology has become embedded in artefacts, equipment and machines, but also in people and organisations (Smith, 2015). The agenda of spatial humanities includes the pursuit of theory, methods, case studies, experiments, applied technology, broad narratives, and persuasive strategies (Travis, 2019). Innovation is drawn not only from fields, such as economics, marketing, and engineering, but also from disparate fields of professional expertise (e.g., scientists, managers, and lawyers) (Smith, 2015).

STEAM initiatives to bridge research fields in arts, humanities, and sciences (natural, life, and social) (Travis, 2019). Socio-economic development nowadays also occurs through the application of social innovation. There are also movements encouraging legislators to support the arts because of their role in fostering innovation. STEAM at the societal level offers an avenue for the sciences, the arts, and the humanities to pool knowledge and resources to address global challenges (Clarke, 2019). Arts should be integrated into the STEM curriculum to spur creativity and innovation (Khine & Areepattamannil, 2019).

Innovation is something new to put into practical use (Gulbrandsen & Aanstad, 2015). As modern technologies become available, innovators apply them to create new products, services, and processes (Smith, 2015). Traditional innovation processes (methods) techniques for R&D are Why, What, Who, When, Where, how to, and how much (5W2H); Bionic association; combination methods of technologies; reverse innovation (reverse engineering); technology transfer; and benchmarking. Nowadays, however, traditional innovation methods and processes have shifted toward digital and advanced technologies. They have been replaced and augmented by technology-driven innovations such as AI, digital technology, virtual reality, and the Internet of Things (IoT) advanced technology. Entrepreneurs leverage digital technologies to drive innovation and contribute to the economy.

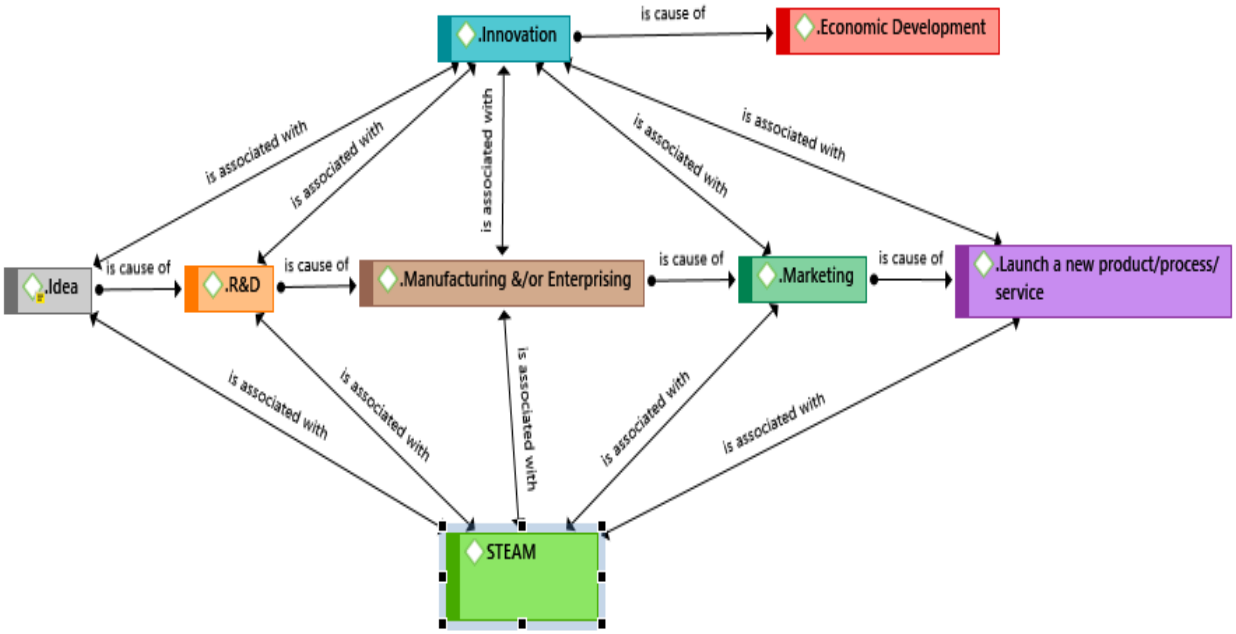


Figure 2: STEAM & Innovation process & its implication for economic development

Author's work using ATLAS.ti 8

R&D expenditures have long been a critical concern for economists. Schumpeter argues for competition through innovation and the importance of education in

ensuring economic growth. Human capital is vital to innovation and a source of knowledge and skills (Smith, 2015). According to Madden et al. (2013), STEAM is about innovation, where critical thinkers develop through education to lead an innovative economy. As Schumpeter argues, the development of government policy in developed countries is informed by neo-classical economic theory; nevertheless, in underdeveloped countries, changes do not take place from within the economy; they are the outcome of generated notions, technology, and capital. Innovations take the existing technologies and innovatively and imaginatively reconfigure or redesign them to create solutions to issues or satisfy yet unmet demands (Smith, 2015). Innovation-driven growth has the potential to create jobs and industries because innovation comes from advances in the STEM disciplines (Corlu et al., 2014). However, Gulbrandsen and Aanstad (2015) argue that innovation can be a valuable concept for arts and humanities scholars, not least. Universities need to implement policy innovation (Chan & Colloton, 2024). Applied to the Ethiopian 70: 30 quota system, this theoretical tension exposes a macro-policy contradiction. The Ethiopian state implements a strict supply-push educational policy in an economy. In Ethiopia, the manufacturing sector is structurally constrained. S&T forms the foundation of Society 5.0 by integrating cyber and physical spaces to address social challenges (Deguchi et al., 2020). Innovation in human-centred AI is crucial for enhancing well-being, healthcare, and sustainable development (Acharya et al., 2025). Industry 5.0 focuses on collaborative innovation between humans and machines to transform the industrial economy (Elangovan, 2022). Advancements in S&T, such as the IoT and AI, serve as catalysts for creating super-smart, people-centric societies (Deguchi et al., 2020). Human-centred innovation promotes inclusivity, social responsibility, and improved quality of life in the context of Society 5.0 (Acharya et al., 2025). Additionally, industrial innovation incorporates automation, robotics, and data-driven processes to achieve sustainable growth (Elangovan, 2022).

Technological innovations are measurable, for example, the introduction of product and process innovations. Barring new notions, which are significant

technological breakthroughs, most project notions involve combining existing fields of technology or offering variants of present products or services. The STEAM framework is applied to research and developing critical reasoning skills (ECT, 2015). The Delphi technique is one method for creating an innovative idea. Nevertheless, from a pedagogical perspective, creativity is one of the top cognitive domains in Bloom's Taxonomy. Brainstorming, nominal group, and mind-mapping are techniques for generating new notions (Smith, 2015). Society needs new educational models to strengthen students' capacity, skills, and entrepreneurial mindsets, especially in the HEI.

Educational institutions should be part of the national system of innovation (Szirmai, 2015). Schumpeter's analysis was purposely for developed countries, but this is also relevant to developing countries for the long-range increase in productivity and absorption of surplus labour in gainful employment because of innovation. Not only does STEM, but social innovation implies new ideas, including products, services, and technology that meet social needs. Nowadays, social innovation contributes to socio-economic development, which has been undermined. Innovative entrepreneurship is also part of human capital. HEs are anticipated to ensure that learners acquire knowledge and skills to act in the interests of innovation. Improvements in technology make human capital more productive. Entrepreneurship is based on innovation, institutions, and ability. Analysed through Skills Mismatch Theory, it fails to support a national system of innovation. This is because of a rigid 70:30 student allocation without integrating these cross-cutting entrepreneurial capabilities. Besides, this is due to the reason that it produces a highly specialised workforce. But their skills do not align with the real operational needs of the local market.

The goals of the global society are dependent on advances in S&T. Studies have demonstrated that spending in R&D, more skilled HR, the efficient economic structure of a country having more employment in the industry and services sectors, and a rapid increase in technological innovation are the key factors that

boost innovation and economic growth. For example, Kuznets traces patterns in technological growth in modern economic growth to scientific discovery or addition to technical knowledge, an invention, innovation, improvement, and the spread of invention, usually accompanied by improvements. Ricardo provided unnecessary information on the law of diminishing returns and failed to visualise the impact that S&T had on the rapid economic development of the now-analysed nations through Western to analyse the issue of Western capitalism; it can give clues to issues that may arise in underdeveloped countries once the process of industrialisation begins-technological entrepreneurship and capability for innovation (Smith, 2015). An increase in labour efficiency depends on progress in technology and social and economic institutions, and processes; such changes can result from specific economic policy measures (investment in R&D or technology transfer and implementation) (Fourie & Burger, 2015).

Up-to-date literature highlights the integration of creativity, S&T, and AI into degree programmes (WEF, 2025); redesigning assessments to ensure integrity in the AI era (Luo et al., 2024); investing in staff skills through AI pedagogy training and policy (OECD, 2024a); and adopting human-centred AI governance (UNESCO, 2023). Curriculum and pedagogy (WEF, 2025), assessment innovation (Luo et al., 2024), research and S&T ecosystems (OECD, 2023), and institutional policies (OECD, 2024a; UNESCO, 2023) are essential today. Education innovation, S&T, and creativity in HE include key drivers (OECD, 2023, 2024a; UNESCO, 2023), creativity as a vital graduate skill (WEF, 2025), the AI shift (Luo et al., 2024; OECD, 2023), and human-centred AI (UNESCO, 2023; OECD, 2024b). Social innovation in Society 5.0 aims to create a forward-looking society through technological progress (Deguchi et al., 2020). The Society 5.0 plan envisions a future society guided by scientific and technological innovation (Acharya et al., 2025). While both Industry 4.0 and 5.0 have laid out roadmaps for industry sustainability, Industry 5.0 is part of the industrial automation landscape, whereas Industry 4.0 remains in development, with humans reclaiming product design through manufacturing, which demands

creativity (Elangovan, 2022). More workers are enrolling in online courses, but online learning is still underutilised by women, especially in STEM and GenAI courses (World Bank, 2025). However, the literature has grave limitations on andragogy of art and scientific teaching in the HEIs, rather than merely on pedagogy. From the perspective of Job Market Signalling Theory, this pedagogical limitation creates an acute crisis in policy effectiveness.

3.2.2.1.2 STEM versus AHSS Implication

The discussion of STEM versus STEAM was covered in the previous section; in this section, the focus shifts to the implications of STEM versus AHSS. A recent study of programmes at state universities based on SHS shows that, despite their prevalence, these programmes have no significant impact on economic growth. Meanwhile, critical socio-economic development programmes like the STEM curriculum have suggested that state university p programmes should align with national requirements and the international labour market (Tianxue & Guiake, 2019). In neo-liberal policy thinking about the economy-whether in manufacturing, agriculture, education, health, or other sectors-it is important to outline the changes that have occurred over the past 25 years (Potter et al., 2018). Research indicates that neo-liberalism has influenced E) by limiting the focus on AHSS fields, as seen in countries like Bangladesh (Anwaruddin, 2014), Ireland (University College Dublin, 2006), and Poland (Kwiek, 2012). This trend could have future consequences for democracy in these countries. HE has increasingly prioritised technological and economic growth (Anwaruddin, 2014). However, universities also play a critical role in developing civil, political, social, and cultural institutions, both locally and globally (University College Dublin, 2006). Critical thinking, reflection, and compassion are essential for a healthy democracy (Anwaruddin, 2014). Challenges in implementing interdisciplinary, trans disciplinary, and institutional approaches are noted within HEIs (Yarime et al., 2012). While STEM is crucial for innovation, it is insufficient on its own; AHSS also plays a vital role. Moreover, STEM alone has limitations in fostering social, democratic, and political development, which underscores the importance of

AHSS implications for these areas. A purely techno-rational policy paradigm creates a deep structural deficit in institutional capacity. This is truer when analysed through the lens of external effectiveness. In other words, over-indexing on quantitative economic metrics, state directives overlook the essential role of HE in producing social capital and civic infrastructure. This leaves the long-term democratic foundations of the nation highly vulnerable.

3.2.2.1.3 Students' interest and talent in STEM implications for relevant human resources development

HRD must comprehend the students' interests and talents, as argued in this section. Based on the modern literature, implications for career intervention relate to the confrontation of career indecision in young adults and the facilitation of the career decision-making process (Argyropoulou & Kaliris, 2018). Adolescents with interests and talents in mathematics and science are more likely to pursue STEM in post-secondary (Subotnik et al., 2010). There is no singular pathway into STEM fields; self-driven interest is an enormous factor (Maltese & Cooper, 2017), and findings hold important implications for educators and the overall goals of talent development (Subotnik & Arnold, 1995). The placement students should consider their interests and talents in STEM (Subotnik et al., 2010). The development of talent in STEM fields and the ultimate career pathway of gifted STEM students depend on the best available scientific evidence on educational environments that produce sustainable interest and motivation for careers in STEM (Subotnik et al., 2010). To increase recruitment to Mathematics, Science, and Technology (MST) by encouraging talented pupils and motivating students to select MST careers by making school science more work-relevant (EC, 2011).

Grouping students by interest and ability (White, 2007), a profession is self-selected, talent and development of intellectual ability and aptitudes (Lange, 2013), and children have a natural degree of curiosity-pragmatism (UNISA, 2018). According to STE, natural ability is predominant for workers in all occupations (Mankiw et al., 2013). Recently, approaches that are gaining

influence endeavour to overcome the traditional focus on the individual and instead conceptualise talent development (Ziegler et al., 2017). However, students may need assistance selecting a profession based on their characteristics. HE students often face enormous career planning difficulties. Because of economic recession, talent often does not know their abilities and talents to decide which professional path they will follow (Argyropoulou & Kaliris, 2018). The limitations of supply-push policies such as the Ethiopian 70:30 enrolment mandate are exposed. Essentially, this is truer when these micro-level behavioural findings are situated within structural labour dynamics. To strengthen the analysis, organic individual interests and relying on state-directed student placement severely degrade internal allocative efficiency. Obviously, this leads to low institutional retention rates and compromised human resource motivation.

3.2.3 Enrolment in Higher Education and Supply of Human Resources

Countries are considering the GER as one indicator of HE development, and the supply of HRs as an output, or graduates of HE, with various fields of study in disparate countries.

3.2.3.1 Enrolment in Higher Education and its Implications

This section discusses GER as one of the indicators of the development of HE. GER is usually an indicator to reflect the development of HE (Chang & Hu, 2019; Szirmai, 2015). In 2011, 39% of the 25–34 age group had completed HE, and 24% of the 55–64 age group in the US (Ghaffarzadegan et al., 2018). In Korea, the proportion of 25-34-year-olds who have attained tertiary education is the highest in the OECD (69%, compared to the OECD average of 42%) (OECD, 2016). In recent years, some countries have increased the number of students in HE, such as Finland, where 70% of young people enter HE, and in the UK, there is a specific policy to increase the number of young people entering HE to 50% by 2010 (Jeff et al., 2010). In 2004, up to 20 million students enrolled in Chinese universities (Mok & Xu, 2008). Public institutions dominate the overall share of enrolments in tertiary education in OECD countries, accounting for an average of

68% of tertiary students across OECD countries (OECD, 2017). HE attainment in Japan is below the OECD average, at 28% for 25-64-year-olds (compared to the OECD average of 33%). It is less common for Japanese students to study abroad than for students in other OECD countries (1% of Japanese students, compared to the OECD average) (Miki et al., 2015)

According to 2017 data from UNESCO, GER is 86% in Finland, 91% in Spain, and 93.78% in Korea (Chang & Hu, 2019). UNESCO (2013) noted that in 2010, over 75% of the eligible population in North America. In contrast, a decade into the 21st century, the gross enrolment in African universities was only 7%, and this was the highest in 200 years of modern university education in Africa (Biao, 2014). Africa has low post-secondary enrolment levels (Altbach & Teferra, 2004). In West Africa, for example, provision for HE was limited (Potter et al., 2018). Hence, Africa requires a collaborative effort between private and public HEIs (Ehile, 2016). As cited in 1993 and the UNESCO-UIS in 2006 (as cited in Potter et al. 2018), 40% of the age group is enrolled in HE in high-income countries, an average figure of under 10% is in low and middle-income countries and ranging from 5% in Sub-Sahara Africa to 11% in Latin America and the Caribbean. Workforce planning in the least developed countries is three-fold: to identify the skilled workforce shortage in each sector of the economy and the reasons thereof; to identify the workforce surplus; and to lay down a strategy for workforce planning (Jhingan, 2015).

About 36 African countries demonstrated that 56% of economic experts reported an acute knowledge and skills mismatch, while 41% noted a lack of skills (Tianxue & Guiake, 2019). In Africa, the countries with universities range from the highest number of universities in Nigeria to no university (for example, Eritrea). On the other hand, having the highest number of universities does not guarantee quality education in Africa. The seats available in technical institutes are few compared to the university (Jhingan, 2015).

UNDP introduced a new gender-adjusted HDI, the Gender Inequality Index (GII), and research studies indicate gender disparity in HEIs (for example, Chang & Hu's, 2019). The average female enrolment rates remain much lower in South Asia and Africa (Burnel et al., 2017). Moreover, Burnel et al. (2017) assert that women are often inferior to men, reflecting gender discrimination in access to education and jobs. There has been a robust call for mainstreaming gender considerations in policy development and interventions (Potter et al., 2018). Several authors also demonstrate that women's education and employment are among the key policy areas. Investment in female education must receive top priority, not least because studies have revealed robust links between education and health, notably a robust correlation between elevated levels of infant and child mortality and low levels of maternal education and basic literacy (Potter et al., 2018).

Although OECD countries have achieved gender parity in access to early levels of education, gender gaps appear in adult education and learning outcomes (OECD, 2017). The new conception of development has been associated closely with an increased emphasis on gender equality (Burnel et al., 2017). A range of countervailing efforts in international policy have attempted to address the convoluted social dimensions of education and development, including work on gender equality, sustainability, and educational quality (CONCORD, 2014). In many countries, there is a notable disparity in the number of boys attending school compared to the number of girls (Potter et al., 2018). Over time, attempts to measure development have evolved into an increasingly diverse and sophisticated range of social indicators, including health, education, gender, well-being, and environmental protection (Harber & Mncube, 2012). As Potter et al. (2018) note, fewer girls are attending school, particularly in Muslim countries, which is reflected in later years in male and female adult literacy rates. In terms of education provision, universities, where they existed, located in enormous cities, notably the capitals, received a disproportionately large amount of funding; for example, in West Africa, provision for HE was limited (Potter et al., 2018).

Such comparative global analysis reveals that a high GER is not a standalone proxy for structural development. This is true when it is evaluated through Job Market Signalling Theory and Skills Mismatch Theory. To make the analysis stronger, it is important to note that in developing economies, rapid massification policies simply transform raw structural unemployment into credential inflation. Obviously, this results in severe limitations on the external effectiveness of public human capital investments.

3.2.3.2 Role of Higher Education for Supply of Human Resources in STEM versus AHSS

The supply of HRs and graduates constitutes the output of HEIs, as reviewed in this section. In OECD countries, the largest share of students pursues tertiary programmes in business, administration, and law, with one out of four students entering these fields of study in 2015 (OECD, 2017). In 2002, the international average for the ratio of STEM to non-STEM degrees was 26.4% (Belay et al., 2016). The shares of new entrants to STEM fields of study are Germany (40%), Estonia (33%), and Finland (33%), compared to the OECD average of 27%. However, Korea produces a proportion of tertiary graduates in engineering, manufacturing, and construction than the OECD average (OECD, 2016). About 23% of new entrants into tertiary education select to study business, administration, and law, compared to 16% in engineering, construction, and manufacturing and 6% in NS, mathematics, and statistics in Europe. The field of ICT attracts less than 5% of new entrants, the smallest share of the field of study, yet yields the highest employment rate on average across OECD countries – even exceeding 90% in about a third of them-signalling a shortage of super (OECD, 2017).

In 2002, the United States accounted for 17% of STEM degrees compared to the international average of 26% (Crisp & Nora, 2012). In 1994/95, 32% obtained STEM degrees, and in 2003/04, 27% received STEM degrees in the United States, according to the United States Government Accountability Office (GAO,

2006). In the 2000s, more than 60% of enrolments were in three fields in Poland: SS, economics and laws, humanities and arts, and education (Kwiek, 2012). According to UNESCO (2010), 80% of the undergraduate students enrolled in humanities, and only 20% enrolled in S&T programmes in Arab Countries (Al-Agtash & Khadra, 2019). In 2002, China stood second in the world in the proportion of STEM to non-STEM degrees awarded, with 52.1%, next to Japan with 64.0% (Belay et al., 2016). However, in 2011, in Singapore, 50% of diplomas were in STEM. About 41% of STEM degrees were in China, twice the proportion in the UK and three times the rate in America, according to the Australian Industry Group (AIG, 2015). In 2002, the US was third behind Japan, and China was near the bottom in the proportion of STEM degrees with 16.8%.

In 2004, Chinese-Foreign Cooperation in Running Schools (CFCRS) programmes by field of study offered enrolment indicated 57% business, commerce, and economics, 22% engineering, 8% education, 5% medicine, nursing, and optometry, 2% law, 1% for each literature and SS and 4% others (Mok & Xu, 2008). In 2016, the international programme of the HEIs in Vietnam was 60% economics and management, the remaining 18% E&T, 9% SHS and 10% others, and 3% medicine and pharmacy programmes (Hai et al., 2019).

In Cameroonian state universities, law and SS alone enrolled 70% of the total tertiary enrolment, while the engineering and agriculture programmes counted only 5% and less than 0.4%, respectively, by 2010 (Tianxue & Guiake, 2019). HE in South Africa in 2009: 30% for business, commerce, and management, 40% for SHS, 30% for NS, and E&T; it is uncertain the extent to which these targets are based on sound labour-market forecasts (Ashcroft & Rayner, 2011). In South Africa, the humanities (such as languages, SS, and the like) have declined from approximately 21% in 1996 to 9% in 2012; however, the number of qualified awards increased, for example, in business, commerce, and management sciences, computer sciences and communication/media studies. (Barker, 2015). In Nigeria, agriculture, medical science, and S&E were higher than in the

preceding four years (2001–2004). On the contrary, arts, education, and law ranged from 14.7% in 2006 to 18.5% in 2008, and the SS witnessed a 20% and 8.0% admission cut down in 2005 and 2008, respectively (Amoo et al., 2018). In these discussions, a demand-supply labour mismatch exists. This makes sense when global allocation patterns are subjected to critical macro-policy evaluation. The outcome is the dictation of numeric distribution targets that fail to integrate rigorous labour-market forecasting tools. State-directed educational outputs are converted into structural labour underutilisation.

3.2.3.4 Gender disparity in enrolment in STEM versus AHSS in HE

Women were underrepresented in agriculture and engineering and/or S&E (Bradley, 2000; Chang & Hu, 2019), often opt to and graduate more in AHSS (Chang & Tzeng, 2018; Bradley, 2000), and are overrepresented in AHSS and health-related fields in a range of countries (Bradley, 2000). For example, in Germany, Ireland, and Scotland, women are less likely to select STEM fields (Jacob, 2020). However, men are more likely to select and graduate in STEM (Jacob, 2020; Chang & Tzeng, 2018; Bradley, 2000). A study in 110 countries indicates that only 30% of women select STEM (García-Holgado et al., 2019). Approximately 60% of HE graduates in science, mathematics, and computing are men in Europe (EC, 2011). The difference between male and female STEM enrolment amounts to 29%, 27%, and 28% in Germany, Ireland, and Scotland, respectively; for sciences, it amounts to 11%, 8%, and 11%; and for E&T to 18%, 19%, and 17% (Jacob, 2020). This has implications for entrepreneurial activity. In recent years, cross-national differences in entrepreneurship were attributed to differences in education, particularly gender differences in STEM (OECD, 2016a). In Ethiopia, not only does gender have a weak transition into HE, but some regions also face disparities, which limit STEM-ready entrants (MoE, 2023). In Latin America, women's participation in STEM and/or in S&E remains low at the HE level (Garcia-Penalvo, 2019; García-Holgado et al., 2019), and Europe also has similar gender issues in STEM (Garcia-Penalvo, 2019), although there are differences from country to country.

Women-STEM strategies have been developed in Latin America (Garcia-Penalvo, 2019; García-Holgado et al., 2019). In Taiwan, the gender gaps demonstrated in the humanities and STEM are narrowing rapidly (Chang & Tzeng, 2018). These persistent gender cleavages highlight a structural failure in input utilisation within state enrolment frameworks. This is evaluated through the lens of internal allocative efficiency. In other words, it ignores regional and gendered pipeline constraints. But at the same time, it aggressively scales S&T streams.

3.2.3.5 Demand and Supply of Human Resources

Matching demand and supply of HR is crucial (Nancee, 2017); HEIs supply HR, while students' preferences for fields of study, the labour market, and economic sectors represent the demand side. Global GER of HE has increased (UNESCO, 2019); whereas in Ethiopia, GER remains low (MoE, 2015). In Ethiopia, although STEM is a favoured intake, there is still a shortage of graduates with generic, technical, and skills (Teshome, 2024). Globally, demand for STEM graduates in many developing countries and oversupply in non-STEM fields contribute to graduate unemployment (World Bank, 2021). The mismatch results from both quantitative disequilibrium (too many graduates versus few jobs) and qualitative mismatches (skills gaps). Skills mismatches (Nancee, 2017; World Bank, 2021) in forecasting demand require techniques to estimate HR projects, while supply forecasting considers factors like population, literacy rates, and technological advancement (World Bank, 2021). UNESCO's Education 2030 Agenda calls for aligning HEIs with labour-market demands by improving curricula, employability skills, and partnerships with industry (UNESCO, 2019). HE must not only expand but also match labour-market demands to reduce youth unemployment (World Bank, 2019). This dynamic directly validates Skills Mismatch Theory. Furthermore, it demonstrates the breakdown of external effectiveness. This discussion leads us to supply-push initiatives that operate independently of structural economic demand. The outcome usually is a structural demand-supply labour mismatch. Such an

outcome unintentionally intensifies graduate underemployment rather than accelerates national growth.

3.2.4 The Role of Higher Education and its Implications

Teaching, research, and community services are the main roles of HE as discussed in this section. The critical mission of the university was teaching, research, knowledge production, and outreach (community service) engagement with society in the 19th, 20th, and 21st centuries, respectively (Stoker, 2017; Oketch et al., 2014; Bell et al., 2012). HCT is part of the neo-classical approach at the microeconomics level (Szirmai, 2015), whereas according to the endogenous growth model, the knowledge sector produces either human capital or R&D (Oketch et al., 2014; Karlsson & Zhang, 2001; Smith, 2015). Though HE is essential to national socio-economic development (Teferra, 2013; Kwapong et al., 2015), the implications of the flawed policy for HE development in the region have been far-reaching (Teferra, 2013). HE generates new knowledge, innovation, and stirs critical thinking that contributes to economic growth and social development (Tianxue & Guiake, 2019; Karlsson & Zhang, 2001; Dunga, 2013; Bitzer, 2009; Benhabib & Spiegel, 1994). The value of education and training, and what must be known as HCT (Vally & Motala, 2014), and HRs constitute the ultimate basis for the wealth of nations (Jansolstad et al., 2012).

Research can still require international collaboration in STEM and language studies or anthropology (Kwiek, 2018). Multi-disciplinary research and teaching concerning human-environment relations of the type that may be a STEAM frontier still needs more fundamental institutional support (Ludlow & Travis, 2019).

Federally funded academic R&D is instrumental in creating and sustaining excellent HES that prepares the next generation of American scientists and engineers to attract and train high-ability international students and researchers National Science Board, (NSB, 2012). Government sponsorship of

R&D can take a variety of contexts: Smith (2015) identifies four: public research laboratories, universities, firms, and consortia. A public perspective suggests that the arts and humanities should provide crucial societal benefits from their study for economic growth (Oketch et al., 2014). STEAM values can be flexible and adapted in teaching and research (Garza, 2019). Research and practice using STEAM have initiatives on developing cultural identity, technology, social media communication, good citizenship, and consideration of complex realities in the university sector (University of California, Berkeley, 2019).

Employee productivity, integrated research, learning, and business and community engagement are essential to a country's economic, social, and environmental well-being, both locally and beyond (Ivancevich & Konopaske, 2013; Bell et al., 2012). One should strengthen the linkages of the educational and productive system of knowledge flows (Szirmai, 2015). Nowadays, service has expanded to disseminate knowledge to government and industry and is increasingly associated with income-generating activities (Oketch et al., 2014). There are five discrete sub-pathways in teaching: productivity, technological transfer, capabilities of graduates, and improved institutions (Oketch et al., 2014). Technology transfer (Kitaw, 2018) and community service are about applying and transferring that new knowledge (Ashcroft & Rayner, 2011). The university provides knowledge and skills (Smith, 2015), knowledgeable graduates who can apply their education to the real world (Ashcroft & Rayner, 2011), and research-led teaching and involving students in research (Schalkwyk et al., 2013). The challenge is good-quality academic teaching, research, and enriching the public realm with informative and insightful public intellectuals (Stoker, 2017).

In Figure 3, the initial point is input, including policy, funding, faculty, and student placement and entry. In policymaking, the first step is planning; relevant policy planners must appreciate policy formulation dynamics before designing implementation and evaluation procedures effectively (Haddad & Demsky, 1995). Haddad & Demsky (1995) further argued that analysis of the existing situation is

the first step in planning policy. Others argued that agenda setting (problem identification) is the first step in policy processes. In a traditional sector, elementary production technologies rely on raw labour, natural resources, and land; however, innovative advanced technologies rely on skilled labour and physical capital. Policy analysis affects individuals, firms, neighbourhoods, cities, and nations, and evaluates economic or social programmes (Wooldridge, 2013). Although there are many inputs to HE, four are critical: enrolment of learners, funding, faculty, and policies.

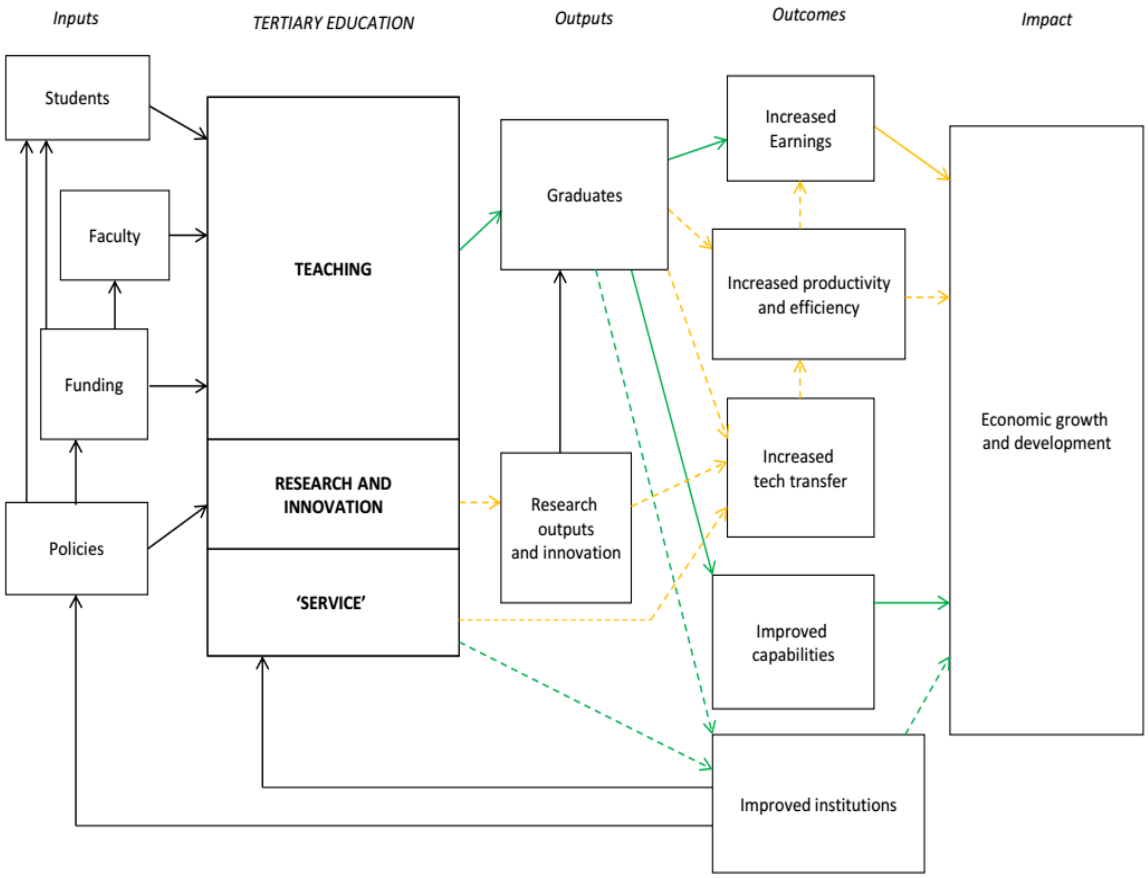


Figure 3: The Role of HE & implications & impacts

Source: (Oketch et al., 2014)

Figure 3 shows the indicators of HEIs, which are related to the 70:30 policy: Policy input (students' entry-related policy) related to 70:30 and micro policies

placement. Input is the policy placement of the students and entry as a ratio and quota of a target that must be achieved in the HE for HRD in S&T and innovation. Appropriateness about the priorities and needs of the target group (students) includes the priorities and the demands of intended beneficiaries (employers). To what extent did the policy address the needs and priorities of students and employers? The implementation (execution) of the policy in terms of actual enrolment of students in HEIs (if they enrol based on the policy enrolment). The short-term or immediate positive and negative impact/effect of the policy on the outcome level, respectively. Effectiveness refers to the implementation of the 70:30 and its micro policies' effect on enrolment in achieving the desired targets of the ratio based on the intended objectives of the policy. After implementation of this policy in the HEIs lead to graduates (if the graduates/outputs are based on the objective of the policy). The relevance refers to the appropriateness of the priorities and needs of the target group (students), as well as the demands of industry and labour-market demands of intended beneficiaries (employers). The question is, is the students' placement policy keeping the needs and priorities (preferences and interests) in their fields of study? In terms of policy placement and student entry (input), the relevance of the policy for HRD and policy implementation in the HEIs, and the outputs (graduates), are discussed in the previous sections.

The graduate of the HE policy is a direct output of the policy. The university's efficiency and effectiveness are used to measure the output (graduates) of the policy. University efficiency is the relevant resource for policy implementation and attainment of enrolment. Implementation is the process through which inputs produce graduates (output), which measures the effectiveness and efficiency of the university. The implementation of the 70:30 and its micro policies' effect on enrolment and outputs (graduates) in achieving the desired targets of the ratio based on the intended objectives of the policy. The outcome of the policy is measured through the employability of graduates in terms of employability skills and employment earnings, and their productivity. The outcome of the policy) on

the employability of graduates, including technology transfers, capabilities, and graduates' efficiency. The employed and unemployed graduates of HE is the policy's immediate positive and negative effects/impacts at the outcome level. GER of HE is one of the indicators of development. The status of self-employment of graduates is one of sustainability. Finally, the implications and impacts of these indicators of the policy on economic growth and development. The operational link between input configurations and systemic outcomes becomes problematic. This debate becomes stronger if it is contextualised within these nested institutional pathways. This analysis leads us to assume that the actual qualitative competencies of the outputs are compromised. Obviously, this directly undercuts external effectiveness and turns potential macro-level human capital assets into market liabilities. However, this is conditional on internal efficiency metrics remaining strictly centred on numeric compliance within the 70:30 entry ratio.

3.2.5 Employability of the Graduates

HE influences graduate employability, including employability skills, knowledge, employment/unemployment, and self-employment as discussed in the following sections.

3.3.5. 1. Employability Skills and Knowledge of the Graduates

Every HE policy has implications for the employability of the graduates. The field of study is one of the factors that function as intervening variables with a differential effect on the employment prospects of graduates from disparate backgrounds. Employability is the capability of obtaining and keeping fulfilling work (Coetzee et al., 2012). Employment generation is an initiator of policy outcomes (Oqubay, 2016). Employability often commences with an analysis of what employers seek when making decisions about prospective employees (Vally & Motala, 2014). Nowadays, there is an argument on education from quantitative exposition to a focus on quality education. WDR (2017) highlighted the learning crisis, and skills gaps depict the proximate determinants of this crisis. People skills most cited by employers were lack of communication skills, people skills, and understanding of business practice (Coetzee et al., 2012). A skilled

and well-developed workforce is at the heart of global competitiveness (Coetzee et al., 2007). The growth in jobs within the knowledge economy is due to elevated levels of education and skill (Jeff et al., 2010). Graduate rating attainment of learning outcomes and generic skills may inflate (Gonyea, 2005). AI-enhanced skillsets (Chan & Colloton, 2024),

As Potter et al. (2018) claim, high skills, low labour wage levels, state support and incentives, and access to global transportation networks have enabled most of Southeast Asia and Latin America to achieve higher levels of employment, integration into global production, gains and economic growth than the rest of the South. It was presumed that HE quality education, research, and services should have been enhanced in the neo-liberal reforms (Tsuruta, 2006). The non-suitability of the skills that graduates possess with those required by the labour market is the main challenge in the education system in Africa (Tianxue & Guiake, 2019). Borjas (1996) argues that skills might be specific to the worker's job or industry and laid off workers need more qualifications than expanding firms seek.

The quality of HE in Africa, Africa Human Development (AHD) as an indicator, is a contemporary issue. High-level competencies, intellectual capital, and industrial skills are required if Africa is to enhance its competitiveness and assume its rightful place in the global arena (De-PaulIkounga, 2016). As Vally & Motala (2014) state, necessary attributes make up the composite of skills and are essential for the prospect of employability. Scientists, technologists, and entrepreneurs ensure the flow of knowledge and information throughout the innovation ecosystem. Michael & Stephen (2011) argue that the indigenous technological R&D of efficient, labour-intensive production methods is also valuable. An organisation can only construct a good team of working professionals with good HR (Brewster et al., 2018). The quality of HE in Africa, as measured by the Africa Human Development (AHD) indicator, is raised as a contemporary issue. High-level competencies, intellectual capital, and industrial skills are required if Africa is to enhance its competitiveness and assume its

rightful place in the global arena (De-PaulIkounga, 2016). As Vally & Motala (2014) state, several necessary attributes make up the composite of skills and are essential for the prospect of employability. Scientists, technologists, and entrepreneurs ensure the flow of knowledge and information throughout the innovation ecosystem. Michael & Stephen (2011) argue that the indigenous technological R&D of efficient, labour-intensive production methods is also valuable. An organisation can only construct a good team of working professionals with good HR (Brewster et al., 2018). Nowadays, however, the work ethics of S&T (Zajda & Vissing, 2025), raising risks around ethics and equity (Luo et al., 2024; OECD, 2023), education as a driver of inclusive labour markets (Zajda & Vissing, 2025), and technology-driven innovation and employability (Chan & Colloton, 2024) are paramount.

Skill gaps are common among employers in discourse about graduate employability (Coetzee et al., 2012). The ability to acquire new skills throughout life to adapt to work flexibly will be at a premium, as well as technical, social, and critical thinking skills (ICFGEO, 2017). Having the necessary knowledge about all these practices and policies of Human Resources Management (HRM) is one of the most concerning issues that all professionals need to deal with their collaborators (Brewster et al., 2018), HRD. The members and stakeholders of the sector education and training authority include employers, learners, providers, the government department, and the bargaining council of each economic sector (Meyer & Orpen, 2007).

In Australia, STEM skills jobs grew at about 1.5 times the rate of other jobs in recent years, by 14% compared to 9% between 2006 and 2011. About 18% of the Australian workforce has STEM qualifications, the fastest-growing occupations (AIG, 2015). There are two arguments regarding the job opportunities in STEM. On the one hand, there have been arguments claiming a shortage of STEM workers, and on the other hand, STEM graduates have difficulty finding jobs that match their training (Ghaffarzadegan et al., 2018). From

the perspective of graduate employability, the 'skills' framework of reference that has been so central in the literature requires a focus highly valued and promoted by holistic approaches of STEAM (Garza, 2019). Thus, STEAM stresses that professional success translates to gaining employment, increasing job opportunities, and addressing the current focus on entrepreneurship (ECT, 2015). STEM education was to educate a more realised youth with the high-tech skills necessary for the expanding STEM job market; however, nowadays, the STEAM initiative offers students more than high-tech skills (Land, 2013). The STEAM curriculum progression helps learners develop increasingly sophisticated reasoning skills and includes skills typically developed outside a particular subject area focus (argumentation, mathematical modelling, visual representation, and writing skills) (ECT, 2015). Implementing a STEAM culture in the workplace allows employees to bring their 'whole selves' to work, fostering a more inclusive, satisfied, and cooperative organisation. This integration of the creative with the practical, the musician with the engineer, and the artist with the scientist leads to the generation of innovative ideas, projects, and breakthrough solutions (Clarke, 2019).

Developing HR competencies fit for the global market is the desire of many professionals and organisations, including multinational experts, who equate their employees with global skills (Brewster et al., 2018). Skill development is not only in HEIs but also in workplace-specific training. For example, one of the reasons is that on-site training by companies is the most crucial element in the formation of technical skills in Japan. Additionally, companies in Japan often have established formal training courses and skill formation centres. This is favoured by an economic system where, traditionally, occupation in a Japanese company is for life. In Australia, almost 44% of employers experience difficulties recruiting STEM-qualified technicians and trade workers. The main barriers are a lack of qualifications relevant to the business (36%) and a lack of employability skills and work experience (34%) (AIG, 2015). In the US, 70% of department employees would be eligible for retirement in the STEM fields by 2013.

The STEAM dimensions of the project's focal disciplines are the creative expression/application and knowledge/skill learning dimensions, based on the main learning objective of the project (Stroud & Baines, 2019). Similarly, ECT (2015) STEAM enables students to be critical thinkers, effective analytical people, productive workers, responsible citizens, and lifelong learners-additionally, creativity and social justice-focused (University of California, Berkeley, 2019). Proponents of STEAM education maintain that it cultivates creativity, critical thinking, teamwork abilities, and personal development opportunities, thereby improving students' prospects for meaningful employment and their capacity to meet societal demands (Clarke, 2019). Moreover, the empirical evidence is that STEAM offers learning opportunities around design thinking, creativity, and innovation while maintaining the deep cognition and reflection of humanist inquiry (ECT, 2015). The researcher believes that critical thinking, creativity, and innovation skills are not only from the STEAM curriculum but also from the pedagogical content knowledge. For example, the critical pedagogical approach to teaching and learning STEAM subjects (Berkeley, 2019); another way to frame a STEAM curriculum is for a specific set of reasoning skills, such as argumentation (ECT, 2015).

Internationalisation of education, especially at the tertiary level, has become a more common phenomenon in institutions worldwide, serving as a tool to provide graduates with cosmopolitan capital and relevant capabilities for the future (Gwakwa, 2016). In doing so, globalisation and internationalisation of education contribute to graduates' employability to compete in the international labour market. On the contrary, HE has an international crisis because we have missed the deepening level of convolution, which has affected the relevance and effectiveness of the policies we put in place (UNISA, 2018). This broad focus on quality reveals a fundamental tension regarding institutional outputs. But this interpretation is limited to Job Market Signalling Theory.

3.3.5. 2. Employment and Unemployment and Self-Employment

Employment and unemployment of graduates are the effects of the HE policy as discussed in this section.

3.3.5. 2.1. The Employment and Unemployment of Graduates

One of the reasons you have selected to study is to enable you to obtain a job that you will enjoy, which will give you a higher salary (Mankiw et al., 2018). Many developing countries must contend with graduate unemployment, one of the most explosive issues of discontent and frustration (Jhingan, 2015; Ntuthuko & Francois, 2016) that must be addressed. A policy or set of policies designed to bring about the far-reaching structural income-earning distribution of assets, power, and access to education and associated income-earning (employment) opportunities (Michael & Stephen, 2011). The modern production process is dynamic, where innovations lead to the adoption of new machines and inventions by displacing existing workers. The academic unemployment rate can lead to incredible frustration for students and graduates, and universities can be hotbeds of political turmoil and instability. Today, government bureaucracies can no longer provide jobs for the growing number of graduates (Szirmai, 2015). Furthermore, Stoker (2017) argues that citizens have become more educated and information is more freely available to all types of authority, including political authority.

Developing countries have extensive academic unemployment. Open unemployment prevents gainful employment in the poorest developing countries, where labour productivity is so low that people can hardly earn sufficient to survive despite working long hours (Szirmai, 2015). The oversupply indicates that graduates' employment opportunities are significant if not confined to Ethiopia (MoE, 2008). Monetary policy can help lessen the adverse effects of economic uncertainty shocks on total employment growth by enforcing price stability (Gumata & Ndou, 2017).

The demand for education is driven by high-wage employment opportunities in the modern sector; an individual's education determines access to jobs. If you obtain services, you will pay more taxes. Thus, the government will be able to provide more services, and this benefits society (Mankiw et al., 2018). Unemployment is when workers who can work and are willing to work do not obtain employment. Despite widespread educated unemployment, there are still severe shortages in specific occupations, especially those requiring technical skills (Szirmai, 2015). Excess educational qualification becomes formalised and may resist downward adjustment (Michael & Stephen, 2011).

Sub-Saharan Africa had the highest unemployment rate at the beginning of the 1990s; nevertheless, several percentage points have declined (Black, 2016). Salvatore (2012) argues that the economic issues are slow growth and high unemployment, evidenced by the period after the Great Recession. The unemployment invariance hypothesis evidence suggests that policies that increase labour force participation will impact the unemployment rate (Gumata & Ndou, 2017). Other authors, for instance, Ingham (1995), assert that poverty alleviation through employment can affect economic development. Oqubay (2016) recently argues that employment creation contributes to poverty reduction. The employment-to-population ratio increased slightly from lower levels (Black, 2016) in the Middle East, North Africa, and Latin America. However, Salvatore (2012) argues that in 2010, advanced countries had overcome the recession, but recovery was slow, unemployment was high, and inflation was low. One often hears the statement that one of the issues of Europe is its labour-market rigidities; the argument goes, are responsible for its high unemployment (Blanchard & Johnson, 2013). Therefore, Michael and Stephen (2011) note that correcting distorted prices should contribute to greater productive efficiency, more employment, and less poverty.

Employment, especially decent and productive employment, has recently become more topical in the development of the world (Black, 2016). Some

authors like Atkinson et al. (1996) emphasise that achieving policy objectives, employing policy instruments, such as higher employment, may boost the economy using fiscal policy instruments. Black (2016) argues that employment is one of the development aims. Meyer and Orpen (2007) assert that development occurs when ongoing learning opportunities are provided so that employees can improve and maintain high-performance levels. This widening pool of educated yet unabsorbed graduates highlights a core systemic breakdown. This makes sense when it is analysed from the perspective of structural demand-supply labour dynamics. In Ethiopia, educational massification functions simply as a state-directed mechanism. Credential inflation compromises external effectiveness and transforms high human capital outputs into vectors of structural economic destabilisation.

3.3.5. 2.2. Self-Employment

The skills of the graduates are necessary for self-employment and job creation, as discussed in this section. For example, Szirmai's (2015) entrepreneurship training empowers students to create small enterprises, apply their newly acquired knowledge, and thus contribute to economic dynamics. Rent-seeking, low levels of entrepreneurial competency, low technology, skill capability, and finance and market-related issues have been the challenges of micro and small enterprises. Self-employment should be analysed and targeted separately rather than dealt with amorphously, in favour of job creation or the labour market (Black, 2016). The setting up of the industrial past favours a small enterprise (Ingham, 1995). However, Szirmai (2015) argues that in the past, pupils' mindset was that education would automatically provide good jobs in government and the formal sector. Black (2016) distinguishes the following five policy areas: an increase in wage employment, the real wage, self-employment, productivity in self-employment, and the terms of exchange of the output of self-employment. Some authors, like Erasmus et al. (2013), assert that the challenge is to provide the country with a solid educational foundation and equip the workforce with relevant and marketable skills. Viewed through Skills Mismatch Theory, the usage of

generic curriculum formats creates an immediate operational deficit. This results in raw technical allocations. Not only does it fail to provide the necessary entrepreneurial training and financial safety nets, but it reduces internal allocative efficiency. The ultimate outcome is degree-milled graduates who lack the structural support required to become independent drivers of economic innovation.

Summary

Education is a cornerstone of a nation's development. The education systems of developing countries are often set up as copies of Western educational models. Literature Africa, the origin of modern education lies in the West, so it has a deficient value for Africa's insistence on the boundedness and invisibility of person and community; thus, what is taught in school is not based on or tied to the accumulated indigenous experience and wisdom of teaching of the ancestors. Rigorous research is required to investigate the impact of the policy. Education policy can be an instrument for promoting economic growth. There is a wide disparity in the enrolment of HEIs between developing and advanced countries. Politicians, education leaders, and policymakers have called for a new emphasis on STEM in schools, from primary school to post-secondary school education. Today, STEM is changing into STEAM, growing. Ethiopia has reformed and introduced a new 70:30 HEP favouring S&T; however, the implications and impact have yet to be studied. It was challenging to find a country with an explicit 70:30 HEP, and most countries have a STEM versus STEAM (currently) STEM versus AHSS policy. In the 19th, 20th, and 21st centuries, the critical mission of the university was teaching, research, and community service, respectively. In Africa, there is a shortage of literature on what African countries are doing to regulate and improve HE quality in S&T. The employability impact and the priorities for capacity construction are required. Graduate employability is one of the outcomes of the HEP. This chapter establishes a robust policy analysis framework. This has been done through a systematic review of these global patterns against internal allocative efficiency and external effectiveness. It navigates the structural demand-supply labour dynamics within these trends. In

addition, provides the critical foundations required to empirically evaluate the systemic outcomes of the 70:30 quota system in the chapters that follow.

CHAPTER FOUR

Implications of the 70:30 Education Policy for Ethiopian Education System

4.1 Introduction

The implications of the 70:30 policy for HRD are discussed in Chapter Three. This chapter reviews the implications of the 70:30 education policy for the Ethiopian education system. The first section highlights the development of HE in the country. The second section is a desk review presenting an overview of how national policies and plans integrate with the 70:30 policy and its implications for education systems in Ethiopia. It also covers the role of HEIs in Ethiopia, along with the country's development trajectory of Ethiopia and its relevance in influencing the shift to the 70:30 policy. Additionally, it addresses the 70:30 policy, including the 70:30 HEP and the implications of primary and secondary education for the 70:30 HEP.

4.2. Higher Education Development in Ethiopia

The development of HE has undergone various stages, corresponding with the policies of the three regimes in Ethiopia, as will be reviewed in the subsequent sections.

4.2.1 Pro-Capital System and Higher Education in Ethiopia

During the regime of Haile Selassie from 1930 to 1973, the Ethiopian economy rested on the "feudal-bourgeois" and pro-capitalist and pro-feudal policies. Addis Ababa University was the first tertiary institution to be opened in 1950. During the Emperor's reign, there were only two HEs: Addis Ababa and Alemaya. Addis Ababa University College had 950 students (39 were female students) (Negash, 2006). The employment and career considerations and visions for change that disparate generations or groups of intellectuals have espoused had, as a starting point, a target for the state as a mechanism of power and control (Loukeris, 2005). Many post-World War II Ethiopian intellectuals were exposed to Western political systems and, through thought, ultimately became an amalgam of this-at least in their outlook- with the autocratic, top-down, and state-oriented ingredients of the patrimonial system that produced them (Loukeris, 2005). Highly politicised university students assumed the role of the opposition, and the pool of unemployed secondary school graduates all combined to bring a total defeat of the government system that had operated in the country (Negash, 2006). The established status quo was that appropriate owners, while adding deficient effort or labour to the economy, took all the fruits of the land and provided only a fraction to the tenants (EBR, 2018). Moreover, Negas (2006) documented that the opposition of teachers and secondary students was widespread; these two groups had nothing to gain from a policy favouring the countryside over the urban landscape. As a result, the country moved from a feudal state to a social system. Viewed through the lens of external effectiveness, this foundational historical era underscores how restrictive, elite-centric input configurations create structural macro-policy vulnerabilities; by failing to match educational access with wide-scale domestic human infrastructure demands, the early patrimonial system

inadvertently turned its limited high-level outputs into agents of political destabilisation rather than drivers of smooth socioeconomic development.

4.2.2 Socialism System and Higher Education in Ethiopia

Derg officially declared Ethiopia a socialist state based on the Marxist-Leninist ideology and anti-feudal and anti-imperialist forces (Fisseha, 2018). During the Derg regime, the government decided that some courses, such as Marxist-Leninist Philosophy and Political Economy, were compulsory in all institutions (Yizengaw, 2003). During this regime, Ethiopia had only two Universities (Addis Ababa and Alemaya). As Negash (2006) noted, the socialist government declared the lie that education was an instrument to inculcate Marxist-Leninist ideology. As a result, the country's education system strictly followed the Eastern European educational system, and the aims, content, and materials of education were designed in alignment with socialist principles. Several scholars have a similar conclusion that in Central and Eastern Europe, HE has a communist heritage, similar economic agendas and frustrations about political and economic failures, and a degree of nostalgia for socialism. During the communist-post-communist transition, they had something in common with all ex-communist countries in Eastern Europe: substituting the concept of competence under Soviet influence. HE researchers believed that the socialist model of the university served as a unifying factor in Central and Eastern Europe. Central and Eastern Europe have shared common economic, cultural, and historical characteristics, such as Eastern Europe, post-Soviet/post-Communist countries, and the former socialist bloc. Socialist education stressed the inculcation of ideology as a prime objective, with Marxism and the value of production as the main pillars (Negash, 2006).

In 1974, enormous student demonstrations about land redistribution were held in Addis Ababa and the Agricultural College in Alemaya (Ege et al., 2009). Marxist state-nationalists are the products of the radical left-wing student movement of the 1960s and 1970s at Addis Ababa University and within the Ethiopian student

diaspora in Western Europe and North America. Scholarship students came from abroad in the summer of 1974 and early 1975 (Ege et al., 2009). The fundamental aim of education was to cultivate Marxist-Leninist ideology in the young generation and to develop knowledge in S&T (Bishaw, 2012). The political economy of Marxism-Leninism became a subject at all levels of the education system (Negash, 2006), and courses on Marxism were mandated (Geda, 2014). In effect, the Marxist-Leninist-oriented HE curriculum had to be abandoned, heralding the end of the communist influence on the Ethiopian educational system (Geda, 2014). Buttressed by the ideological position of the Soviet Union and its Eastern European allies, the Ethiopians endeavoured to put more emphasis on the role of education for development (Negash, 2006).

During the Derg (1974-1991), the conditions for developing a political culture of dialogue and openness at Addis Ababa University were discouraging due to brutal repression (Ege et al., 2009). During the Derg regime, the capacity of the government and its willingness to support the provision and development of education and HE in Ethiopia was affected (Yizengaw, 2005).

The absence of a transparent vision of HE, severe resource constraints and settings that provide access only to the benefit of the elite have contributed to the contribution of HE to socio-economic development in our country, which has been much less than anticipated (Yizengaw, 2003). The broad slogans were education for production, scientific research, and the politics and economy of the country (Bishaw, 2012). Analysed within structural demand-supply labour dynamics, this highly centralised regime model demonstrates the constraints of direct state intervention on internal allocative efficiency. Subordinating academic programming strictly to ideological inputs rather than rigorous market-driven demands resulted in profound structural labour underutilisation, compromising the institutional output capacity necessary to drive genuine technological and industrial expansion.

4.2.3 Developmental State and Higher Education in Ethiopia

EPRDF has practised the economic policy systems of capitalism (1991 to 2004/05) and developmental state (2005/06 to 2018/19), but the current government still needs to clarify it. Since the country's high-growth phase about 15 years ago, policy priorities have been heavily on boosting economic growth, with massive efforts directed at public investment and raising agricultural output. In line with the developmental state model, Ethiopia has formulated disparate national development programmes and plans and transformed ADLI, GTPs, ESDPs, and CRGE. 70:30 is one of the reform programmes. The purpose of the 70:30 policy is to transform from an agrarian economy to an industrial economy. Developmental state theory explains the 70:30 policy as a framework for state HRD and human capital investment, where the government strategically allocates resources toward S&T for industrialisation. The primary characteristics of the developmental state paradigm relate to addressing the required HRs and undertaking research that is targeted at accelerating economic growth-the non-economic functions of HE takes a pivotal place (Woldegiyorgis, 2015). There is a distinction to make between authoritarianism and democracy, which has implications for education (Harber & Mncube, 2012). Botswana is a democratic developmental state; Southeast Asian countries are authoritarian developmental states. Ethiopia is a democratic developmental state; however, it has limitations in democratic rights. Before 1994, there was a lack of democratic rights for the people of Ethiopia; critically scrutinised academic autonomy had been in the HEIs (Yizengaw, 2003). In the Southeast Asian region, the role of education and HE in accelerating economic development has been observed (Woldegiyorgis, 2015).

Ethiopia is engaged in an ambitious effort to realign its HES to contribute more directly to its national strategy for economic growth and poverty reduction (Yizengaw, 2005). The development of the tertiary education policy and strategy is based on the political economy reform (Yizengaw, 2005).

The country's education has been entangled with convoluted issues of relevance, quality, accessibility, and equity during past regimes. Towards the fulfilment of

the policy, HEIs anticipate producing qualified researchers, improving research commencement rates, new knowledge, along with adaptation, incubation, transferring, and linking technologies. At the commencement of the 21st century, Ethiopia's HES was traditional in its academic orientation, penuriously connected with national development requirements, and hardly met international standards (Yizengaw, 2005). The World Bank set up a Post-Secondary Education Project in Ethiopia in 2004, which developed to support the expansion and strengthening of human capacity in HE and led the transition from an agrarian economy to a service and production-oriented one through improving university education (Ashcroft & Rayner, 2011).

Alongside improving HE, attention has been given to the development strategy, ADLI, and new programmes and institutions have been opened (FMoE, 2015). The developmental strategy of ADLI was initiated by agriculture and is believed to take a leading role in economic growth, supplemented by sector-specific strategies in areas such as health, education, ICT, population, and industry (Yigein, 2013). The first programme provided clear directions and roles for HE in Ethiopia on the ADLI programme in the country. The second programme is strategic frameworks for the five years from 2005/06–2009/10. In both documents, investment in human capital and the capacity-building component is believed to be fundamental to enabling the country to meet the challenges of the MDGs and mitigate the poverty level (Yigezu, 2013). The objective of the S&T and Innovation Policy (STIP) is to realise technology transfer, commercialise traditional knowledge, and strengthen linkages among the disparate actors. The supply of a relevant and trained workforce with technological capabilities and productivity improvement skills are ensured by the HEIs for various industrial/agricultural setups and the Ministry of S&T (MoST, 2012). This structural paradigm shift directly invokes the core mechanisms of Skills Mismatch Theory and Job Market Signalling Theory within a developmental state framework; while aggressively shifting resource inputs toward S&T streams aims to optimise internal allocative efficiency, it runs the risk of creating a deep

macroeconomic disequilibrium if the downstream industrial labour market lacks the structural absorption capacity to deploy these technical signals productively.

4.3. National Policy, and Integration with 70:30 Policy

The section offers insights into the GTP, ESDP, and their alignment with the 70:30 policy, with an implementation review in the subsequent section.

4.3.1 Growth and Transformation Plan and the 70:30 Policy

After the Ethiopian government implemented GTP I (2010/11–2014/15), the second GTP, GTP II (2015/16–2019/20), was launched aiming to boost the economy and transform Ethiopia into a middle-income country by 2025. The main goals of GTP II are economic growth and industrialisation. It will also reinforce the implementation of strategic interventions that are critical and useful for meeting the national requirements in line with the 70:30 policy. To materialise such a national vision requires transforming the country's economy from one reliant on agriculture to one reliant on industry through S&T and innovation. Sustaining economic growth demands highly qualified and competent professionals in S&T. According to GTP II, the linkage between the education sector and national macroeconomic plans supports Ethiopia's objective of reaching middle-income country status by 2025. As MoFED (2010) stated in the GTP I period, public resources were allocated to expand HE. According to GTP I and II, enrolments in undergraduate and postgraduate programmes had been planned to increase, considering the 70/30 strategy (MoFED, 2010) and (MoFED, 2015), respectively. This coincides with the government's policy objective.

The GTP aims to achieve Ethiopia's long-term vision (industry-led economy) and sustain rapid and broad-based economic growth anchored on the experiences drawn from implementing development policies and strategies. Expanding human capital and improving human development outcomes remain the central pillar strategy of the GTP, whereby the government of Ethiopia has been taking measures to improve HRD as a healthy, productive, and trained HR (MoFED,

2010). Through GTP, the government of Ethiopia attempted to strengthen the expansion of HE with a big push in S&T, whereby the priority remained to ensure educational quality and relevance. Accordingly, the increase in enrolment in undergraduate and postgraduate programmes has been facilitated, considering the 70:30 programme. Since the formulation of the 1st GTP, education has provided special attention for transforming the economy from agriculture-led to industry-led activity, thereby supporting the manufacturing sector by providing the required professionals and problem-solving technological innovations (MoE, 2017). When contextualised within comprehensive structural demand-supply labour dynamics, this deliberate policy coupling represents a classic supply-push intervention intended to optimise external effectiveness. However, forcing rigid quantitative enrolment targets at the institutional input phase without utilising dynamic labour-market forecasting tools creates a major structural risk, potentially generating widespread credential inflation and graduate underemployment instead of driving sustainable economic transformation.

4.3.2 Education Sector Development Programme and the 70:30 Policy Implementation

The Education Sector Development Programmes (ESDP) I (1997/98–1999/2000), II (2000/01–2004/05), III (2005/06–2009/10), IV (2010/11–2014/15), and V (2015/16–2019/20) were planned and implemented in Ethiopia. ESDP I, initiated in 1997/98, aimed to achieve Education for All (EFA) and the Millennium Development Goals (MDGs) by 2015, as outlined by the MoE in 2008/09; the 70:30 policy was introduced. Its goals and strategies were aligned with the ETP. The provision of equitable distribution of HEIs is to address regional imbalances (Yigezu, 2013). HE under ESDP III (2005/06–2009/10) focused on massive expansion, increasing the number of public universities from 8 to 21, which also required resources to match (Yigezu, 2013). Digitalisation in HE (Adamu, 2024), competent pre-service training and continuous professional development (World Bank, 2023), and competency-based education across universities (Kotebe University of Education) (KUE, 2025).

During ESDP III (2005/06 –2009/10), the 70:30 policy was introduced in 2008/09. Moreover, the government has developed and implemented another five-year programme action plan, ESDP IV (2010/11–2014/15), which capitalised on the quality of education to meet the country's education requirements along with the country's five-year GTP I with a continuing 70:30 policy. As indicated in ESDP IV (2010/11–2014/15), the significant issues emphasised in the programme are improving the quality and employability of graduates, developing research capacity for knowledge creation, and transferring technology. The role of the ESDPs is to ensure quality, relevance, equity, efficiency, and access within the education sector. Since the launch of the ESDP I (in 1997/98), public universities and student enrolment have expanded at record levels. 70:30 as a key approach for enrolment and workforce development, even as its implementation has varied and been periodically revised (e.g., flexibility introduced in 2019) (Teferra, 2018; Gofere, 2022; World Bank, 2023; Ayele, 2022; Sebsibe, 2023; Tegegn, 2024).

The intake capacity of the government HEIs in ESDP III (2005/06–2009/10) has increased from 4,821 undergraduate degrees in 1996/97 to 31,997 in 2004/05 (MoE, 2005). Total enrolment in HEIs (both government and private) increased from 42,132 to 192,165 in 2004/05, an increase of 36%. In 2004/05, however, with a tertiary level GER of 1.5%, Ethiopia lags the 3% average for Sub-Saharan African countries. The student population per 100,000 inhabitants is estimated to be only about 125-150, which indicates a critical shortage of highly trained workers in the country. The intake in ESDP IV (2010/11–2014/15) undergraduate enrolment (government and private) rose from 447,693 in 2010/11 to 593,571 in 2013/14. The target of 90% stands at 84% in 2014/15. Of total enrolment, 57% of students participated in regular undergraduate classes and 43% in distance, summer, and extension courses. Likewise, total Master's enrolment in public HEIs increased from 7,211 in 2007/08 to 27,643 in 2013/14. Recently, private institutions began enrolling postgraduate students, accommodating 3,000 master's students. As a result, the total enrolment at this level reached 30,643 by

the end of ESDP IV (2009/10–2014/15). Doctorate candidates are enrolled in public institutions.

During ESDP IV (2010/11–2014/15), the 70:30 policy continued and was implemented. Ethiopia's ESDP V (2015/16–2019/20), like the ESDP IV (2009/10 –2014/15, has retained a target programme commingle of a 70:30 policy of S&T to SS programmes. The draft version of ESDP V (2015/16–2019/20) is derived from the goals of GTP and aims to address the current challenges of education (MoE, 2015). The ESDP IV (2010/11 –2014/15) addressed the issues of strengthening the capacity for knowledge creation, especially in the domain of S&T and the expansion of access in TVET and HE. Public universities aimed to ensure relevance and quality in the provision of undergraduate and postgraduate programmes, in general, to enable the subsector to bring change through giving particular emphasis to S&T. The other focus is on the employability of graduates of HEIs along with the sustainable development of research capacity for knowledge creation and technology transfer in priority sectors, ESDP V, (2015/16 –2019/20). However, quality remained a crucial challenge at the HE level. To date, STEM readiness (MoE, 2023, 2024) has been emphasised at desk level, as has improving STEM participation and employability through Global Partnerships for Education (GPE, 2023, 2024), and the university-based STEM need for better resources/industry ties in campus STEM centres (Tegegn, 2024).

Under ESDP IV (2010/11–2014/15), efforts were devoted to enhancing S&T through the effective promotion of the 70:30 Policy in HE intake ratios. In line with the 70:30 policy, the outcome of ESDP V (2015/16–2019/20) has enabled the HE sub-sector to review for planning, implementation, and M&E of the day-to-day activities of the HEIs. Total enrolment of undergraduates in HE (regular government programme) will increase from 467,445 in 2014/15 to 597,685 in 2019/20. The intake ratio to SS would also be 70:30. The graduation rate planned to increase to 95% in 2019/20. The share of graduates with degrees-relevant

employment within 12 months after graduation reaches 80%. Teachers' qualifications (first, second and third degrees) would be 70:30; however, this has not been realised. The percentage of research projects jointly run by universities and industries could be 50%. The percentage of student cost-sharing is planned to increase from 15% to 20%. During ESDP V (2015/16–2019/20), it shall increase the intake and enrolment capacity in public HEs for undergraduates and postgraduates. Evaluated through the analytical lens of internal allocative efficiency versus external effectiveness, the rapid multi-phased expansion across successive ESDP cycles reveals an operational imbalance; prioritising massive input massification to fulfil the 70:30 ratio while missing critical resources, staff qualifications, and institutional infrastructure compromises the internal yield of high-tech programmes, failing to generate the high-quality human capital signals needed to satisfy real industrial demands.

4.3.3 The 70:30 Policy & implication for Ethiopian Education System

The implications of the 70:30 policy for the Ethiopian education system and its relevance are discussed in the subsequent sections.

4.3.3.1 The 70:30 Policy Implication for the Structural Education System in Ethiopia

During Derg, the structure of education in Ethiopia, which was 6:2:4 (6 years of first cycle and 2 years primary education of second cycle primary education, and four years of secondary education), during EPRDF, had been 8:4 (4+4+4) that is 8 years of primary education (1-4 first cycle and 5-8 second cycle) and four years of secondary education structures in the last decades. In the current government (Prosperity Party), MoE and the Government have again proposed the status quo of 6:2:4 (education structure of the Derg) in their roadmap for 15 years (2020/21–2030), with ambiguity in education philosophy and ideology. The new education roadmap has terminated the national examination at Grade 10 and returned to taking NAL at Grade 12, and a regional exam continues to be given at Grade 8 throughout the country, which appears to

be the status quo of Derg's education system. Once they have passed the Grade 10 national exam, they would prefer either the NS or SS stream to cover the preparatory programme, which is the first-year course of the university, which is the basis for the 70:30 policy. Since 2008/09, the 70:30 policy has had the effect of decreasing the term of study at HEIs by one year for all disciplines.

To certify completion of the preparatory programme and select students who qualify for the next higher level of education, called the preparatory level, based on the new policy of 70:30. The preparatory level is the second cycle of secondary education and prepares students for university education. At grade 11 preparatory, students are anticipated to select or place their field of study as either NS or SS. The 70:30 (S&T to SS) students' streaming policy in the preparatory schools of Ethiopia has been a new trend for the country since 2008/09. Based on the 70:30 student streaming policy, 70% of grade 11 students who scored passing marks in the Ethiopian General Secondary School Certificate Examination (EGSCE), which was administered at grade 10 were required to join the natural science stream while the remaining (30%) were placed in social science stream. The recent trend of students' streaming practice in HEIs is far below the standard set-in guideline 70:30. Focusing on S&E, the government's poverty reduction plan capitalises on accumulating adequate human capital to ensure fast economic growth and achieve the vision of becoming a middle-income country (Geda, 2014). Enrolment in HEIs has dramatically declined; for example, as per MoE, only 3.2% of students scored above 50% on the Ethiopia Higher Education Entrance Certificate Examination between 2021 and 2023; however, quality education cannot be assured only with the assessment, and other quality assurance measures are underestimated. This has grave implications for GER in HIEs, HRD, and challenges for socio-economic development in Ethiopia. Viewed through the perspective of structural demand-supply labour dynamics, these recurring adjustments to the system's institutional layout illustrate the profound pipeline disruptions affecting HCD; forcing an aggressive 70:30 macro-allocation down to the preparatory level while structural

entry metrics decline introduces an acute quantitative and qualitative supply block that undermines systemic efficiency and hampers steady human resource creation.

4.3.3.2 Relevance for Primary and Secondary School Education

The challenge begins with the placement of students in the two streams and the choice of students in grade 11. At the preparatory school stage of students' enrolment in these two streams, some students may have interests, while others may not, and this has implications for their career development.

There are two contradictions to deciding on the 70:30 policies: On one hand, students select the field of study, and either NS or SS fits one's requirements best; on the other hand, the policy requirements (ratio/quota) are applied simultaneously. As per the MoE (2008), the 70:30 policy, the 70:30% conversion, should have been established in the preparatory school system. The practical implications of the policy shift are and its institutional ramifications, including its impact on the prospects of science and mathematics education in primary and secondary schools. It would have durable systematic implications at least soon after its full implementation. MoE (2017) stated that a STEM intervention programme was introduced in secondary and preparatory schools to reinforce the education of S&T. However, STEAM had not yet been introduced.

As to ESDP IV (2010/11–2014/15), HRD should be strengthened by training competent and innovative people with particular attention to E&T and NSs through introducing high-quality science and mathematics curricula at primary and secondary schools and the recently adopted policy of the 70:30 university intake ratio in favour of S&T (MoE, 2010). A strategic issue in the relationship between effective student demand and the conversion is the suitability of preparatory-school graduates in the sciences stream to meet the 40% demand of E&T. This, in turn, takes us to the critical issues of the relevance and quality of sciences and mathematics education in the general secondary and preparatory schools. The medium of instruction up to grade 8 is local languages in Ethiopia.

However, the tendency to shift from English as a language of instruction to an indigenous language in countries such as Tanzania, Malaysia, and Indonesia may isolate pupils from the international learning community (Szirmai, 2015).

Recently, the Ethiopian government has emphasised STEM education (Belay et al., 2016). Currently, the emphasis on STEM reinforces efforts already underway at 70:30. For example, towards meeting the targeted 70:30 professional commingle in HE-70% of students enrolled in S&T and 30% of SS from secondary education, including TVET on the track to feed into this aim (Belay et al., 2016). The emphasis on STEM consequently puts the quantifiability of outcomes and knowledge itself. Simply, sweeps away all nuance, all understanding of complication and contradiction, and creates the illusion of a simple, linear universe in which once anything has a number, it is in some sense 'valuable' (Vally & Motala, 2014). In line with STEM, the government has introduced the 70:30 policy. Countries with a general strategy for science education and motivate students to learn science are Germany, Spain, France, Ireland, the Netherlands, Austria, the UK, and Norway (EC, 2011).

The 70:30 policy needed a feasibility study. With identified shortages across engineering, science, and medical professionals, there is a growing requirement for a highly trained pool of qualified experts specialised in STM disciplines. The government anticipated the challenges in the processes underway to overcome the weaknesses of secondary and primary education (MoE, 2008). Quality of education and its assurance come to the forefront of all crucial issues in the context of increasing recognition of the role of HE in national development (Kahsay, 2012).

Admission to HE requires passing academically focused exams (Szirmai, 2015). However, studies in Ethiopia demonstrate that students from lower grades suffer from a deficiency in science and mathematics knowledge (Nega, 2009; Belay et al., 2016), with scores significantly below the 50% minimum passing threshold

established by the ETP (1994). This issue persists not only in HEI entrance exams but also in earlier education levels. For instance, GEQUAEP conducted three national assessments for 4th- and 8th-grade students (Belay et al., 2016), with the 8th-grade studies concentrating on Biology, Chemistry, English, Mathematics, and Physics. The assessments from 2011, 2004, and 2007 indicated a concerning decline in performance, highlighting the severe challenges in achieving quality in science and mathematics education. This systemic drop across lower grade tiers highlights a major operational friction when evaluated via Job Market Signalling Theory and Skills Mismatch Theory; forcing a rigid 70:30 supply-push quota onto students facing deep baseline learning deficits creates a fundamental mismatch between administrative targets and student capacity, which ultimately dilutes the credibility of the academic credentials and limits downstream external effectiveness.

The Ethiopian government has launched a 70:30 ratio policy to cultivate skilled educators in S&T, thereby enhancing human capital. Nevertheless, there is a need for improved foundational S&T education at the lower school levels. Research, such as the study by Dufera et al. (2016), indicates that students entering preparatory schools under the 70:30 policy often require assistance with basic literacy skills. This aligns with findings from the Ethiopian NLA for grades 12 and 10, which revealed that student performance was subpar and fell below the national benchmark of 50% (MoE, 2010; Belay et al., 2016). Students have been admitted to HEIs despite scoring below the 50% threshold in entrance exams. Additionally, the study highlighted particularly low results in physics, which is fundamental for engineering studies. The EC (2011) international student achievement surveys have examined factors linked to science performance, including the characteristics of students and their families, teachers, schools, and educational systems.

4.3.3.3 Relevance for Higher Education

The Ethiopian Policy 70:30 demanded a new transformation from the agricultural sector to industrialisation through S&T and innovative HRs (MoE, 2008). In the

HEIs, 70:30 has six micro policies to supply HR for disparate sectors. This process confirmed the advisability of the policy decision to establish, in public institutions, a 70:30% professional commingle in favour of S&T (MoE, 2008). The policy was formulated based on political ideology or the common sense of governments without comprehensive study. However, Ethiopia introduced STEM education in secondary schools in line with the 70:30 in the HE policy, but not a contemporary STEAM, which needs to be introduced in Ethiopia.

As per the new 70:30 Policy MoE (2008), the overriding urgent tasks are attainable, and the conversion is on the 70:30 ratios and the academic development plan. This overriding task consists of tasks, which would determine success in achieving the task. (1) Distribution of the annual intake of undergraduate students based on the 70:30 professional mixes by micro policy and cluster of disciplines. (2) Establishing at the level of each public university the current enrolment in the undergraduate programme to assist in determining the gap (surpluses and deficits) provided the target of the annual intake and the national objective of achieving the professional mixes of 70:30 at the level of micro policy and disciplines (outstanding tasks).

It is rational to think that demand and supply can achieve a state of equilibrium, but demand must dictate supply. The purpose is to meet the demand (MoE, 2008). According to Belay et al. (2016), the Ethiopian government recently emphasised STEM education. For instance, studies in 2012 indicate that the graduation rate of regular undergraduate students was 79% (MoE, 2010). The strategic policy will provide a shared roadmap to guide and ensure that the MoE and regional education bureaus, collaborating with other sectors such as the MoST, have the best potential for making a substantial impact in key priority areas (Belay et al., 2016). The SS disciplines, particularly those other than B&E, should have mitigated intakes (MoE, 2008). In Ethiopia, the undergraduate programme has a disparate duration of study in the third, fourth, fifth, and sixth years of enrolment (MoE, 2015). E&T determines the features of the conversion process

and the resulting system for two fundamental reasons: its 40% share is dominant, and the length of study is five years (MoE, 2008).

The current world is driven within the framework of the knowledge economy context of globalisation. This economy is unthinkable without a high density of expertise in S&T. The policy document further stated that S&T education should be mainstream in HE indisputably. What can be disputed is the magnitude of the quantitative share it should have at any stage in the country's development. The strategic policy of 70:30 stated that we have a theoretical range of ratios to consider for Ethiopia; however, the rival ratios are 70:30, 65:35, 60:40, and 55:45 (MoE, 2008). In 2008, 70:30 was implemented. Viewed through the analytical lens of internal allocative efficiency versus external effectiveness, the enforcement of this strict supply-side quota creates an operational imbalance; prioritising massive input enrolment to meet the 70:30 macro-target without addressing the corresponding micro-level structural deficits compromises the pedagogical output and reduces the actual external utility of these graduates within specialised industrial fields.

4.3.3.4 The 70:30 Policy Implication for Expansion of Higher Education

HE in Ethiopia has a short history (only about 60 years). The strategic goal of the policy requires the fair and equitable Equi distribution of quality education as rapidly as possible to all regions, particularly to rural areas where 80% of the population lives (FMoE, 2015). The rapid expansion of HE may affect the quality of education and the production of competent graduates in line with the 70:30 policy. Ethiopia has indeed registered remarkable progress in expanding HE since the 1990s. The number of public universities offering undergraduate and postgraduate degree programmes has increased from two in 1991 to 48 public and 98 private universities within less than three decades (1991 to 2017). By the 70:30 policy, universities specialising in S&T, such as Adama and Addis Ababa S&T universities were established, along with S&T programmes in all other universities.

In the past few years, the government has embarked on a nationwide reform and expansion in HE to enhance relevance, strengthen the quality, and increase the contribution of the tertiary education sector towards the country's poverty reduction strategy. In the last decade, the government of Ethiopia has demonstrated a continued commitment to expanding equitable access to quality and relevant HE (MoE, 2015). Policymakers observe the shift to mass HES as the principal mechanism of supplying knowledgeable and skilled workers to the expanding jobs in the economy, stimulating demand for improved jobs, improving the quality of work itself, and driving economic prosperity (MoE, 2010). Private HEIs have also expanded, reaching ninety-eight and accommodating around 15% of all student enrolments by the end of the ESDP IV period (MoE, 2015).

There has been rapid expansion in HE infrastructure (institutions and facilities), qualified HRs, the enrolment rate (10.2% in 2016/17 and 10.4% in 2017/18), and the graduation rate in the country's HE over the last 15 years. However, there is a gender gap in enrolment between males and females. Most universities need more supplies of text and reference books, laboratory and workshop equipment, and access to ICT facilities. To reach a middle-income category, Ethiopia must achieve at least 22% gross enrolment; however, the available resources do not allow it to attain 22% by 2025 (MoE, 2017). The current situation and position of the country are the worst for attaining this target. When evaluated through the dual framework of massification versus quality assurance, this rapid structural expansion demonstrates that an aggressive focus on quantitative growth without proportional resource allocation dilutes institutional quality, turning specialised S&E centres into overextended academic facilities.

4.3.3.5 The 70:30 Policy Implication for the Role of HEI of Ethiopia

The 70:30 policy document states that Ethiopian EHE started to move purposefully on all the fronts that should change its institutional landscape and bear positively on its mission: Relevance, or Quality Education, Research/Technology Transfer, and Community Service (MoE, 2008). Currently,

all HEIs of Ethiopia declare that their missions are teaching, research, and community service, and none of them has a unique mission (Asgedom, 2009). However, in other countries, not all institutions have identical missions. For example, the HEIs in Vietnam are divided into three big categories: research universities, application universities such as S&T universities, and professional universities such as education universities (MoE, 2017). The Malaysian university system has both research and application universities; however, professional universities are not standard.

The 70:30 policy emphasises producing professionals to serve Ethiopia's development agenda. There is a repeated call for the curriculum to be geared to producing graduates capable of 'solving', and in response, there have been attempts to incorporate more vocational and professional into the curriculum (Asgedom, 2009). One of the aims of Ethiopian HEIs is to set up cost-effective, efficient, results-oriented systems, develop effective HRM procedures and practices, and develop the volume, quality, and relevance of research and consultancy services directed to the country's requirements. Federal Negarit Gazeta (FNG, 2009) declares that the core business of any institution in Ethiopia shall be to offer education and training through regular programmes, conduct research, and render community services. If universities are required to achieve the quality of education for economic and social development, they must think carefully about the assessment strategy (Ashcroft & Rayner, 2011).

The HE Proclamation of Ethiopia was launched to provide community and consultancy services that cater to the developmental requirements of the country (FNG, 2009). The research role is about generating new knowledge (Ashcroft & Rayner, 2011). Research in the development context is not only an analysis of survey results or descriptive research; it is problem-solving. Furthermore, Srikanthan and Dalrymple (2002) contend that the assessment of quality in HE should be grounded in the quality of university-community relationships and the outcomes achieved, as supported and cited by Shibeshi et al., (2009). National HE research directives and framework focused on technology transfer will be

developed and implemented jointly with the MoST GTP II (MoFED, 2015). Analysed through the lens of Skills Mismatch Theory and public accountability, the institutional homogenisation of Ethiopian universities undermines their capacity to deliver on specialised mandates, as forcing a uniform tripartite mission onto all campuses prevents the development of highly specialised, industry-aligned technology transfer centres.

4.3.3.6 Development Trajectory of Ethiopia and Relevance to the 70:30 policy

The Ethiopian government has formulated a 70:30 ratio to accelerate development, especially for industrial development, with the developmental state and other national development programmes. The transformation from the agricultural sector to the industrial sector, the further export corridor it offers, and the role of democratic developmental states together begin industrialisation and the comprehensive development of the modern sector (MoE, 2008). Government commitment and the professional workforce play a role in the developmental state. EHE must transform itself into the professional mixes of its undergraduate and postgraduate programmes and institutionally to meet the new Ethiopian challenges. Since 2008/09, Ethiopia has introduced a 70/30 policy of enrolment in S&T fields at undergraduate and postgraduate levels. This has implications for research and supplies a pipeline of STEM students for doctoral study (Molla & Cuthbert, 2016).

The world experience demonstrates that capabilities in S&T serve as an engine of development. For any thriving economy, particularly in today's quest for knowledge-based economies, S&T is requisite. The industrial economy requires more graduates and skilled HRs in S&T and innovation. Thus, S&T disciplines are the prerequisites for industrialisation. Following the developmental state model and disparate development programmes, Ethiopia has formulated a 70:30 HEP for industrial development. To make this national vision tangible, S&T HRs require transforming the country's economy from agricultural to industrial.

From the word experience, Germany, Japan, South Korea, China, and Taiwanese have underscored beyond any reasonable doubt the point that capabilities in S&T serve as an engine of development and that creating and sustaining expertise density or critical mass in the fields is a prerequisite for industrialisation-sustain industrialisation (MoE, 2008) Countries recognised for their strength in STEM, like China, Taiwan, Korea, Finland, and Switzerland, have established strategic national frameworks for STEM policies (Clarke, 2019). However, the requirement for 21st-century workers to be skilled in STEM-Ethiopian universities are steering students towards these STEM-related degrees. However, Ethiopia's educational system must simultaneously be culturally relevant and flexible/responsive (Bishaw, 2012).

Creating a partnership between universities and industries is a crucial strategy for technology transfer, which is essential for community service. In Ethiopia, technology transfer is crucial for the GTP. Universities play an essential role in establishing industry relationships through teaching and research. To equip students with practical skills, they are assigned to relevant industries as part of their course completion, where they learn from experienced industry staff. This knowledge dissemination pathway is like research and innovation, and it is assumed that the dissemination of knowledge improves technological transfer in all sectors, leading to increased productivity and efficiency (Oketch et al., 2014). In addition, students and professors can bring their theoretical knowledge to the industry to create reciprocal benefits. Research-led and inquiry-focused learning is the foundation of a student profile, which is achieved by involving students in research-like activities (Schalkwyk et al., 2013).

The university's role in producing competent human capital for the industry is crucial. The link between the university and industry is vital in improving the quality of education and job opportunities for graduates. Technology transfer can take various forms, such as sharing research products like publications, goods, and designs or internationalising universities to exchange experiences with other

countries. Technology provides goods and services that meet real-world requirements. With the growing importance of ICT, technology now encompasses a wide range of knowledge and skills that drive the advancement of the business, government, and non-governmental services sectors. According to Belay et al. (2016), this new area is known as service sciences.

Experiences from developed countries and emerging economies underscore that increasing the number of high schools, colleges, and postgraduate students majoring in STEM is critical for sustainable economic development (Belay et al., 2016). STEAM is critical for industrial development, but not yet in Ethiopia. In Ethiopia, public universities were required to admit 70% of their students in S&T to enhance the national research and technology capacity for the country's industrial development. The 70:30 admission policy in the HEIs needs to be studied to analyse the supply and demand for S&T relative to the country's development requirements (MoFED, 2015); nevertheless, the demand and supply of HRs have not been analysed. Effective education in S&T will enable more citizens to delight in and feel a share in the human enterprise we call science. The case for new policy decisions is compelling urgently. Evaluated through the theoretical framework of the Developmental State and HCT, this supply-push enrolment mandate creates a profound risk of structural unemployment; forcing a massive output of technical graduates without a synchronised expansion in industrial market absorption generates a critical mismatch between state-driven academic supply and actual economic demand.

4.3.3.7 HEIs Gross Enrolment Ratio and Implication for Human Resources

In the early 1990s, Ethiopia's GER was a mere 1% (Yizengaw, 2003, 2005; Loukeris, 2005), reflecting the nascent state of its HES at the time. Though there is a rapid expansion in the development of HE infrastructure and the enrolment rate in Ethiopia in the last two decades, the GER is too low compared to the Sub-Saharan countries. GER of HE in Ethiopia, which was 5.3% in 2008/09, is below the rate of the Sub-Saharan region of 6% and indicates the considerable effort the country requires to make to advance HE. Ethiopia still had the lowest HE

enrolment rate in the world and below the sub-Saharan African average (Molla & Cuthbert, 2016; Yigezu, 2013; UNESCO, 2010; Yizengaw, 2005). The World Bank's (2018) report underscores Ethiopia's challenges in advancing its knowledge economy, indicating an HDI score of 0.38, one of the lowest globally, highlighting the critical need for enhanced educational quality and accessibility. In 2009, the GER of HE was 3.6% (UNESCO, 2010), and in 2010, it was 5% in Ethiopia and 6.8% in sub-Saharan Africa (Szirmai, 2015). These all imply that the HRD in Ethiopia is scant. This low GER not only signals educational and economic hurdles but also suggests potential impacts on the nation's political stability and development trajectory. The world and African average HE enrolment rates were 32% and 8%, respectively (Molla & Cuthbert, 2016). The GER of HE in 2010 was 21.4% in developing countries and 69.7% in developed countries (Szirmai, 2015).

Education and health expenditures are a proxy for human capital. Education and knowledge are among the quantitative indicators used to measure the dimensions of the UNDP HDI. Adult Literacy Rate (% aged 15 and over) and Adult Literacy Index, whereas GER (% in primary, secondary and tertiary education) is the GER index. However, the World Bank indicates that Ethiopia's knowledge economy is meagre; for example, in 2018, the World Bank recognised Ethiopia's HDI score as 0.38, which is the lowest (World Bank, 2018). The UNDP's ranking of Ethiopia at 173 out of 189 countries in terms of HDI further emphasises the dire need for concerted efforts in educational development as a cornerstone for national progress and HRD. Nowadays, enrolment in education is one of the indicators of knowledge used to construct HDI, and HDI is also one of the best indicators of development. A low GER indicates the country has a meagre knowledge economy and knowledge. The low GER in Ethiopia signifies more than just educational and economic challenges; it also has implications for the country's political development, especially given the current political crises.

Despite ambitious targets set in GTP I and II (2010/11-2025), aiming for middle-income status by 2025 with a GER target of at least 22%, this indicates

sluggishness. By the 2015/16 academic year, the GER in Ethiopian HE was 9.4%, slightly increasing to 10.2% in 2016/17 (MoE, 2017) and 10.4% in 2018 (World Bank & UNESCO Institute for Statistics, 2025). This increment, though indicative of efforts to expand HE infrastructure and HRs, still points to a significant gap between educational outputs and the strategic benchmarks necessary for fostering a knowledge-based economy and addressing HR needs in S&T. This reflects a raw labour force; nevertheless, it is unequipped for S&T. The challenges of limited resources and financing are significant obstacles in achieving the 22% target by 2025. (MoE, 2017). Viewed through Job Market Signalling Theory and Human Capital Accumulation models, Ethiopia's low gross enrolment trajectory demonstrates that while the 70:30 policy altered the internal composition of university intakes, it has been structurally constrained by an overall capacity deficit; the slow growth in total enrolment fails to produce the volume of specialised labour required to signal a mature knowledge-based economy to international markets.

Summary

During Emperor Haile Selassie and the Derg, HE was not given due attention; it needed to be more relevant to the solution-seeking issues of the country, and its capacity needed to be commensurate with the country's trained workforce, both in quantity and quality. Within less than three decades (1991 to 2017), public universities increased from 2 to 48 universities and from prohibited private universities to 98 private universities. In a similar period, the GER increased from 1% (1991) to 10.2% (2016/17), reflecting the nascent state of its HES at the time. As per the Ethiopian GTP I (2010/11-2014/15), the increase in enrolment in undergraduate and postgraduate programmes shall align with the 70/30 Programme. According to Ethiopian GTP II (2015/16-2019/20), to sustain the promotion of the 70:30 admission policy of HEIs, the demand and supply of HRs for S&T under the country's development is required. The ESDP V (2015/16-2019/20) has continued to retain the programme mix of a 70:30 ratio of S&T programme to SS programme by increasing the institutes of technology and upgrading S&T universities to international centre of excellence standards.

In 2008/09, Ethiopia introduced and adapted the 70:30 HEP to accelerate national development. Ethiopia has STEM education in secondary schools in line with the 70:30 in the HE policy, but not a contemporary STEAM, which needs to be implemented in Ethiopia. The policy requires an evaluation of its impact on development in the country. To reach a middle-income category, Ethiopia must achieve at least 22% gross enrolment; however, the available resources do not allow it to attain 22% by 2025 (MoE, 2017), and the current situation and position of the country are the worst for attaining it. There has been a rapid expansion in the development of the HE infrastructure (institutions and facilities), qualified HRs, the enrolment rate (10.2% in 2016/17), and10.4% in 2018 (World Bank & UNESCO Institute for Statistics, 2025), and the graduation rate in the country's HE for the last 15 years. Synthesising these multi-layered findings through the combined lenses of the massification-quality dilemma and structural labour-market mismatch, it is evident that while the 70:30 policy has successfully engineered a massive quantitative expansion of S&T infrastructure, its ultimate external effectiveness is fundamentally bottlenecked by severe baseline learning deficits in the lower school pipeline and a lack of synchronised industrial absorption capacity.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 Introduction

The previous chapter discussed and reviewed the implications of the 70:30 education policy for the Ethiopian education system. In this chapter, the researcher has developed an approach and a rigorous evaluation methodology based on the literature and desk review, research, and the nature of the 70:30 policy. Appropriate analytical methods, including a policy analysis approach, were employed to evaluate the policy. The main purpose of this innovative methodological approach is to evaluate the implementation of the 70:30 policy in the HE outcome-effect on HRD and its implications for development. The quantitative method is used, with the qualitative supplement embedded to address the research questions and/or objectives. The researcher planned to collect data using existing statistical data and meta-analysis, including statistical reports, and analyse it using appropriate methods and techniques. Thus, the implementation of the 70:30 policy and its micro policies by HEIs' roles necessitate an evaluative study to determine if they were executed per the national guidelines policy and the policy's target. Hence, the evaluation research encompasses the research paradigm, methodological approach, methodology rationale, organisational, and statistical data sources. The methodology further includes the type of research, research design, sampling and sample, data verification and organising, data collection method, analytical methods, and ethical considerations. Additionally, the researcher has ensured that the quantitative method is valid and dependable, while the qualitative method is trustworthy and credible.

5.2. Research Paradigm and Approach

The research paradigm, policy analysis approach, methodology, and methods have been designed to evaluate the policy and will provide the foundation for this study, as will be reviewed in the subsequent sections.

5.2.1 Research Paradigm

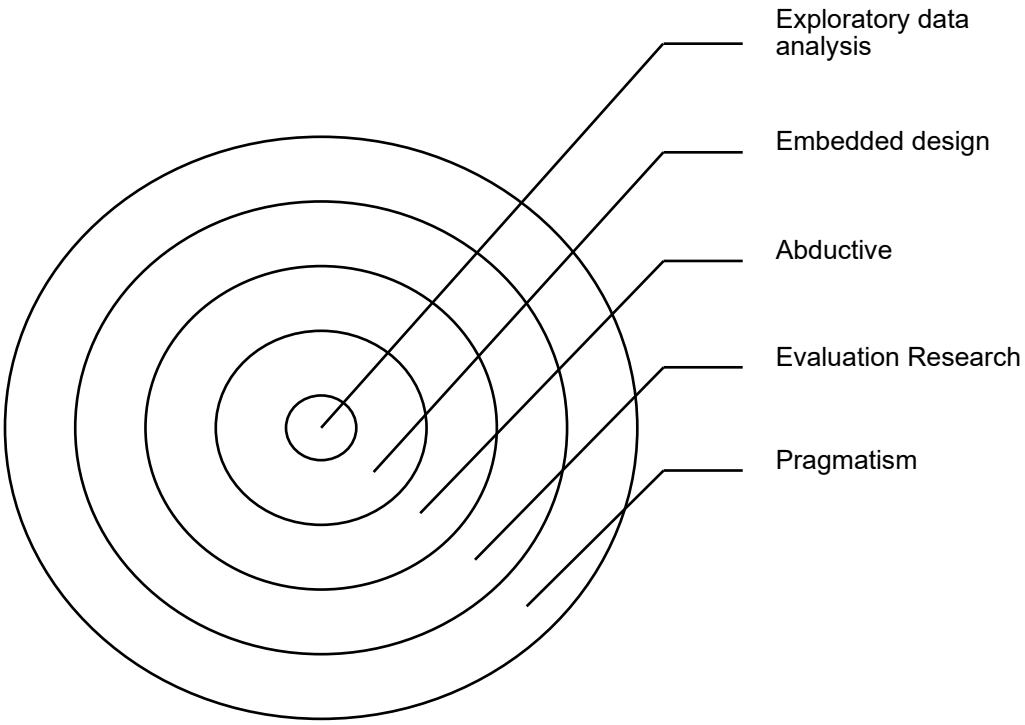


Figure 4: Onion model of paradigm, research approach & design

The study employs the onion model basis, uses abductive reasoning, and is grounded in pragmatism. The study employs a mixed-method approach (embedded type of mixed) and integrates evaluation research with evaluation design. The research used concurrent triangulation data collection and exploratory data analysis of existing statistics (administrative data), such as time series data analysis and ITSD with qualitative data analysis. The methods encompass meta-analysis, specifically metadata analysis of alumni and tracer data, panel data analysis of public and private universities' enrolment, as well as interview and data visualisation analysis. Pragmatism serves as the philosophical foundation of this study. A convergent parallel design refers to equal priority assignment (QUAN+QUAL) for the quantitative and the qualitative data within the pragmatist framework. It ensures that statistical and thematic trends are synthesised during the final interpretation.

5.2.2 Methodological Approach of the Research

The policy analysis approach aimed to provide a relevant analysis. The policy was expressed in a ratio of 70:30, including its micro policies. Thus, in this research, time series data analysis was employed encompassing the elements of the quantitative ratio of the policy.

The commingle method is more suitable for better research and triangulation to create a comprehensive and complete picture. The purpose, subject areas, and research sub-questions determine the methodological approach to employment. Occasionally, the nature of the topic can also be determined by a methodological approach like the policy of 70:30. Thus, the methodological approach of this study needs to be determined based on the purpose, including the sub-objective, and research questions. The nature of the topic was formulated in ratio forms at both macro and micro levels. In line with these indicators, this study has relied more on a quantitative approach; however, in the qualitative component, policy KIIs and desk review were conducted to complement the quantitative method. Implications require statistical data analysis. Hence, the researcher has employed a quantitative analysis of the enrolment and graduation rates of HEIs concerning the 70:30 policy, micro policies, gender, and programmes. In addition, the placement policy versus students' choices of fields of study and their performance in the NLA entrance exam of HEIs, and its implications for HRD, were collected and analysed. A meta-analysis, particularly of alumni and tracer studies, was also reviewed to examine the policy outcome on graduate employability. Since the 70:30 HE policy provides HRs for each economic sector of the country with diverse fields of study, a policy analysis approach is more suitable for understanding the implications of the 70:30 policy for HRD. This quantitative approach’s identification strategy exploits the strict policy variation between public HEIs and private HEIs. The former are legally mandated to execute the 70:30 enrolment ratio, and the latter operate outside this mandate and serve as the baseline control group.

5.3 Rationale of the Research Methodology

Belay et al. (2016) claimed that education policy and its practices were informed by evidence. WDR (2017) indicates a surge in high-quality, policy-relevant research and innovative approaches in education during this century. Scholars, like Newby (2010), assert that research needs to assess whether we are heading in the right direction once a policy was executed. The 70:30 policy has been implemented in Ethiopia with the allocation of resources (human, material, infrastructure, equipment, and finance) since 2008/09; however, the role of HEIs in implementing the policy has yet to be assessed. Once a new policy has been implemented, policymakers and others desire to know how well it is working. Hence, an evaluation study was needed to comprehend if it is effective (Newby, 2010). Some authors argued that either the commissioned consultant or the academic community judges the policy through research, often involving either internal or external evaluators, or both in joint evaluations. Universities serve as agents for government policy (Newby, 2010); however, they still need to conduct evaluation research on the 70:30 policy. Johnson & Christensen (2017) assert that applied research often leads to the development of interventions and programmes to improve societal conditions, and policymakers increasingly draw on research evidence when developing new policies (Law et al., 2013).

Scholars like Law et al. (2013) assert that the use of research to influence policy is increasing within development work. According to Ozga's (2004) arguments, current developments linking research to policy and practice must pay greater attention to the convolution of relationships between policymakers, researchers, and practitioners as well as the extent to which they pursue differing agendas. In this research, interviews were conducted with policy key informants, like policymakers, beneficiaries, implementers, practitioners, researchers, HR units from various sectors, professional associations, and research agencies and institutes related to policy. Haddad & Demsky (1995) claim that policy consists of seven policy-planning processes: (i) analysis of the existing situation, (ii) the generation of policy options, (iii) evaluation of policy options, (iv) making the

policy decision, (v) planning for policy implementation, (vi) policy impact assessment, and (vii) subsequent policy cycles. From the policy planning processes, it is evident that the first four pertain to policymaking, the fifth to planning, and the sixth and seventh to policy evaluation and adjustment, respectively. Other scholars' policy processes include agenda setting (problem identification), policy formulation, adoption/decision-making, implementation, and evaluation. However, the 70:30 policy must incorporate such policy procedures and processes. Before formulating and planning, it is essential to identify potential problems or risks that may arise. These pitfalls need to be considered and addressed to create effective policies and plans. An ex-ante and an ex-post evaluation are parts of the evaluation that have not been evaluated on the policy. Hence, an ex-ante and an ex-post evaluation are essential for educational policies aimed at addressing unemployment issues. Any policy decision adoption and implementation require procedures that require studying the policy. Policymakers should engage in research to enhance and adapt to policies/change the broader policy environment.

As Newby (2010) argues, policy performance and evaluation depend on practice as on policy formulation. Policy drives research; second, one must be involved in any aspect of policy assessment (Newby, 2010). Programme evaluation and log-frame methodologies provide frameworks for such assessment (Ntuthuko & Francois, 2016). Michael and Scott (2013) assert that policy legitimation and policy change are other components of the policy planning process. According to all policy scholars, policy evaluation is one of the policy processes to evaluate its effectiveness; however, the 70:30 policy lacks such a process, especially in evaluation studies. Thus, this thesis aims to conduct an evaluation study. This study seeks to evaluate the implementation of the 70:30 policy, its outcome-effect on HRD, and implications for development.

Studies within HEIs in Africa have conducted reviews to comprehend the approaches and methods used. For instance, the impact of tertiary education on

development (Oketch et al., 2014), the effect of motivation on performance and employability (Kwapong et al., 2015), the contribution of modern HE to development (Biao, 2014), the internationalisation of tertiary education curricula, and its impact on global employment opportunities (Gwakwa, 2016), and a study on HEIs (Kwapong et al., 2015). These studies employed a quantitative research approach. Researchers have conducted trend analyses on students' enrolment in HEIs (Dunga, 2013; Ronoh et al., 2013; Ssempebwa & Segawa, 2013). Some utilised time series-trend data analyses on students' enrolment by gender, S&T, arts and humanities, and SS.

In Ethiopia, the researcher reviewed the role of HE in national development (Woldgiyorgies, 2015), quality assurance policy and practice in HEIs carried out using both qualitative and quantitative approaches (Geda, 2014; Kahsay, 2012), and an assessment on the HEIs graduates that employed time series-trend data analysis to analyse enrolment and graduates' rates (Chalchesa, 2012). In Ethiopia, studies have been conducted on the NLA and entrance exams of HEIs (Nega, 2009), the quality assurance systems and accreditation of HEIs (Woldetensae, 2009), and the relevance of HE curricula and the status of learning inputs (Asgedom, 2009). Factors such as HE teaching personnel's pedagogical training and performance assessment (Yimam, 2009), HE expansion and intake capacity (Leka, 2009), and quality indicators of science education in HEIs (Shebeshi et al., 2009) are significant. Ashcroft & Rayner (2011) conducted interviews with managers, academics, staff, and students at public and private universities, as well as with employers, to understand the methodology employed.

Chang and Tzeng (2018) employed the Autoregressive Integrated Moving Average (ARIMA) model on humanities and STEM graduates and the enrolment ratio. Gender parity enrolment in faculty is done using ARIMA (Chang & Hu, 2019) and analysis and forecasting of the university student population using the ARIMA Model in Kenya (Cheruiyot, 2015). Among others, ARIMA employed an

integrated enrolment forecast model (Chen, 2008), and advanced researchers used Regression Discontinuity Design (RDD), advanced triple Difference-In-Difference (DID) models to evaluate policy and correlation. Another example is statistical data analysis, an appropriate method to study implications that has been conducted using statistical data analysis on the labour-market and fiscal policy adjustments to stocks (Gumata & Ndou, 2017). To link the research questions with the advanced analytical tools cited in the literature, this study establishes a clear identification layout. In other words, DID isolates public versus private macro-policy variations across symmetric horizons. On the other hand, RDD evaluates systematic behaviour immediately surrounding the 2008/9 threshold. Moreover, the ARIMA/ITSD tracking architectures resolve data stationarity issues for annual enrolment and graduation data.

5.4 Organisational and Statistical Sources of Data

The researcher gathered information from various data sources. The MoE collects census data from all HEIs using a census questionnaire. Considering this, the researcher has collated data to cross-check the existing statistical data on the 70:30 policy documents and programmes, the EMIS, ESAA, NEAEA, and HEIs. Principally, ESAA and NEAEA data sources were used for analysis, while others were used for verification and triangulation. These documents were received and collected from the MoE, NEAEA, and HEIs. The MoE has statistical data on HEIs, especially the EMIS and ESAA, including enrolment and graduate rates and gender disaggregated enrolments (MoE, 2014). The MoE maintains and publishes summarised university-level statistical data to generate national-level statistics and reports for dissemination, which can be used for research, policy decision-making, and planning purposes.

The results of tracer studies, including statistical data on the employment of HEIs and alumni studies from MoE and HESC, were collected and rigorously reviewed to understand the policy's effect on the employability of the graduates.

Furthermore, NEAEA provides statistical data on the placement policy in relation to the choice of fields of study and students' performance at NLA.

5.5 Type of Research

Type of research: This study aimed to assess the effect of the 70:30 policy on HRD and its implications for development, particularly in industry and manufacturing initiatives through S&T HR. The evaluation policy required both an ex-ante and an ex-post analysis of the 70:30 policy regarding its implementation and effectiveness. In this study evaluation research, ex-post evaluation, was conducted. The purpose of this evaluation research is to evaluate the implementation of the policy in the HE.

Type of evaluation model or approach: The goal-based model is one of the post-positive paradigms to determine. Context, Input, Process, and Product (CIPP) is also a comprehensive model for programme evaluation. This evaluation study is on the goal-based and CIPP models. The goal-based approach measures the relative attainment (efficiency) of predetermined, clear, and identifiable programme treatments. The objective-based model focuses on the policy/programme and their achievement (effectiveness). Context evaluation is the rationale for justifying a policy intervention that is relevant. The evaluator must determine priorities among needs (e.g., the interest of the students and keeping their preferred fields of study and employers' priority demand). Input evaluates the implementer university's resources (efficiency) to meet policy objectives. Process evaluation assessed policy implementation differently from planned policy. Product evaluation compares the policy output and outcome with intended objectives. Goal-based and CIPP models utilised qualitative and quantitative data collection methods. The selection of CIPP and Goal-Based frameworks was applied to the quantitative metrics. This avoids structural ambiguity. Goal-Based framework measures the 70:30 enrolment quota deviations. The CIPP framework categorises institutional inputs, processes, and products.

5.6 Research Design

A mixed-methods research design was adopted. It is an embedded quasi-experiment design with a qualitative method to support the larger quantitative method. The embedded method is a type of mixed design (Creswell & Creswell, 2018, 2023; Du Plessis & Abdool—Satar, 2021). Plano Clark and Ivankova (2016) refer to embedded design as an advanced, complex, or scaffolded design (as cited in Creswell & Creswell, 2023). The mixed-methods evaluation design includes one or more core designs added to the evaluation process, focusing on assessing the success or failure of an intervention, policy, or programme (Creswell & Creswell, 2018, 2023). This involves intersecting administrative data (existing data) from the MoE and secondary data from universities within a primary qualitative method. In the mixed-methods design, qualitative data can serve as a supportive method within administrative/existing data and secondary data. It is also an ideal approach for testing theories or explanations (Creswell & Creswell, 2018, 2023). This thesis applies an evaluation design to assess the developmental state theory of education's outcome-effect on HRD and its implications for national development. The mixed-methods approach can be integrated into the core design, with a combination embedded within a larger design, theory, or method (Creswell & Creswell, 2018, 2023).

The policy implementation in public universities created a natural experiment, making a quasi-experimental design ideal. Hence, a quasi-experiment design can explore the causal relationship between the macro and micro policies and their effects on enrolment and graduation completion rate (output) and outcome (employability of the graduates). In this quasi-experiment design, the HRD outcome variable is measured after the 70:30 policy intervention has been implemented. Hence, examining the policy's intervention on the employability of the graduates is one aspect. The success of any analysis depends on the availability of the data. Time series data, including historical data on the 70:30 policy (after the policy enrolment as a treatment group) and PPC baseline data (before the policy enrolment as a control group), are available for empirical analysis. Thus, the researcher can apply certain controls for the selection bias

issue using **post-hoc matched-grouping techniques**. It made comparisons to panel data between enrolment in a private university (comparison group) and in a public university (treatment group) to examine the effect of the policy on enrolment. This quasi-experiment was supported by a qualitative method**.**

In a mixed-method design, one of the fields of evaluation is education policy (Creswell & Creswell, 2023). In organisations and institutions, an ex-post evaluation is usually conducted six months to three years after the completion of the project. UNESCO recommends assessing graduates' employment and skill utilisation after six months (UNESCO, 2012). After the programme ends, a follow-up survey is conducted with participants to examine their employment status and earnings level six months later. The study gathered and analysed data on graduates six months post-graduation to evaluate their employment status and skill levels. The employment and unemployment of graduates and their skills are immediate impacts and effects on the policy to be assessed after six months.

Time series design is one form of quasi-experiment**.** A time series of regular time intervals reports existing statistical data available, especially enrolment and graduation rates in 2003/04, when a new programme of HEIs, PPC, was introduced and implemented. A new 70:30 policy has been implemented since 2008/09. The study collected and analysed the trend data of enrolments and graduates to compare PPC and the 70:30 policy and examine the policy's effect on enrolment and graduation rates.

An embedded mixed design was used with a comprehensive evaluation process. A quantitative approach was adopted because the problem focuses on identifying factors influencing HRD outcomes and the effect of policy interventions on HRD. A qualitative approach served as a supportive follow-up with participants, policy implementers, and HR units from various sectors, and employers to gather their specific perspectives, experiences, demands, and insights to address certain research questions. The researcher does this by embedding the supportive data within the method that plays the primary role (for example, quantitative data can

be embedded within a qualitative method (quantitative design has less weight than the qualitative design), or qualitative data can be embedded within a quantitative method (qualitative design has less weight than the quantitative design) (Du Plessis & Abdool-Satar, 2021). Qualitative data were embedded within the quantitative method to help answer the research questions. The quantitative approach mainly guided this research because the 70:30 ratio and its micro policies were expressed quantitatively, particularly in terms of quota allocation. A qualitative study alone cannot assess outcomes against alternatives or counterfactuals. According to Cresswell and Plano Clark (2007), a single data set or mono-method design cannot fully answer a research problem (cited in Du Plessis & Abdool-Satar, 2021). The quantitative method was crucial for achieving the research objectives, and both methods were employed to comprehensively address the research questions. The study considered both between-groups and within-subjects designs.

As stated in the scope of the study and Figure 3, the policy indicators include inputs (placement policy and ratio/quota), policy implementation (enrolment in the HEIs), outputs (graduates of the policy), outcomes (graduates' employability), and impacts (short term/immediate like employment versus unemployment). These indicators are evaluated using evaluation criteria such as relevance (like relevant student recruitment and their performance at NLA and/or HEI entrance exams, interests/demands of students and employers in industries and labour market,), efficiency (policy implementation attainment and resource use), effectiveness (achievement of the targets and objectives of the policy), immediate impact, and sustainability (self-employment of graduates), along with their implications for economic growth and development.

A time series design was used as one of the longitudinal evaluation methods to gather and analyse data about the enrolment and graduates of HEIs. Additionally, a time series design is a type of quasi-experimental design. A comparative ITSD was used to assess the policy's impact on enrolment and graduation rates by

comparing pre-and post-intervention periods, analysing trends, and contrasting control and treatment groups. This represents a longitudinal evaluation utilising census and panel data analysis of time series data before and after the policy change, including enrolment data from both private and public universities, especially for the DID model. The change is measured by comparing differences in enrolment and graduation rates between the PPC and the 70/30. The researcher aimed to determine whether the observed changes in the series aligned with the policy implementation, occurring at a specific point (in 2008/09) or across different time points. Hence, census data were employed in this design.

A Pearson correlation analysis was conducted between graduates' choices of study fields and their employment status. Additionally, Pearson correlation was performed between placed graduates without their prior choice and their unemployment.

There are two types of quantitative effect evaluation: an ex-ante and an ex-post, comparing the input (quota and/or target to be achieved, which can serve as baseline) and the output/outcome (an ex-post estimation). One approach is to estimate both ex-ante and ex-post. Hence, the placement policy ratio (input) is an ex-ante measure, and the output of the policy is an ex-post evaluation. An ex-ante stage*,* before policy implementation, is the *interim stage,* where each macro and micro has an allocation ratio to implement in the HEIs, whereas the ex-post *is* when all public university implementers implement the policy. Attaining ex-post Pareto-efficient outcomes is required.

An ex-ante evaluation is a forward-looking assessment of the likely future effect of new initiatives and support of such policies and programmes. A comparison was the target need-to-be-achieved placement policy (input) as an ex-ante and the output (enrolment and graduates) of the policy of HEIs as an ex-post evaluation. The desired target ratio of the macro and micro policies is considered an ex-ante (baseline data) to compare with the effects of the policy in an ex-post evaluation. An ex-ante anticipated ratio was compared with an ex-post efficiency.

Baseline data, target, and time: The baseline was established temporally with the introduction of the PPC in 2003/04 before the policy, and the 70:30 follow-up policy after 2008/09, as well as in terms of scope and/or allocation for each macro and micro policy (bands) to facilitate a comprehensive evaluation. The evaluation was conducted in terms of the achievement of the target enrolment of the quota and/or the ratio of each macro and micro policy.

Concurrent Triangulation design: The study employed a concurrent triangulation design by collecting both quantitative and qualitative data simultaneously during the thesis process. Data were gathered at the same time and analysed in an explanatory sequence (first quantitative, then qualitative analysis). The triangulation involves not only combining quantitative and qualitative results but also integrating coding with quotations from both qualitative and quantitative techniques.

Matching and controlling for confounding and extraneous variables: Matching and control methods address confounders. To manage confounding variables, we divided our samples into four groups. The first and second groups included the enrolment control groups before the policy change in both public and private universities. The third group is the control group after the policy change in private universities. The fourth group is the treatment group after the policy change in public universities. The causal-comparative/ex-post design also involves studying potential extraneous variables that are controlled (Londic et al., 2006). Technique selection, stratification, and statistical adjustments (Zegeye et al., 2009) help control the influence of extraneous factors on outcome variation. Therefore, stratification and matching were used. DID matching requires panel data from before and after the policy intervention. Matching enrolment in public universities (treatment group) and private universities (control group) is regarded as controlling for the confounding factor. ITSD relevant in a quasi-experimental setting with a low level of confounding variables. Matched pairs groups have been used based on pre-and post-enrolment data in public and private universities. This approach is the most common method researchers use today to identify

extraneous variables in causal-comparative studies: by statistically estimating the effect of extraneous variables on the dependent variable (Londic et al., 2006). RDD, DID, ITSD, and longitudinal evaluation were chosen because policy implementation, especially in education, naturally creates a suitable quasi-experimental design. In general, a quasi-experiment design is appropriate for educational research. The formal Difference –in-Differences (DID) identification strategy is constituted by this four-group framework. To isolate the true policy effect from general historical enrolment trends over time, the private group is exposed to the control group.

Variables: The dependent, independent, and controlled variables in this study were considered. The 70:30 policy, including micro policies, is the independent variable; enrolment, employment, and graduates of public universities are the dependent variables, and the controlled variables are the matching groups (enrolment in private universities)**.**

Type of data: Enrolments, graduates, and employment and/or unemployment are discrete, whereas gender and age are categorical data. Macro and micro policies are discrete data on students' quotas/ratios, expressed as the number of students to enrol in HEIs. Thus, both independent and dependent variables are discrete data.

Clustering data into macro, micro policies, and gender: Once the data is collected, clustering the data into groups-macro, micro policies, and gender. They also grouped the clustering into fields of study and/or departments.

Maximum likelihood estimation method: The Maximum Likelihood Estimation (MLE) method estimates the parameters for the before-and-after policy analysis because the policy affects enrolment and graduation, making it non-linear. Logistic regression analysis was employed to examine the effect of policy on employability in terms of policies, gender, and age, which are among the reasons for MLE. Another reason is the large sample employed in this thesis.

Ordinary Least Squares. The **Ordinary Least Squares** (OLS) estimator was considered only after the policy analysis, particularly for multiple regression analysis, because the researcher anticipated linear regression, as the policy allocated for each macro and micro policy with an identical quota to enrol students in the HEIs every year since 2008/09.

5.7 Sampling and Sample

Appropriate sampling and sample selection are critical for evaluating this study.

5.7.1 Sampling

Stratification sampling was used based on public and private universities. The study covered enrolment in government and non-government universities. The 70:30 policy is implemented in public universities, but not in private universities. Stratification was the basis of macro policy (S&T and SS) and micro policies (E&T, NCS, MHS, ANRS, B&E, and SHS). Stratification was used to categorise the universities based on Generation University (1st, 2nd, and 3rd). Stratified sampling was employed to examine the enrolment in S&T and SS in the 1st, 2nd, and 3rd generations.

Universities have a common mission, i.e., teaching, research, and community service. The effects of disparate generations of university policy implementation affect enrolment and graduate employability. Stratified sampling subdivides the total items in the frame into separate strata (Levine et al., 2016). The study defined a stratum by some common characteristics based on gender and school years. Universities were stratified by the years of establishment, into first-, second-, and third-generation universities. The first-generation was established from 1990 to 1999. The second and third-generation universities were established in 2006 and 2011, respectively.

Another purpose of the stratified sampling approach is gender (male and female) enrolment in S&T at the University. During ESDP IV (2010/11-2014/15) and V (2015/16-2019/20), gender was one of the components to ensure equality, and

efforts were made with particular attention to their enrolment in S&T. In addition, Ethiopia's gender population is almost equal (females are slightly higher than males). Hence, the analysis considers the effect of these ESDPs on gender enrolment in S&T. Another reason is that the gender population should have equal enrolment in S&T.

Purposive sampling is likely to make appropriate qualitative approaches (Law et al., 2013). The term purposive refers to a particular group of people sampled to obtain specific information about those groups (Law et al., 2013). Hence, a purposive sampling approach is employed to select key informants who have relevant experience with the policy and its effects. The key informants were selected from disparate institutions, organisations, professional associations, and HR units across economic sectors, research institutes, and HEIs, especially employers of graduates of the micro policies. In general, the direct and indirect beneficiaries of the policy participated.

5.7.2 Sample

Time sample for enrolment: This is a time sample required. A time sample enrolment was studied. Thus, the period covered the whole PPC (2003/04 to 2007/08) and the 70:30 follow-up policy (2008/09 to 2016/7). The study covered the differences between PPC and the 70:30 policy. It used the ARIMA model to determine the effect of the policy and its stationarity (assuming PPC is stationary and 70:30 another stationary series). The PPC is the baseline data, and 70:30 is the follow-up policy. The time series might be non-stationary, and its parts (PPC and 70:30) might be stationary. For RDD and DID micro-econometrics models, the study covered the period between 1998/99 and 2016/17 to satisfy its assumptions. DID is consistent when implemented symmetrically (i.e., the identical number of periods before and after treatment). The study employed the identical period before (from 1998/99 to 2007/08) and after (2008/09 to 2016/17) for DID and RDD.

Time sample for graduates: The time sample for graduates was another sample. The policy effect on graduates is between 2003/04 and 2009/10 and the 70/30 policy, which starts from 2010/11 to 2016/17. From 2003/04 to 2009/10, undergraduate graduates are the baseline data, and from 2010/11 to 2016/17, undergraduate graduates under the 70:30 policy are the output. The ARIMA model was employed to determine the effect of the policy on graduates. To ensure stationarity of the graduates of the 70:30 policy, which started in 2010/11.

Sample for KIIs: The sample for KIIs depends on the saturation of interview responses. 73 KIIs were selected using purposive sampling (Table 25), and 38 interviews were used for analysis because some interviews had redundancies, saturated responses, and some participants did not reply.

5.8 Data Verification and Organising

The MoE collects and reports on education data obtained from HEIs, especially gender disaggregation, discipline, and faculty. MoE did not provide data based on macro policy (70:30), micro policies, or gender enrolment based on S&T and SS. MoE did not cluster the enrolment and graduation based on macro-70:30, micro, and university generation. It requires clustering, summarisation, and verification based on S&T, SS, and micro policies and gender enrolment in S&T and SS. The study clustered the enrolment and graduates based on the macro policy and its micro policies. MoE must produce quality data and statistics, as they verified the statistical data of HEIs produced by MoE. The study verified the collection and reporting of HEIs by field of study, discipline, micro policy, programme, gender, and university. Data verification was conducted and cross-verified through disparate sources such as EMIS, ESAA, HEIs, NEAEA, and the policy document itself.

Data were recounted for accuracy and cross-verified by comparing alternative data sources to ensure the reliability of the data. Data verification was carried out before data entry, and quality control mechanisms were carried out when entering

data from paper to computer. Data accuracy was verified for error correction, like the summation of each university, discipline, macro and micro policy, field of study, and gender from the statistical outputs of MoE and HEIs. NEAEA also provides the placement of students in each micro and macro. Clarity on metadata and error-free reference time, data updates, compatibility between file formats, and comparability of administrative data sets were endeavoured.

5.9 Data Collection Method

Relevant data collection methods were employed using a concurrent triangulation data collection approach.

5.9.1 Existing and Administrative Statistical Data

All the public universities' existing and/or administrative statistical data of MoE on placement, enrolment, and graduates of the 70/30 policy were included in the study. Enrolment in private universities was collected and compared with enrolment in public universities. Panel data were collected and DID was used to examine the policy implementation effect on enrolment. This is part of a big data analysis of national education data. A trend analysis of enrolment was conducted, which has implications for GER of the HEIs for both public and private universities. A new 70:30 policy has been implemented in government universities only; therefore, public universities are the target of this study. Statistical data on employability were collected and analysed from HESC, one of the MoE organs, to determine the effect of the policy on the employability of 70:30 policy graduates.

5.9.2 Meta-Analysis and Secondary Data and Documents

Meta-analysis involves the rigorous statistical integration of findings reported across primary research studies. Thus, meta-analysis intends to review and analyse the outcome of the 70:30 policy on graduate employability. Meta-analysis was used for quantitative evaluation to assess the immediate positive and negative impacts of the policy on graduates who are employed and those who

are unemployed, respectively. These alumni (from diverse generation universities, including first-, second-, and third-generation universities) and tracer studies (from different generation universities) are thorough (an ex-post evaluation) sources of evidence. If it is impossible to determine the employment status of programme participants from available data sources, follow-up or tracer studies may be necessary to measure their employment rate. The researcher has collected and reviewed the tracer and alumni studies reports to gather relevant data about the policy's effect on employability. They can also collect data from the employers of the graduates and employees to gain their observations on the relevance of the programmes, quality, skills, and overall employability of the graduates. Thus, tracer and alumni studies from HEIs were collected and reviewed comprehensively, especially the discussion section. HEIs anticipated undertaking tracer studies on the programme's effect on graduates' employability. However, the original data from disparate sources can be arduous to aggregate, and advanced analysis techniques may be limited. Due to the constraints in developing advanced statistical analyses across these studies, this section relied on descriptive statistics for comparison in the discussion section.

5.9.3 Key Informant Interview

Policy KIIs were conducted with relevant stakeholders, including beneficiaries, practitioners, government ministers, HR units/departments of different economic sectors, and implementers of the policies at both the federal and institutional levels, to assess the current state of education 70:30, particularly its relevance, implementation, effects, and implications for development in Ethiopia. The KII is a kind of Delphi method that is used to determine the demand and supply of HRs across different sectors. Thus, a Delphi method interview was conducted with employers, managers, HR units, and professional associations in various fields of study and economic sectors to examine the demand and supply of HRs for different economic sectors. The purpose of interviewing authorities and experts is to gain an in-depth insight into policy issues and their relevance within the national HES of the country. Recruiting specific individuals for interviews requires

experience, specific knowledge, and expertise, all of which are vital for addressing our research questions (Lindlof & Taylor, 2019). The selection process was to identify and list potential key informants-individuals or groups from whom information about the target population could be obtained (representatives). The list was then narrowed by reviewing and selecting one or two persons from the same sector believed to provide relevant information (UCLA, 2018).

KII samples of implementers and practitioners were purposely selected from each university generation: the 1st, 2nd, and 3rd generation universities. The key informants came from six colleges (the implementers and practitioners of the six micro policies) across the three types of universities. Likewise, key informants were drawn from each beneficiary (HR unit) of the six pillars of micro policies, as well as from professional associations related to each micro policy. The study also included research institutes, which shared their experiences, information and insights regarding the relevance of the policy, especially the demand and supply of HRs for each primary economic sector.

A KII is a loosely structured conversation with individuals who possess specialised knowledge about the topic we wish to understand. According to Law et al. (2013), it is a one-to-one interview in which a series of questions are posed to an informant, and their responses are recorded. As USAID (1996) stated, informants should be selected for their specialised knowledge and unique perspectives on a topic. It is anticipated that managers, engineers, and all professionals will recognise that HR is the key strategic issue and a source of cut-throat market advantages for all organisations (Brewster et al., 2018). The policymakers include politicians, senior government officials, chief executives, senior administrators in ministries, government agencies, and influential individuals in national associations representing various groups (UNESCO, 2015). Accordingly, all these are among the key informants (see the annexe).

5.10 Data Analysis Methods and Techniques

5.10.1 Introduction

An exploratory data analysis approach was employed to address the study's objective. ITSD, ARIMA, RDD, DID, Pearson correlation, multiple, and logistic regression were used for quantitative analysis, accompanied by data and graphic visualisation with SPSS and Stata. Subsequently, for the qualitative part as a supportive method, methods such as coding, nodding, categorising, networking, and hyperlinked quotations were employed, using data visualisation with ATLAS.ti 8. Before data analysis, data mining techniques-including classification, clustering based on macro and micro policies, networking, and visualisation-along with statistical analysis, were performed to achieve comprehensive insights. Embedded design-integrating qualitative data within quantitative data-provides greater significance. Policy analysis is an area that has produced diverse methodological perspectives (Clarke, 2019). The concurrent triangulation design involves separate analysis methods for quantitative and qualitative data-an explanatory sequential approach (first quantitative, then qualitative analysis). After conducting separate analyses, the results are combined and triangulated within the summary and interpretation sections.

5.10.2 Quantitative Data Analysis

Once the required data has been collected using concurrent triangulation with various methods, each section conducts relevant data analysis techniques, graphs, models, and econometric analysis.

5.10.2.1 Time Series-Descriptive and Graphical Analysis

A trend of annual enrolment and graduation growth rates, a trend line, and a line graph are highlighted. The linear model driven by the approach identified several challenges, including the need for policy analyses to address context, timing, and the influence of political ideologies (Clarke, 2019). Time-series clustering is used to analyse macro- and micro-policies to assess their implementation in HEIs. Additionally, it considers gender disparity, the macro-70: 30 (S&T versus SS) ratio, micro-policies, modes of training programmes, and degree programmes. In

some instances, descriptive statistics, particularly percentages, such as the results of NLA and/or entrance exams, along with graph analysis, comparison between placement policies by the government versus students' choices of fields of study and their implications for HRD, rates of enrolment and graduation completion, along with visualisation data, and employed versus unemployed graduates of the policy, are examined. Trend ratio analysis of macro and micro policies was conducted. Enrolment and output/graduates compared with inputs examine whether the target attainment rate against time (efficiency) was met. Percentages are used to assess whether the policy quota target has been achieved (effectiveness).

5.10.2.2 Time Series Econometric Model Analysis

The collected data, obtained through methods, needs to be thoroughly analysed. The following sections review relevant data analysis techniques, graphs, models, and econometric analyses.

5.10.2.2.1 Interrupted Time Series Design with Natural Logarithmic Transformation

An ITSD is suitable for policy evaluation, comparing the pre-intervention and post-intervention periods, and assessing trends, control, and treatment groups using quantitative methods. This approach involves a longitudinal time-series data analysis. As the policy is formulated, ratio analysis at macro (70:30) and micro (six micro) policy levels is considered. ITSD detects the structural policy at a specific time in 2008/08 and identifies no effect, or an immediate or long-term/permanent effect of the policy on enrolment.

In a time series, graphical visual data is plotted in the order of occurrence at regular intervals over time. According to Mohr (2014), a log scale enables the user to read both absolute numbers (plotted on the y-axis) and the rates of change simultaneously. Time series visualisation, including a time trend, demonstrates whether it has a structural break in 2008/09. An effective year is the date when enrolment at the public university begins in 2008/09. An ITSD was employed when longitudinal data of the policy (outcome over time-observations

before and after the intervention of the policy) and all population enrolment in public universities were affected at one specific point in time in 2008/09 based on the intervention.

There can be possible scenarios of outcome after an intervention

- No effects
- Immediate effect at the effective year of the policy
- Sustained (long-term) effect (permanent effect)
- Both immediate and sustained effect
- Temporary effect
- Not immediate effect at the effective year/date of the policy, but through time

$Y=\beta 0+\beta 1T+\beta 2D+\beta 3P+\epsilon$……1

Where

- Y is the outcome/enrolment/graduate/output variable,
- β0 is the baseline level (PPC) of the outcome/enrolment and/or graduate/output
- T is the time variable yearly enrolment/graduate from the commencement of the intervention period (2008/09),
- β1 is the slope of the line before the intervention of the 70:30 policy,
- D is the treatment variable where 1 is after the intervention of the policy, and 0 is before the intervention,
- β2 is the immediate effect at the effective year of the 70:30 policy
- P is the time variable indicating time passed since the intervention (before the intervention, the value is set to 0) to examine the sustained effect.
- β3 is the sustained effect (difference between the slope of the line before the intervention and the slope of the line after the intervention).

The time coefficient indicates the outcome trend before the intervention, while the treatment coefficient shows the immediate increase in outcome following the intervention. A positive coefficient suggests that enrolment and/or graduation rates have risen. The coefficient for time since treatment reflects any changes in trend after the intervention.

The time series plots the values of numerical variables on the Y-axis and the associated periods on the X-axis (Levine, 2016). The structural breaks are identified through both graphical and unit root processes (as discussed later).

The break ends are identified by examining the series graphically using a semi-log scale (Mohr, 2014). A change in policy could influence the econometric regression, which should show differences before and after the changes- such as ups and downs in time series-indicating a structural break at the policy's effective year. Thus, semi-log scale visualisation and graphical analysis are used to examine if a structural break exists, comparing baseline data before the policy and data after the policy implementation (follow-up) in 2008/09. A structural break needs to be generated from the baseline PPC data, and the new 70/30 policy introduced in 2008/09. If the variability changes, the process may be non-stationary, which can be detected through logarithm transformation.

Time-series plots can assist in understanding trends in data that occur over time (Levine et al., 2016). A random walk with or without drift trends either upwards or onwards, indicating non-stationarity. A random walk with drift is non-stationary because both its anticipated value and its spread change over time. This study aims to use a time series econometric model to analyse the policy effect on enrolment and completion rates across different fields of study over the past 14 years (observations). Specifically, the policy effect on enrolment and graduate completion is assessed by comparing the ratio or quota of macro and micro policy (input) with the enrolment and graduation (output). The comparison also includes the macro policy of 70:30 (S&T versus SS) and among the micro policies. The research employs visualising parameter estimation to analyse the data.

5.10.2.2.2 Model specification

Many scholars and educators usually use intervention time series analyses as a standard statistical method to assess the impact of an intervention-usually a planned policy change on a series of relevant outcome indicators. Understanding past outcomes and policy effects is part of the modelling of time series. Econometric models are usually for policy purposes (Porter, 2009) and to the extent that econometrics can illuminate the impact of policy (Studenmund, 2015). Primarily, Mohr (2014) claims that structural analysis and policy simulations, which estimate the potential effects of specific policy measures, employ many of

these models. Accordingly, the econometric model analysis was used to determine the policy effect not only on policy implementation in HEIs but also on enrolment and graduates. Thus, applying the time series modelling procedure allows for completing the original models and simply re-estimating model parameters to account for the new data.

A time series econometric model analysis is employed to assess the effect of the policy on enrolment and graduates. Thus, the model requires non-stationary data for analysis, as a random walk model must be used, with the data-generating process parameters changing in 2008/09. Another reason is the introduction of the 70:30 policy in 2008/09, which would lead to behavioural changes in the data series once the new policy takes effect. Consequently, this assumes a non-stationary time series. Since the policy was implemented in 2008/09, it has affected enrolment and graduates because the parameters of the data-generating processes changed in 2008/09 and 2010/11, respectively. After the policy was introduced in 2008/09, each macro and micro policy should have anticipated consistent values and distribution over time in line with the policy quota.

Multiple regression model

One possible use of a regression equation is to assist in determining (Studenmund, 2015) which independent variable has the most significant effect on the dependent variable. The multiple regression model was used to analyse the relationship between the dependent variable (enrolment) and the independent variable (policy). This model specifies how much the policy is implemented based on the quota and the formulated ratio. The multiple linear regression model was designed to examine the implementation of macro and micro policies. To compare variables, it is essential to use standardised coefficients, not the unstandardised ones (Pallant, 2016), because these are standardised; we can compare them (Hinton et al., 2014). An unstandardised regression coefficient for β, denoted by β, indicates the average change in Y for

a one-unit change in X, accounting for other variables. A standardised regression coefficient is obtained from regressing standardised Y on standardised X. The standardised variable can be calculated by subtracting its mean from the observed value and then dividing by the standard deviation. A standardised regression coefficient thus represents the mean change in Y, measured in standard deviations of Y, associated with a one standard deviation change in X, while controlling for other variables. This means that standardised regression coefficients can be derived from their corresponding unstandardised coefficients by dividing by the standard deviation of Y and multiplying by the standard deviation of their respective variable. Gujarati (2004) elucidated that regression models use k regressor variables X1, X2, X3, and Xk to predict Yt. For regression results, it is essential to standardise all variables, both dependent and independent. Therefore, the relationship between the macro policies is the independent variable, and the enrolment rate is the dependent variable.

ER= β1 S&T + β2 SS +*E*……..*2*

Where ER is the enrolment rate or graduation rate, Bs are coefficients, S&T and SS are policies, and *E* is the error term.

The model specification of micro policies is based on the formulated micro policies/programmes to provide HRs for each economic sector of the country. The micro policies are independent variables, whereas the enrolment rate is the dependent variable.

ER= β1 E&T + β2 NCS+ β3 MHS+ β4 ANRS+ β5 B&E + β6 SHS + E……3

Where ER is the enrolment rate (dependent variable), Bs are coefficients, micro policies (E&T, NCS, MHS, ANRS, B&E, and SHS) are independent variables, and *E* is the error term. These micro policies are also predetermined variables.

ARIMA models

A specific ARIMA model with input series is an intervention analysis along an ITSD. In time series analysis, such as ARIMA, we must consider not only the magnitude of the effect but also other factors. The time series model procedure

estimates exponential smoothing, univariate ARIMA, and multivariate ARIMA (or transfer function models), and produces relevant estimates. ARIMA models provide a more formal statistical basis for estimating parameters (Becketti, 2013). ARMA models represent stationary series, whereas ARIMA models represent non-stationary series. Understanding the sources of non-stationarity has policy implications (Levendis, 2018). The intervention time series analysis evaluates the impact of planned policy changes on enrolment and graduation in HE. According to Hyndman and Anthanasopoulos (2014), exponential smoothing and ARIMA models are the two most common approaches to time series analysis and offer complementary methods. The researcher has selected the time series model because it accounts for both exponential smoothing and ARIMA. ARIMA corrects for autocorrelation in the time series.

ARIMA models are more sophisticated than simpler filters and trend regressions, and under appropriate circumstances, these modern models provide superior forecast accuracy (Becketti, 2013). The Box-Jenkins procedure involves ensuring that the estimated residuals are white noise (0, 0, and 0). The Box-Jenkins approach recommends modifying the model, re-estimating it, and re-examining the like the model analysis used by ARIMA to understand the impact of policies on enrolment and graduation. We should recognise that a discrete change in the effect of the parameters on enrolment and graduation occurs at a certain point. Since a new 70:30 policy has been anticipated, a structural break in 2008/09 suggests the series is non-stationary. The 70:30 policy should therefore be associated with at least a breakpoint or structural break in 2008/09. Data prior to 2008/09 are used as a baseline, and the data after the policy are used for follow-up analysis. Intervention analyses are employed when we wish to precisely measure the impact of an intervention or to estimate the series considering the intervention's effect (Makridakis et al., 1998). A stationary process, which requires no differencing, is denoted as I (0), while differencing is indicated as I (1) and I (2). In this research, I (1) is assumed. In practice, most series are I (0), I (1), and occasionally I (2), following the Box-Jenkins methodology (Dougherty,

2011). Therefore, the original series is modelled as ARIMA (p, d, q), where d represents the number of differences needed to achieve stationarity. ARIMA is an advanced model used in time series analysis, such as examining policy changes and their impacts. It involves defining a custom model with explicitly specified autoregressive and moving average components, along with the degree of differencing. The policy intervention occurring at the effective date, or around 2008/09, can be represented by a dummy variable.

$$Xt = \begin{cases} 0 & \leq \\ 1 & \geq \end{cases} \quad \text{.....4}$$

Where 0 is before the intervention, and 1 is after the intervention (Makridakis et al., 1998). Likewise, 0 is before, and 1 is after the 70:30 policy. This can assist us in identifying the stationarity and non-stationarity of the variables and interpreting their implications for the policy effect on enrolment and graduation.

The random walk model is widely used for non-stationary data (Hyndman & Athanasopoulos, 2014). We can specify the model to examine the effect of the intervention using a dynamic regression model; the impact may be instantaneous, or it may spread over time (Makridakis et al., 1998). As Studenmund (2014) notes, a random walk model is non-stationary because it can wander up and down without an inherent equilibrium and without approaching a long-term mean of any sort. A random walk model is a case of what is known as a unit root process (Wooldridge, 2013).

ARIMA model (0, 1, 0) is the function form of $y_t = y_{t-1} + \varepsilon_i$……**5**

A special one known as the Random Walk model. From a policy perspective, it is often difficult to understand whether an econometric time series is highly persistent (Wooldridge, 2013). Time-series econometric model analyses were used to identify the best type of model for each macro and micro-policy to examine the effect of the policy on enrolment and graduation before and after.

The researcher applied the time series model to find the best-fitting model for each macro and micro-policy. Modellers can determine the best-fitting model for each policy. The researcher can identify independent variables (both macro and micro policies) included if they are statistically significant with the dependent variable (enrolment and graduation in the public university). Model variables are transformed where appropriate using differencing and square root or natural log transformation. AR and MA are two widely used linear models that work on stationary time series, and I have a pre-processing procedure for stationary time series if needed.

Intervention models disclose the effect of an intervention; they assist in accuracy estimates after an intervention (Makridakis et al., 1998). If there is an intervention effect to be estimated by identification, the ARIMA model is the best based on the data collected before the intervention. Thus, advanced models are considered to assess the policy effect on enrolment in the HEIs. The time series modeller can also identify the type of ARIMA, like the Random Walk (0, 1, 0) model and the standard notation of ARIMA (p, d, q) (P, D, Q) m,

p-the number of autoregressive terms- the number of lag observations included in the model (the lag order).

d-number of differencing (or integration)- the number of times raw observations are differenced as the degree of difference.

q-the number of moving average terms- the size of the moving average window (order of moving average).

m-refers to the number of periods in each year (number of observations per year), and

P, D, Q represent the (p, d, q) for the seasonal part of the time series and their seasonal counterparts.

The number of differencing (d): The equation for differencing (d) or integration (I) follows. Differencing raw observations is used to make the time series stationary. That is, a systematic change in slope and variance. Let *Y* denote the *original* series and d denote the *difference* of Y, which means:

No difference (d=0): yt = yt……6

First difference (d=1): yt = Yt - Yt-1……..7

Second difference (d=2): yt = (Yt - Yt-1) - (Yt-1= Yt - 2Yt-1 + Yt-2……8

Moving Average (MA): The number of moving averages is ordered in the model. This is a time series model, which uses past errors as an explanatory variable. A model that uses the dependency between an observation and a residual error from a moving average model is applied to lag observations. Let (t=1, 2, 3...) be a white noise process, a sequence of independently and identically distributed (iid) random variables with E (iid)=0 and Var (ut) = u2. Then the qth order q model provided as

$$Y_t = \mu + u_t + \Theta_1 U_{t-1} + \Theta_2 U_{t-2} + \ldots\ldots\ldots \Theta_q \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

Auto-Regression (MR): Autoregressive orders specify which previous values from the series are used to predict current values. A model uses the dependent relationship between an observation and some lagged observations. An autoregressive model of order MR (p) needs to be as follows:

$$Y_t = c + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \ldots + \alpha_p y_{t-p} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 10$$

The critical point to note is that to employ the Box–Jenkins methodology, we must have either a stationary time series or a time series that is stationary after one or more differencing.

Exponential Smoothing Models

ESM was proposed in the late 1950s (Brown, 1959; Holt, 1957; and Winters, 1960 are key pioneering works) and has motivated some of the most successful forecasting methods (Hyndman & Anthanasopoulos, 2014). The trend is linear when the variable changes at a constant rate over time. Econometric time series have a better-approximated trend, which occurs when a series has the identical average growth rate from period to period (Wooldridge, 2013). Exponential smoothing specifies a custom ESM. Forecasting using exponential smoothing methods is a weighted average of past observations, with a weight decaying exponentially as the observations are older (Hyndman & Anthanasopoulos, 2014). The exponential model is linear. In practice, Wooldridge (2013) states that

an exponential trend in a time series is captured by modelling the natural logarithm of the series as a linear trend. Identifying the type of ESM, such as Holt or Brown, is essential for time series modelling. These methods involve fitting a curve to the historical data of a given time series. Some models include single exponential smoothing, Holt linear, and Holt-Winters variations. To capture an exponential smoothing trend in the time series, the natural logarithm of the series is typically modelled as a linear trend. In the case of Holt and Brown's models, the enrolment time series data demonstrates exponential smoothing, indicating no effect of the policy (no structural break) on enrolment in the HEIs.

On the other hand, the enrolment time series is stationary. There are three techniques for exponential smoothing: simple (Brown), double (Holt), and triple (Winters). Before developing a model, it is crucial to understand the existing data on enrolment. Depending on the data's characteristics, models like Brown, Holt linear, or Holt-Winters trend can be used.

Brown model: The Simple Exponential Smoothing method, developed by Brown, is a computationally efficient method used when historical data patterns do not exhibit cyclic variation or trend. This method uses one actual past value and one predicted past value to generate a smoothing curve. The Brown ESM is suited to model a time series with a trend; nevertheless, without seasonality. Brown's linear trend model is appropriate for a series that has a linear trend with no seasonality, and its smoothing parameters are level and trend, which are assumed equal. As to Hyndman & Anthanasopoulos (2014), the simplest form of an exponential smoothing formula is provided by:

$$\hat{Y}T+1/T= \alpha yt+ \alpha (1- \alpha) YT-1 + \alpha (1- \alpha)^2 YT-2+ \alpha (1- \alpha)^3 YT-3 \ldots\ldots\ldots\ldots 11$$

Where $0 \leq \alpha \leq 1$ is the smoothing parameter, T+1 is a weighted average of all the observations in the series Y1…...YT. The rate at which the weights decrease is controlled by **α,** and **α is** a smoothing factor of the data.

According to Wooldridge (2013), $0 \leq \alpha \leq 1$ is a parameter we select. Exponential smoothing is used for forecasting because the weights on the lagged Y decline

to zero exponentially. A value close to 1 indicates the most recent values influence the forecasts, whereas a value close to 0 indicates that past observations have an enormous influence on the forecasts.

We can assign the smoothing weights α1, α2…, to the immediate past actual demands, Xt, Xt-1, Xt-2…., where 0≤αt≤1 for each t and α1, α2+

Holt Model: Holt (1957) extended simple exponential smoothing to forecasting data with a trend (Hyndman & Anthanasopoulos, 2014). Holt's linear trend model is appropriate for series with a linear trend and no seasonality, and its smoothing parameters are level and trend, which are not constrained by each other's values. This method involves an equation and two smoothing equations (one for the level and one for the trend).

Level equation is ℓt= αyt+(1- α) (ℓt-1+ bt-1) ……14

Trend equation is bt=β (ℓt-1+ℓt-1) +1- β) bt-1…… ……15

Where ℓt denotes an estimate of the series level at time *t, bt* denotes an estimate of the trend (slope) of the series at time t, and α is the smoothing parameter for the trend, 0≤β≤1.

Regression Discontinuity Design

The purpose of RDD is to evaluate the effect of policy intervention on public university enrolment. Emphasis has been placed on employing random assignment studies to evaluate educational intervention approaches of widespread interest. One such approach is RDD (Jacob & Zhu, 2012). The estimated impact, if valid, only applies to the observations at or close to the cut-point (Jacob & Zhu, 2012). Researchers usually conduct RDD in the context of educational evaluation programmes and policies. In this model, we can employ visual graphics analysis and estimation to assess the effectiveness of the policy on enrolment in HE. As previously mentioned, the conventional parametric approach utilises all available observations to estimate treatment effects, relying on a specific functional form for the enrolment relationship. The equation below offers a straightforward method to operationalise this estimation procedure.

$Y_i=\alpha+\beta_0 Tr+f(Z_i)+E_i$.....16

Where:

α= is the average value of the enrolment for those in the treatment group under the policy placement after introducing the policy for the rating variables

Yi=the enrolment measure for the observation

Ti= 1 if observation i is assigned to the treatment group after the policy is introduced and 0 before the policy

ri= the rating variable for observation i, cantered at the cut-point.

*E*i= a random error term for observation i, which is assumed to be independently and identically distributed. The function f(ri) represents the relationship between the rating variable and the enrolment outcome. Various functional forms can be explored to ascertain the best fit for the data, thereby minimising bias. Following the policy introduction, a consistent enrolment ratio is anticipated across all macro and micro policy environments; nonetheless, the subsequent models can be examined in the parametric analysis of the RDD. Where the rating is centred at the cut-point and all variables are defined as the first equation of RDD. The first, third, and fifth models fix the slope of the enrolment outcome and rating relationship to be the identical on both sides of the cut-point. In contrast, the second, fourth, and sixth models allow for a disparate polynomial function of rating on each side of the cut-point. The interaction between the rating variable and the treatment accounts for the possibility that the treatment affects the intercept and the slope of the regression line. The policy introduced in 2008/09, maintained the identical ratio for each macro and micro policy, suggesting linearity post-policy implementation. This consideration is crucial when the analysis includes data far from the cut-point or when the relationship between enrolment outcome and rating is non-linear. However, allowing the slope to vary on either side of the cut-point while adding complexity, can also diminish the analysis's power.

Two types of RDD: Sharp and fuzzy designs exist. In Sharp, all subjects receive their assigned treatment or control condition and the fuzzy design, which some subjects do not (Jacob & Zhu, 2012). In 2003/04, a new curriculum of HEIs was

introduced and implemented, that is, PPC (enrolment as a control group), and in 2008/09, the new policy of 70:30 was introduced (enrolment as a treatment group). Stata version 14 was utilised to run the RDD and graphical presentation.

Sharp design: $Y_i=\beta_0+\beta_1+D_i+ f (Z_i)+ E_i$.....17

Yi is the outcome for individual *I*, and **β1** is the average treatment effect. To control for differences between the treatment (after the policy) and control individuals (before the policy) away as their distance from the discontinuity point, we control for a function of the forcing variable (Zi) as f(Zi) in the estimation. The control group consists of individuals enrolled in public universities before the policy, while the treatment group consists of individuals enrolled after implementing the 70:30 follow-up policy. Since the 70:30 policy was implemented in all public universities commencing in 2008/09, a sharp design was employed in this thesis**.**

Triple Difference-In-Difference Model

DID is the most widely used method to evaluate the effects of policy interventions with observational data. DID is used to estimate the effect of the policy. The DID model includes participants before programme implementation, non-participants before and after programme implementation, and non-participants after programme implementation. The purpose of the advanced Triple-DID model is to evaluate the effect of policy intervention on the enrolment of students. DID models make use of pre-treatment and post-treatment outcomes for subjects affected by a policy change that is not, or less affected by, the exact change. This model type is particularly applicable if a policy intervention is in specific regions, like the 70:30 policy in Ethiopia. DID, at a minimum, one must observe participants and non-participants at two points in time before and after the follow-up 70:30 policy. Although we have participants and non-participants both before and after the initiation of a programme, it is critical to empirically differentiate even before the programme commences. Thus, our sample was four groups: the control group before the change, the control group after the change, the treatment

group before the change, and the treatment group after the change (Wooldridge, 2013).

DID is designed to compare changes over time in treatment and control outcomes. The two groups and two periods, with a sample of data from the population enrolment, are used to estimate DID policy effects. The DID compares the changes in enrolment over time between a population enrolled in a programme as a treatment; control groups before the policy in the public universities enrolment that is not treated (the comparison group) before and after the policy enrolment in the private universities. A natural experiment always has a control group, which is unaffected by policy change, and a treatment group, which is thought to be affected by policy change (Wooldridge, 2013). The triple-DID design extends the basic DID cover above to multiple groups and for several periods. The researcher can compare three groups. The outcome *Yigt* for an individual *i* at time t in group g (treatment or control) and subgroup (s) denoting participation in the policy itself:

$E[Yigt|G, S, t] = \alpha g + \pi s + \Theta t + \beta 1G + \beta 2S + \beta 3t + \beta 4GS + \beta 5\ Gt + \beta 6St + \beta 7GSt$……18

Where *E* represents the enrolment; αg represents group-level time-invariant 'fixed' effects; πs represents time-invariant effects between participating and non-participating in the policy; Θt represents period fixed effects; G is indicator variable for the public university treatment (=1) or private university control (=0) groups; S is an indicator variable for the participant/enrolment in the policy (=1) or non-participants (=0)group; t is indicator variable for baseline (=0) or follow-up of the policy (=1) measurements (t the treatment variable where 1 is after the intervention and 0 is before the intervention that is the time variable yearly enrolment from the commence of the observation period of effective in 2008/09). To do so, nineteen observations on enrolment from 1998/99 to 2016/17 were collected.

The following are the regression coefficients (βs) required for estimation: The enrolment variable is represented as E.

- β1 represents the slope of the line before the intervention.
- β2 represents the immediate effect after the intervention.
- β3 represents the sustained effect, which is the difference between the slope of the line before the intervention and the slope of the line after the intervention.
- β4 represents the baseline difference between the treatment and control groups.
- β5 represents the slope difference between the treatment and control groups before treatment.
- β6 represents the baseline difference between the treatment and control groups associated with the treatment.
- β7 represents the difference between the sustained effect of the treatment and the control group after the treatment.

The coefficient β7 provides the average treatment effect of the policy intervention on enrolment from the treatment public university, compared to the control enrolment from the control private university. The two groups and periods, and with a sample of data from the population enrolment, the DID estimates of policy effectiveness can be written as follows:

DID= (ýs=Treatment, t=After–ýs=Treatment, t=Before) – (ýs=Control, t=After–Control, t=Before)

……19

Where *y* is the outcome variable, the bar represents the average value (averaged over individuals, typically indexed by i), the group is indexed by *s* (because in many studies, policies are implemented at the state level), and *t* is time. With before and after data for treatment and control, the data is divided into four groups, and the above double difference is calculated. The DID is the most frequently used effective evaluation methodologies. It compares the changes in outcomes over time between a population that is enrolled in a public university (the treatment group) and a population that is enrolled in a private university (comparison group).

Logistic regression model

First raw data regarding employment status were collected from the MoE, especially HESC. For identifying significant determinants of the employability of graduates, a logistic regression model was used. Mainly, binary and multiple logistic regression models were carried out to examine the effect of the policy on the employment of the graduates. To do so, graduates' employment status is considered a dichotomous variable coded as 1 & 0:

$$Y_i = \begin{cases} 1 & \text{if } i^{th} \text{ graduate is not employed} \\ 0 & \text{if } i^{th} \text{ graduate is employed} \end{cases}$$

Where i = 1, 2, …n, and n is the sample size. The independent variables (called factors) that are anticipated to affect graduates' employability are represented as $X_1, X_2, \ldots, X_k$. The vector of factors for the i^{th} individual is given by:

$$X_i = (x_{1i}, x_{2i}, x_{3i} \ldots, x_{ki}) \qquad i = 1, 2, \ldots, n$$

The probability that the i^{th} graduate is unemployed/employed given his/her individual, household, institutional, etc. characteristics (X_i) is called the response probability and is given by: ($P_i = Prob(Y_i = 1 \mid X_i)$). Similarly, the non-response probability is defined as: $1 - P_i = Prob(Y_i = 0 \mid X_i)$.

In the logistic regression model, the response variable is the natural logarithm of the ratio of the odds Y_i=1 against Y_i=0 (or log-odds). These log-odds are a linear function of the explanatory variables:

$$\ln\left[\frac{P_i}{1 - P_i}\right] = \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} + \varepsilon_i$$

The selection of the dependent (employment versus unemployment) and explanatory variables (age, gender, policies) was based on descriptive statistics and relevant literature.

Correlation analysis

A Pearson product–moment correlation analysis was conducted to examine the relationships between graduate employment status and placement in macro and micro fields of study. The variables included unemployed graduates, employed graduates, placement outside the first-choice field of study, and placement within the first-choice field of study.

5.10.2.2.3 Unit Root Testing

A change in educational policy in 2008/09 could influence enrolment and graduation. Unit root testing is essential for policymakers and academics alike to assess policy change and its implications (Levendis, 2018). Two forms of non-stationarity are unit roots and structural breaks. Hence, the unit root tests verify the stationarity and non-stationarity of the variables to examine the policy's effect on enrolment and graduation. Thus, the unit root process is non-stationary. If the policy does not exhibit a unit root, the trend is stationary. A random walk is a unique case of what is known as a unit root process (Wooldridge, 2013). The process is known as a random walk with drift, which refers to the systematic change in the anticipation from one period to the next (Dougherty, 2011). Thus, the effect of the 70:30 macro and its micro policy on enrolment is required to be assessed using a random walk model with drift (in 2008/09). The policy effect on graduation as well. The drift method is either to increase or to decrease over time, where the amount of change over time (the drift) is the average change observed in the historical data. It is anticipated that there is integration and a difference in a systematic change (for the enrolment) at the policy introduction point in 2008/09. In the analysis, the researcher considers AR processes without zero means, non-stationary processes, and deterministic trend processes. However, the anticipation is a random walk with drift. The trend stationary process (non-stationary without a unit root) and the difference stationary process (non-stationary with a unit root) are included in the unit root test.

The unit root is to test the random walk (non-stationary)

H_0: $y_t = y_{t-1} + \varepsilon_i$,…..20

The alternative non-unit root is to test for stationarity

H_A: $y_t = y_{t-1} + \varepsilon_i$,.....21

The unit root test indicates non-stationarity, particularly a random walk, while the alternative non-unit root test is a stationary process. Under the unit root test (non-stationary), the relevant coefficient value is β1=1 and y0=0. Moreover, this research considers random walk processes with and without drift. Principally, *d*=0 or I (0) and *d*=1 or I (1) or I (2) were used to identify the stationary and non-stationary, respectively. This transforms the relevant coefficient value from β1 = 1 to β1 = 0, so that we can test the unit root test. A compares *d* unit-roots with the alternative *of (d-1) unit-roots.* Under the alternative, the generating data process is stationary, such as /β1/<1 and y<0. The non-unit root test is H0: α=0, and β=0 against the alternative HA: α≠0; and β≠ 0, and α=0, and α≠0 using the likelihood ratio test. A test of a random walk model versus an alternative of a random walk with a drift model test whether β0 = 0 against the alternative that β0≠ 0. Testing between random walk and deterministic trend models involves joint tests of several parameters. The zero-mean stationary (β0=0 and /β1/ <1) and non-zero-mean stationary (β≠0 and /β1/<1). The random walk with drift (β1≠0 and β=1) and without drift (β0=0 and β1=1). A random walk process and a zero-mean AR (1) process are both nested by the overarching model.

The structural break is one of the tests of unit roots. A structural break occurs when there is a significant change in government policy, which is one such event. The structural break was assumed in 2008/09. Structural breaks need to understand the stationarity of data generated from two different processes, including PPC before the policy and a new 70:30 policy follow-up. There would have been two stationary processes (PPC is stationary, and 70:30 is another stationary process), which together amount to a non-stationary process.

5.10.2.2.4 Diagnostic Testing

Multi-collinearity: When our predictor variables are highly correlated, we have what is referred to as multi-collinearity (Hinton, 2014). A closely related issue is multi-multicollinearity, which occurs when two or more of the predictor variables in multiple regressions (Hyndman & Anthanasopoulos, 2014) provide similar

information. When predictor variables are very highly correlated, we must wonder whether they are not measuring the same thing and would improve and combine into one new variable (Muijs, 2004). The predictors are highly correlated with each other (that is, they have a correlation coefficient close to +1 or -1). In the time-series process, the independent variable is neither constant nor a perfect linear combination of the others (Wooldridge, 2013). The researcher has verified the possibility of multicollinearity using the Variance Inflation Factor (VIF) and Tolerance.

Autocorrelation: Autocorrelation is the violation of the classical assumption that disparate observations of the error term are uncorrelated with each other (Studenmund, 2015). It occurs most frequently in time series data sets (Studenmund, 2014). Autocorrelation is the relationship between successive values of the disturbance term. Autocorrelation is associated with the variance of the estimators; nonetheless, it does not affect estimation. In essence, serial correlation implies that the value of the error term in one period depends systematically on the value of the error term in another period (Studenmund, 2015).

If X follows an MA (1) process, then Xt and Xt−1 will be correlated, but Xt will not be correlated with Xt−2, nor with longer lags of X

MA (q) process: Xt =ut +β1ut−1 +β2ut−2

+⋯+βqut−q……22

The researcher tested the autocorrelation, using the Durbin-Watson d-test.

$$d = \sum_{t=2}^{n=} (et - et - 1)2 \qquad \sum_{t=1}^{n=} et2$$

Where:

$$et = residual\ at\ time\ t$$
$$n = nuber\ of\ observations$$

Heteroscedasticity: The relationship between the disturbance term and the independent variable is heteroscedastic. The observations are scattered over the regression line. The plot is one remedy for heteroscedasticity. The natural logarithmic transformation and plots are remedies. Data transformation involving the application of the natural logarithm to enrolment and graduation rate values

addresses heteroscedasticity and facilitates growth comparisons. If the time series is stationary, it has no heteroscedasticity. In addition, RDD was employed.

Spurious: In the presence of non-stationarity, there might be a spurious regression. Regression among non-stationary variables may be spurious. Fortunately, adding a time trend eliminates the spurious regression issue. A time trend in the regression model is also one of the remedies for spuriousness (Wooldridgies, 2013)**.** To do so, the time trend for RDD and DID extends between 1998/99 and 2016/17. Time trend regression was also employed.

Diagnostic testing of ARIMA: Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plots were used to examine the diagnostic model of ARIMA using SPSS. These are powerful in analysing the stochastic process of a time series. The ACF and PACF plots were used to test each macro and micro policy.

Measurement of errors: Root Mean Squared Error (RMSE), confidence intervals, and residual error were used for measurement of errors.

5.10.3 Qualitative Data Analysis

The ATLAS.ti 8 software package was used to analyse the qualitative data (KII) by identifying categories, codes, nodes, quotations, and networks. The researcher followed the general procedure of qualitative methods, starting from data collection, preparation, visualisation, analysis, and storytelling. The qualitative analysis focused on relevance, outcomes, implementation, and policy implications. Additionally, the policy effect on graduates' employability, including their skills, was considered. The supply and demand of HR for different sectors of the economy-coding, categorising, and memo writing-was one of the issues (Saldana, 2013). According to Lindlof & Taylor (2019), during data analysis, the qualitative researcher aims to advance in three areas: data management, data reduction, and conceptual development. Data reduction, display, and interpretation were addressed in the analysis. The stages of qualitative data analysis include open coding, axial coding, and selective coding (Curtis & Curtis, 2011). Visualising coding is part of the analysis process. In thematic coding, the

interviews were analysed through open coding (identifying initial themes), axial coding (focusing on coded themes, such as interviews with various deans of faculty, employers, professional associations, and key figures in HEIs), and finally, selective coding.

Advanced qualitative data analysis was conducted using ATLAS.ti 8. In the open coding, an attempt was made to organise the masses of data into categories and themes and assign initial codes, like writing a preliminary code (utilise colour, for instance, the diverse interviewees of HR units of organisations and institutions) and link the analytic memo writings. In this qualitative analysis, data visualisation, data analysis, and storytelling were carried out. The qualitative analysis network was conducted in terms of links and network among the codes, categories, and quotations. Similar codes were merged and renamed. Once made categorised, code networked and/or code linked in terms of similarities (is associated with, is part of, causes of) and differences-coding and sub-coding occurrence (contradicts**,** causes of, is part of). Quotation and hyperlinked quotation (justify, discusses, continues by, contradicts, and criticises) are analysis techniques of the qualitative part.

The researcher used specific steps and/or stages of ATLAS.ti qualitative data analysis. Open or in vivo coding was used in the first stage to consider small data segments in detail and compare them. In the second stage, similar codes were grouped and merged into higher-order categories, continually compared and revisited using the manager function to group the codes under themes. The third stage involved using the network-construction function and selective coding to search for theme relationships. Network diagrams were created to assist in finding patterns and relationships in the data. In the fourth step, diverse types of cause-and-effect relationships between the themes were explored and elucidated. Relationships in the data were elucidated through the creation of code and sub-code networked hyperlinked quotations in ATLAS.ti.

5.11 Validity, Reliability, Rigour and Trustworthiness

Reliability and validity of the quantitative method: The researcher utilised various sources of data available from the MoE, including EMIS, ESAA, the entrance examinations of HEIs, and NEAEA. Despite efforts to cross-check using these diverse sources of data, some inconsistencies were encountered, as mentioned in the limitations section. The consistency verification was conducted for enrolment and graduation over time, cross-verifying and triangulating data from diverse sources (from the MoE and each university), which is often referred to as reliability and is an aspect of accuracy. The researcher paid close attention and care to the interpretation and processing of statistical data from EMIS and ESAA, ensuring the appropriateness of the statistical data for this research. The comparison of enrolment in public (treatment group) and private (control group) universities over time before and after the policy, using all census data, allows the researcher to have internal validity and generalise the findings, and draw a comprehensive conclusion.

Rigour and trustworthiness of the qualitative method: The interview guide was demonstrated to the supervisor to ensure the questions were appropriate for collecting relevant information. More importantly, the quality of the qualitative data aimed to ensure rigour and trustworthiness (credibility, dependability, transferability, confirmability, and authenticity). During the interview, the interviewer remains neutral (Curtis & Curtis, 2011).

5.12 Ethical Consideration

This study obtained ethical approval certificates from the UNISA Department of Development Studies. The ethical issues addressed in this thesis include the privacy, anonymity, and confidentiality of respondents' information and data providers. Furthermore, the data were collected in accordance with the principles of volunteerism. Not recording names but instead using a code to identify participants should protect the interviewees. All instruments involved a statement of informed consent to the participants, detailing the purpose of the study and

stating that participation is voluntary and would not affect their access to information and data.

Summary

A relevant methodological approach was used to analyse the implications of HEP for providing HR to various sectors of the economy. Primarily, a policy analysis approach was employed. A mixed-method approach, especially an embedded design type, along with evaluation research, was used to do so. Time samples of enrolment and graduates were analysed. All universities (implementers) of the 70:30 policy were included in the study. These are the sources of existing statistical data on enrolment and graduation. Additionally, enrolment figures from public and private universities were compared for a broader analysis. Meta-analyses of tracer and alumni studies were collected and analysed to assess graduate employability. Policy KIIs were integrated into the quantitative approach. Analyses were conducted using graphs and data visualisation, along with descriptive statistics, a time series design, trend analysis, and a natural logarithm transform graph. A time series econometrics model (ARIMA, RDD, DID, Pearson correlation, multiple and logistic regression, and exponential smoothing) was used to meet the study's objectives. Before analysing the time series econometrics model, diagnostic tests were performed.

CHAPTER SIX

RESEARCH FINDINGS AND DATA ANALYSIS

6.1 Introduction

The previous chapter outlined the methodological framework used for gathering and analysing data. The methodology explained that quantitative administrative data (enrolment and graduates) were collected from the MoE (ESAA), NEAEA, and public HEIs. Panel data on enrolment in private universities (control group) was compared with enrolment in public universities (treatment group) before and after the policy. Alumni study reports, were collected from the MoE and public universities to analyse the policy's effect on the employability of graduates. Qualitative data in the form of KIIs was stakeholders at federal and institutional levels. A concurrent data collection approach was conducted used inclusive analysis. The data were organised and presented to facilitate analysis.

The findings and data analysis are assessed against the established indicators and evaluation criteria to address the research objectives and/or answer the research questions raised in Chapter 1. Quantitative data analysis, followed by qualitative data analysis and findings. A summary of the triangulation of the quantitative and qualitative findings. Time series quantitative data were analysed using SPSS and Stata, followed by the analysis of qualitative data using ATLAS.ti, culminating in a summary of the findings for each objective/research question, including the analysis methods and techniques utilised in this study.

The first section examines the evidence concerning the findings and data analysis for the relevance of the 70:30 policy for HRD in Ethiopia. The second section analyses the extent of the 70:30 policy implementation in. The third section analyses the outputs of the 70:30 policy in supplying HR to disparate sectors of the economy in Ethiopia. The final section presents the outcomes of the 70:30 policy's effect on the employability of graduates.

6.2 Findings and Quantitative Data Analysis

This section reports on quantitative data analysis of the policy to address the objectives and/or answer the research questions and their implications. Some research questions were raised in Chapter 1 for the quantitative-causal-comparative analysis using SPSS and Stata to examine the cause and effect of the policy. The analysis is organised first by discussing the characteristics of the sample, followed by the findings and analysis of the study, which are centred on the objectives of the study.

6.2.1 Characteristics of the Sample

Tables 1, 2, and 3 illustrate postgraduate and undergraduate enrolments, graduates, and gender distribution across disparate domains from 2003/04 to 2016/17. The 70:30 policy was implemented in government and/or public universities as treatment groups, and enrolment in private universities was the control group. The Tables highlight the characteristics and demography of study sample. PPC was a control group, and the 70:30 policy was a treatment group. Time samples for enrolment and graduation were used. Stratification was based on public and private universities, gender, macro policy (S&T and SS) and micro policies (E&T, NCS, MHS, ANRS, B&E, and SHS), and Generation University (1st, 2nd, and 3rd).

Time sample for enrolment: The time sample was required because the study was a time series design. In 2003/04 and 2008/09, a PPC and 70:30 policy was introduced and implemented. The period covered the PPC (2003/04 to 2007/08) and 70:30 policy (2008/09 to 2016/7) follow-up. The PPC was the baseline, and 70:30 was the follow-up policy. Table 1 shows the sample of the undergraduate and postgraduate enrolment in government and non-government universities (2003/04-2016/17) implications for GER, and from 1998/99 to 2007/08 as a baseline data before-policy and after policy 2008/09 to 2016/17 follow-up policy for DID analysis.

Table 1: Undergraduate & postgraduate enrolment in government & non-government Universities (2003/4-2016/17)

Undergraduates Enrolment in Gov't and Non-Government Universities						Postgraduate Enrolment in Gov't and Non-Government Universities				
Year	Male (No)	Female (No)	Total	Male(%)	Female(%)	Male (No)	Female (N	Total	Male(%)	Female(%)
2003/04	44657	11415	56072	79.6	20.4	2388	172	2560	93.3	6.7
2004/05	105013	33146	138159	76.0	24.0	3274	330	3604	90.8	9.2
2005/06	130835	43066	173901	75.2	24.8	5746	639	6385	90.0	10.0
2006/07	150530	52869	203399	74.0	26.0	6349	708	7057	90.0	10.0
2007/08	199684	63317	263001	75.9	24.1	6652	703	7355	90.4	9.6
2008/09	219300	89792	309092	70.9	29.1	8979	1146	10125	88.7	11.3
2009/10	286758	133629	420387	68.2	31.8	12569	1703	14272	88.1	11.9
2010/11	326769	120924	447693	73.0	27.0	17368	2782	20150	86.2	13.8
2011/12	355006	139104	494110	71.8	28.2	20478	5182	25660	79.8	20.2
2012/13	387707	166141	553848	70.0	30.0	25208	6096	31304	80.5	19.5
2013/14	413556	180018	593574	69.7	30.3	26266	6341	32607	80.6	19.4
2014/15	475971	253057	729028	65.3	34.7	30704	9583	40287	76.2	23.8
2015/16	512915	265851	778766	65.9	34.1	39621	11900	51521	76.9	23.1
2016/17	506604	281429	788033	64.3	35.7	59450	12895	72345	82.2	17.8
Total	**4115305**	**1833758**	**5949063**	**69.2**	**30.8**	**265052**	**60180**	**325232**	**81.5**	**18.5**

Sources: MoE and Author's computation

Table 2 shows characteristics of the sample of the undergraduate and postgraduate enrolment in government universities (2003/04-2016/17) for an interrupted time series, descriptive analysis, and from 1998/99 to 2007/08 as baseline data before policy and after policy (2008/09 to 2016/17) follow-up policy for RDD analysis.

Time sample for graduates: The time sample for graduates of public universities was another sample. The policy effect on undergraduates is between the graduates of 2003/04 to 2009/10 and the 70/30 policy, which starts from 2010/11 to 2016/17. From 2003/04 to 2009/10, undergraduate graduates are the baseline data, and from 2010/11 to 2016/17, undergraduate graduates under the 70:30 policy are the output. Hence, undergraduate and postgraduate graduates for an ITSD and descriptive analysis. However, policy enrolment was used for multiple regression analysis from 2008/09 to 2016/17.

Table 2: Undergraduate and Postgraduate Enrolment in Government Universities (2003/04-2016/17)

Undergraduates Enrolment in Gov't Universities						Postgraduates Enrolment in Gov't Universities				
Year	Male(No.)	Female (No.	Total	Male %	Female(%)	Male(No.)	Female (N	Total	Male(%)	Female (%)
2003/04	62394	15661	78055	79.9	20.1	2335	161	2496	93.5	6.5
2004/05	129667	38265	167932	77.2	22.8	2714	337	3051	89.0	11.0
2005/06	148078	39779	187857	78.8	21.2	5799	582	6381	90.9	9.1
2006/07	124658	40090	164748	75.7	24.3	5900	707	6607	89.3	10.7
2007/08	129347	42349	171696	75.3	24.7	6583	772	7355	89.5	10.5
2008/09	99549	42724	142273	70.0	30.0	9017	1487	10504	85.8	14.2
2009/10	228510	79344	307854	74.2	25.8	11662	1451	13113	88.9	11.1
2010/11	253366	86021	339387	74.7	25.3	18263	2762	21025	86.9	13.1
2011/12	286588	103243	389831	73.5	26.5	20536	4000	24536	83.7	16.3
2012/13	322206	124635	446841	72.1	27.9	24459	5222	29681	82.4	17.6
2013/14	328532	128393	456925	71.9	28.1	22691	4395	27086	83.8	16.2
2014/15	413616	204754	618370	66.9	33.1	21479	9381	30860	69.6	30.4
2015/16	447593	212596	660189	67.8	32.2	36842	9989	46831	78.7	21.3
2016/17	451675	227624	679299	66.5	33.5	57014	11237	68251	83.5	16.5
Total	**3425779**	**1385478**	**4811257**	**71.2**	**28.8**	**245294**	**52483**	**297777**	**82.4**	**17.6**

Sources: MoE and Author's computation

Table 3: Undergraduate and Postgraduate Graduates from Government Universities (2003/04-2016/17)

Undergraduate Graduates in Gov't Universities						Postgraduate Graduates in Gov't Universities				
Year	**Male(No.)**	**Female (No.**	**Total**	**Male %**	**Female(%)**	**Male(No.)**	**Female (N**	**Total**	**Male(%)**	**Female (%**
2003/04	33363	10897	44260	75.4	24.6	670	59	729	91.9	8.1
2004/05	55981	19548	75529	74.1	25.9	1025	101	1126	91.0	9.0
2005/06	60669	19530	80199	75.6	24.4	1139	135	1274	89.4	10.6
2006/07	77346	26621	103967	74.4	25.6	2412	282	2694	89.5	10.5
2007/08	95539	31517	127056	75.2	24.8	2407	326	2733	88.1	11.9
2008/09	66010	31579	97589	67.6	32.4	2249	710	2959	76.0	24.0
2009/10	125351	52339	177690	70.5	29.5	3842	626	4468	86.0	14.0
2010/11	126732	58659	185391	68.4	31.6	4466	698	5164	86.5	13.5
2011/12	131059	69617	200676	65.3	34.7	5043	802	5845	86.3	13.7
2012/13	139482	87557	227039	61.4	38.6	5041	750	5791	87.0	13.0
2013/14	139156	86857	226013	61.6	38.4	5041	750	5791	87.0	13.0
2014/15	69648	24608	94256	73.9	26.1	9019	1669	10688	84.4	15.6
2015/16	74348	42668	117016	63.5	36.5	7346	1505	8851	83.0	17.0
2016/17	87444	34810	122254	71.5	28.5	13804	2672	16476	83.8	16.2
Total	**1282128**	**596807**	**1878935**	**68.2**	**31.8**	**63504**	**11085**	**74589**	**85.1**	**14.9**

Sources: MoE and Author's computation

The macro policies have micro policies of quota to be achieved in the government and/or public HEIs. The trends can guide analysis aimed at addressing HRD gender gaps and the development of macro and micro policies and programme designs to balance enrolment and graduation outcomes.

6.2.2 The Relevance of 70:30 Policy for Human Resource Development

This analysis section aims to determine whether the 70:30 policy is relevant to HRD. HRD includes learners' performance at NLA and/or entrance exams of the HEIs, and their relevant recruitment and the relevance of 70:30 macro and micro policies, which all have implications for HRD. Quantitative analysis includes an assessment of whether the learners have performed at NLA results based on the 70:30 policy, especially to advance S&T/STEM in the HEIs; the learner placement policy aligns with the priorities, interests and preferences of the target group basis for S&T, which in this case are the learners (demand) in the following sections.

6.2.2.1 Students' Performance in National Learning Assessments at HEIs and their Relevant Recruitment and its Implications for Human Resources Development

The performance of learners in the NLA and their entrance exam results for HEIs are critical for effective HRD in supporting the 70:30 policy. The cut-off point for NLA is 50% and above to be admitted into the HEIs. However, Figure 5, spanning from 2008/09 to 2014/15, demonstrates a troubling pattern in NLA performance for public university admissions. Figure 5 illustrates that 43.7% and 45.3% of learners met the half-pass mark in 2008/09 and 2012/13, respectively, with most scoring below yet still gaining admission. This trend is marked among female learners and in crucial subjects (such as physics, mathematics, and English), challenging the 70:30 policy's goal of advancing S & T education in HEIs for a knowledge-based economy. Such a discrepancy poses grave questions about the calibre and readiness of graduates entering the S&T programme, which may jeopardise national HRD goals. Except for the years 2014/15 and 2011/12

(equally), most learners were admitted to HE without meeting the required standards of results of the NLA and the entrance exam of HEIs. Trend data illustrate that most learners were admitted to HE with scores below the standards of the education policy of the country. This poses grave challenges and implications for the advancement of STEM HRD in general in the HEIs.

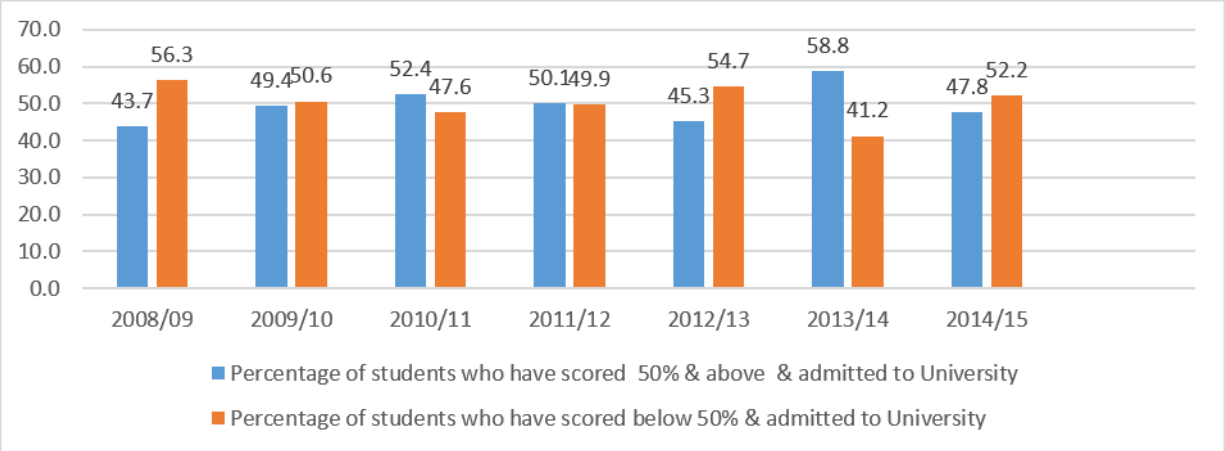


Figure 5: Learners who scored ≥50% & <50% on the Grade 12 entrance exam and admitted to a public university and its implications

Source: NEAEA and Author's computation

For HEIs to supply competent graduates in S&T, entrants (learners) must possess a solid foundation in science and mathematics (STEM) at schools (lower and secondary schools), which requires evidence of analysis of NLA results and the entrance exam of HEIs. The Ethiopian government universities executed a 70:30 ratio policy aimed at developing skilled HR, especially in S&T. The result indicates an urgent need to enhance foundational S&T education not only in the HEIs, but also at lower educational levels of primary and secondary schools, in general lack of quality education, particularly in STEM. Learners were admitted to HEIs, though they scored below the 50% threshold in the entrance examinations of HEIs and the NLA results of NEAEA. Most learners who were admitted to public HEIs, lacked the foundation to advance in S&T in the HEIs. This indicates a lack of quality education in the primary and secondary school, especially in science and mathematics. Since the performance of students at

lower and preparatory schools has implications for the 70:30 ratio in HEIs, especially for S&T. The 70:30 policy allocation of the government policy also has implications for public universities, which have no mandate or autonomy to enrol students in the HEIS.

Table 30 shows that the NEAEA results of learners taking the entrance exam for HEIs, based on gender and micro policies/bands, demonstrate that learners from MHS perform remarkably well, and males outperform females across all micro policies, except in MHS. This has implications for the appropriate assessment and early foundation of learners in S&T at lower schools.

6.2.2.2 The Relevance of Macro and Micro Policies of Regular Students Placed into Public Universities versus Select Fields of Study of Students and its Implication for Human Resource Development

Aligning learner placements with their interests and preferred fields of study is a key aspect of the relevant recruitment policy. The 70:30 policy stated that the learners should make their own choices (which shall be the demand) and expand the supply, taking cues from the weight of those choices (MoE, 2008). The 70:30 placement policy, was assessed from the academic years 2011/12 to 2017/18 to observe if placements matched learner preferences. The NEAEA required learners to rank their study preferences, with choices ranging from 1st to 9th in 2011/12-2013/14, 1st to 11th in 2015/16-2016/17, and 1st to 12th in 2017/18. While predictive analytics are yet to be determined, learners who enter the university with a prior interest in their chosen field of study are likely to be more academically successful in HEIs, as reviewed in chapter three. The 70:30 policy stated that when learners make a choice, resources should be readily available, (MoE, 2008). This approach is common in the developed world, where demand, not supply, is the challenge; however, it is not replicated in Ethiopia.

Table 4 shows the gap between learner preferences and actual placement results and mismatch between learners' choice and fields assigned. In 2011/12

academic year, the MoE set a placement ratio of 72:28 for SS to S&T learners in public universities. Enrolment data, including regular, evening, summer, and distance programmes, showed that, on average, 78.9% of SS learners and 27.7% of S&T learners were placed in their first-choice field of study. In 2012/13, only 37.5% of learners were placed in their preferred programme.

Table 4: Percentage of macro policy of regular students placed into public universities by government versus selected fields of study by students & implications for HRD (2011/12-2016/17)

Year	S&T		SS	
	1st Choose(%)	without 1st choose(%)	1st choose(%)	without 1st choose(%)
2011/12	27.7	72.3	78.9	21.1
2012/13	26.1	73.9	72.4	27.6
2013/14	31.5	68.5	69.9	30.1
2014/15	34.6	65.4	87.1	12.9
2015/16	33.7	66.3	60.7	39.3
2016/17	30.3	69.7	59.4	40.6
Total	**29.9**	**70.1**	**71.4**	**28.6**

Sources: NEAEA and Author's computation

Table 4 illustrates that most learners (70.1%) in S&T were placed without their preferences. About 71.4% of SS learners were placed in their preferred fields of study. Most learners were pushed into S&T without consultation. Most SS learners were placed according to their choice of study. This has implications for the continuous professional development in S&T in Ethiopia.

Table 5 highlights the discrepancies between learner preferences and actual placement outcomes due to micro policies of the government. Learners aiming for B&E programmes were likely to be placed in their top-choice field, with chances ranging from 80.2% to 100%. Learner allocation by the MoE challenges and puts pressure on universities' capacity to manage enrolments based on their resources (human, budget, and material), leading to a lack of quality training,

disinterests of students and lack of career development. This issue leads to a wider indigent quality of education in the HE for HRD, as it hinders institutions from effectively fostering the skills and talents development necessary for a competitive market workforce.

Table 5 Percentage of macro policy of regular students placed into public university versus select fields of study and implication for HRD (2011.12-2016/17)

Year	E&T		NCS		MPH		ANRS		B&E		SHS	
	1st choose	without 1st choose	1st choose	without 1st choose	1st choose	without 1st choose	1st choose	without 1st choose	1st choose	without 1st choose	1st choose	without 1st choose
2011/12	32.6	67.4	12.3	87.7	45.6	54.4	21.9	78.1	80.2	19.8	77.7	22.3
2012/13	29.7	70.3	13.1	86.9	43.5	56.5	20.4	79.6	84.2	15.8	59.7	40.3
2013/14	36.3	63.7	11.5	88.5	49.1	50.9	25.3	74.7	91.0	9.0	46.2	53.8
2014/15	47.7	52.3	8.2	91.8	28.4	71.6	29.7	70.3	100.0	0.0	56.5	43.5
2015/16	42.5	57.5	8.4	91.6	52.4	47.6	28.8	71.2	100.0	0.0	17.3	82.7
2016/17	34.6	65.4	12.8	87.2	54.5	45.5	28.7	71.3	100.0	0.0	20.3	79.7
Total	**37.2**	**62.8**	**11.1**	**88.9**	**45.6**	**54.4**	**25.8**	**74.2**	**92.6**	**7.4**	**46.3**	**53.7**

Sources: NEAEA and Author's computation

From 2011/12 to 2017/18, regular learners pursuing NCS had only an 8.2% to 13.1% chance of getting their first choice, with the most placed based on their 2nd to 12th preferences. Similarly, learners choosing NCS (11.5%), Veterinary Medicine (6.4%), other ANRS (26.3%), Computer Sciences (29.4%), and E&T (37.3%) encountered comparable difficulties in securing placements with their prior choices at public universities; there is a mismatch between learners' choices and fields of study assigned. The allocation targets or plans for each macro and micro, but if the macro and micro targets and enrolment in the HEIs did not match, the fields of study as well.

The findings on macro and micro policies placement indicate pupils are placed by the government force, which is an extrinsic motivation that negatively impacts their academic and work performance. The table indicates a mismatch between learners' choices and the fields of study assigned. The learners who were placed according to their prior preferences will have internal motivation to study hard, likely talent and career development, and continue developing their skills after

graduation because of their ambition, curiosity, and intrinsic motivation and performance. Not only enjoy studying their fields of study, but also the types of work. Those placed without their interests/preferences have extrinsic motivation due to the policy of the government; likely, they were disinterested in studying and working in these fields of study. Learners who place their preferences lead a sense of autonomy, enjoy studying, and work well. The policy's current misalignment with learners' preferences, largely shaped by the government, which steers them towards S&T, adversely affects HRD outcomes and learner performance. In general, the policy has very low relevance because most STEM students were placed outside their prior interests/chosen programmes, which violates HRD principles related to extrinsic motivation and performance. The placement of students into programmes that were not their choice-essentially forcing them to study in fields they did not select-combined with low scores in NLA results, has serious implications for their academic pursuits and performance in HEIs.

6.2.3 Implementation of the 70:30 Policy in the HEIs in Ethiopia

This section provides an analysis of the implementation of the 70:30 policy in the HEIs to address its implementation by examining its execution from its inception up to the introduction of the PPC (before) in 2003/04 to the 2016/17 academic year (after the 70:30 policy). An ITSD analysis was conducted to present the policy execution. This section presents the findings of GER, macro, and micro policies implementation in the HEIs against the target of the policy (the national Set Annual Intake Target for macro and micro policies (Table 26).

6.2.3.1 The Enrolment Trend Analysis of Higher Education in line with the 70:30 Policy Implementation and its implications for the Gross Enrolment Ratio.

GER is one of the indicators of development, particularly HRD. An analysis of enrolment trend implications for GER from 2003/04 to 2016/17 was conducted, revealing a significant transformation in HE enrolment in Ethiopia, influenced by

the 70:30 policy initiated in 2008/09. The post-2008/09 trend is analysed, which has implications for GER exhibits a growth acceleration (slope change) after the policy. A lag regression in policy effects was identified, with noticeable growth shifts occurring 2–3 years later in 2008/09. The trend before 2008/09 reveals that the behaviour before policy intervention was steady growth. Data transformation involving the application of the natural logarithm to GER values addresses heteroscedasticity and facilitates growth comparisons.

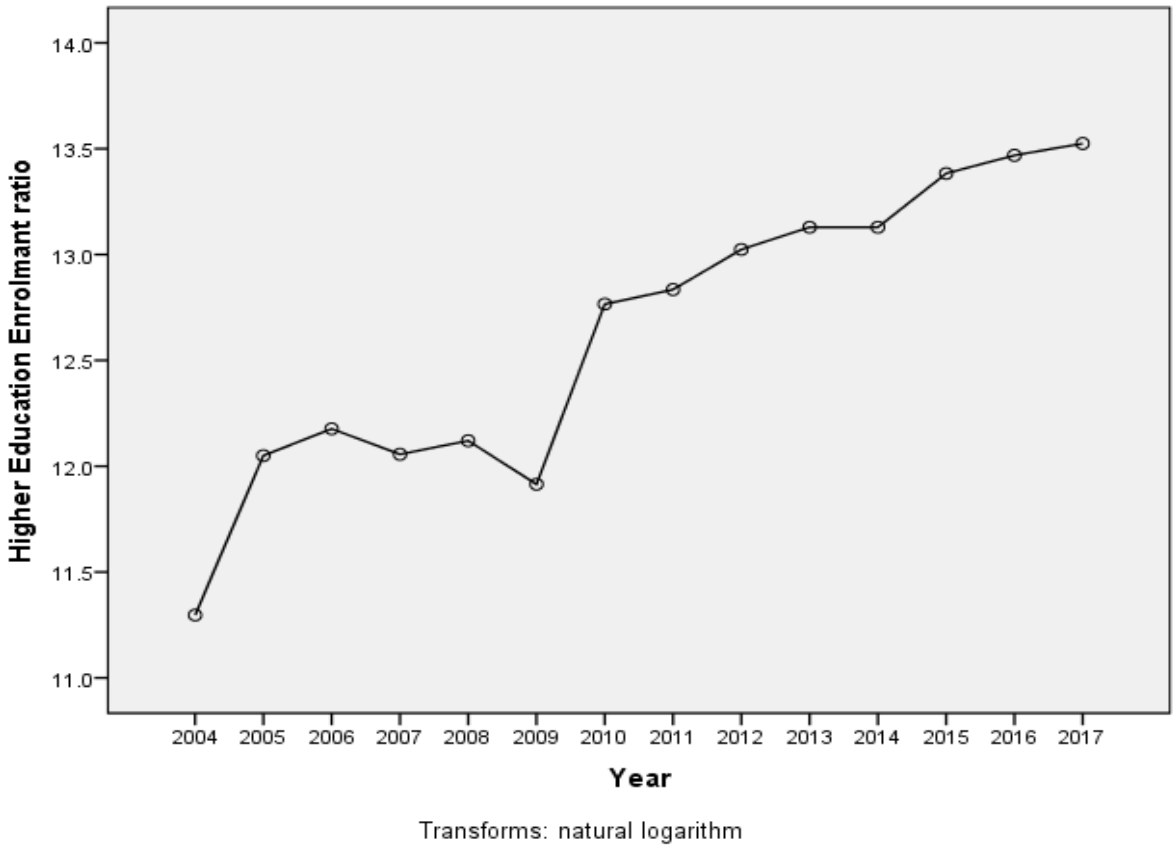


Figure 6: HE enrolment ratio- 2003/04 & 2016/17

Source: MoE, 2003/04-2016/17 & Author's work using SPSS 24

Figure 6 illustrates the HE enrolment ratio between 2003/04 and 2016/17 using transformed natural logarithm and lagged relationships in both public and private universities, with small enrolment in private universities. The number of Master's

learners enrolled in public HEIs increased from 20,150 in the 2010/11 academic year to 72,345 in the 2016/17 academic year. In addition, private institutions serve over 3,000 postgraduate learners. The enrolment of postgraduate learners rose by 41,041 in 2016/17 compared to 20,824 in 2012/13, and by 20,824 compared to the previous academic year. In the 2015/16 academic year, more than four-fifths of undergraduate learners were enrolled in public universities, while private HE providers accounted for less than one-fifth of the total learner intake (MoE, 2017).

The graph demonstrates the trend of the HE enrolment ratio between the PPC and the 70:30 policy in public universities, which dipped in 2008/09 with the introduction of the 70:30 policy while increasing steadily throughout this study. From 2003/04 to 2016/17, especially after 2008/09, enrolment increased, indicating continuous growth in the HE sub-sector. The graph illustrated the transformation of enrolment figures using natural logarithms and lagged relationships, which smoothed the trend and accentuated annual patterns.

The shifts in educational demographics reveal that a gender gap persists. In 2016/17, the total undergraduate enrolment (government and non-government universities) across all programmes was 788,033 (MoE, 2017). Of this total, only 35.7% were females (see Figure 33 in the annex), even though the sex composition in Ethiopia is nearly equal. Among these, private institutions accounted for 13.8% in 2016/17. UNESCO reported that GER for men was approximately 13%, compared to about 8% for females in 2018 (World Bank & UNESCO Institute for Statistics, 2025). Female postgraduate enrolment peaked at 23.8% in 2014/15 and dropped to 17.8% in 2016/17, as shown in Figure 34 in the annex. Despite an increase in female graduates from 2014/15 to 2016/17, the percentage of female graduates remains low, highlighting the significant gender disparity in Ethiopia's higher education subsector. This underscores a high gender gap in postgraduate programmes, even though the share of female enrolment has grown compared to previous years (MoE, 2018).

Despite the ambitious targets set by the GTP I (2010-2014/15) and GTP II (2015/16 -2019/20) for 2010/11-2025, with a GER target of at least 22% aiming for middle-income status by 2025, progress has been sluggish. For example, by the 2015/16 academic year, the GER in Ethiopian HE was at 9.4%% (MoE, 2016), with a slight increase to 10.2% in 2016/17. GER is one indicator of development; however, in Ethiopia during the transition government (1991), the GER was only 1% (Yizengaw, 2003; Yizengaw, 2005; and Loukeris, 2005), 10.2% in 2016/17 and 9.4% in 2015/16 (MoE, 2016, 2017) and 10.4 % in 2018 (World Bank, & UNESCO Institute for Statistics, 2025), which indicates sluggish. Due to data and reporting gaps, analysis at World in Data, based on UNESCO Institute for Statistics datasets and statistical interpolation, projects that Ethiopia's GER may reach approximately 14% by 2025 (Global Change Data Lab, 2025). This indicates that Ethiopia might not achieve its target of being classified as a lower-middle-income country. Although this increase indicates efforts to expand HE infrastructure and HR, it also highlights a gap between educational outcomes and the strategic benchmarks needed to foster a knowledge-based economy and meet the HR demands in S&T, indicating raw labour but not adequately equipped in S&T.

6.2.3.2 Implementation of the Macro and Micro Policies on Undergraduate Enrolment in Public University

The Ethiopian government implemented the 70:30 policy since 2008/09 to accelerate national development by strengthening the S&T HR. This analysis conducts a time-series analysis of enrolment trends, comparing the before-policy phase (PPC (2003/04-2007/08) data with the post-policy phase (2008/09-2016/17) to examine the effectiveness of the policy implementation in the HEIs. Data were clustered based on macro policies (S&T and SS), micro policies, and gender. An ITSD analysis was conducted to examine the policy's effect on enrolment rates by analysing enrolment trends over time before and after the policy's implementation. Thoroughly, the study explored whether the policy had an immediate, gradual, negligible effect, and/or no effect at all.

The Figure illustrates that SS enrolment exceeded S&T from 2007/08 to 2008/09, indicating no immediate change in enrolment patterns in line with the timeframe of the policy. The consistent slope of enrolment changes post-intervention reveals that the policy did not have an immediate effect on the intended parameters. The analysis emphasised the importance of evaluating both marginal and cumulative effects of policy changes to understand their full effect on enrolment trends. This analysis underscores the importance of logarithmic transformation for discerning subtle shifts in enrolment trends, particularly for policies with deferred effects like the 70:30 initiatives. A demarcation is made between the baseline and post-policy periods to isolate the policy's specific effect on enrolment. In doing so, a separate line was drawn at the policy effective time in 2008/09 to visualise key inflexion points before and after the 70:30 policy. Hence, stationarity tests were performed on the log-transformed enrolment series to confirm the validity of the results. Lagged variables were utilised to detect the policy's delayed effects, which may take years to become evident. A time-series ARIMA model or lagged regression analysis can be used to measure the 70:30 policy's effect on enrolment.

Figure 7 demonstrates the random walk with the drift model of S&T enrolment; however, it was less effective execution in the policy's effective year (2008/09). The introduction of the 70:30 policy was assumed to have an instantaneous effect and a continuing effect in 2008/09; nonetheless, the policy effect did not have an immediate effect. The policy was ineffective at the introduction of the policy. It gradual changed gradually, particularly after 2009/10, when S&T had an increasing and upward trend, which was better than the SS curve that coincided with the GER. Both macro policies (S&T and SS) assumed a parameter change, i.e., a structural break, by generating new data in 2008/09. S&T is a random walk and non-stationary; it lagged 2 years since the introduction of the policy in 2008/09. The plot of the S&T programme depicted a time series for a random walk (0,1,0) with drift (one difference), which had an effect but was less effective in the year of the policy's introduction, as presented in Tables 32

and 33. This indicates that S&T had started implementing the policy less effectively within the specified timeframe. The lagged effects employed as the S&T programme effect emerge 1–2 years after enrolment after 2008/09, in line with the GER result, with increases starting in 2009/10 and beyond. The lagged variables of the S&T model quantify this delayed effect-a positive long-term trend-and a spillover effect after 2009/10.

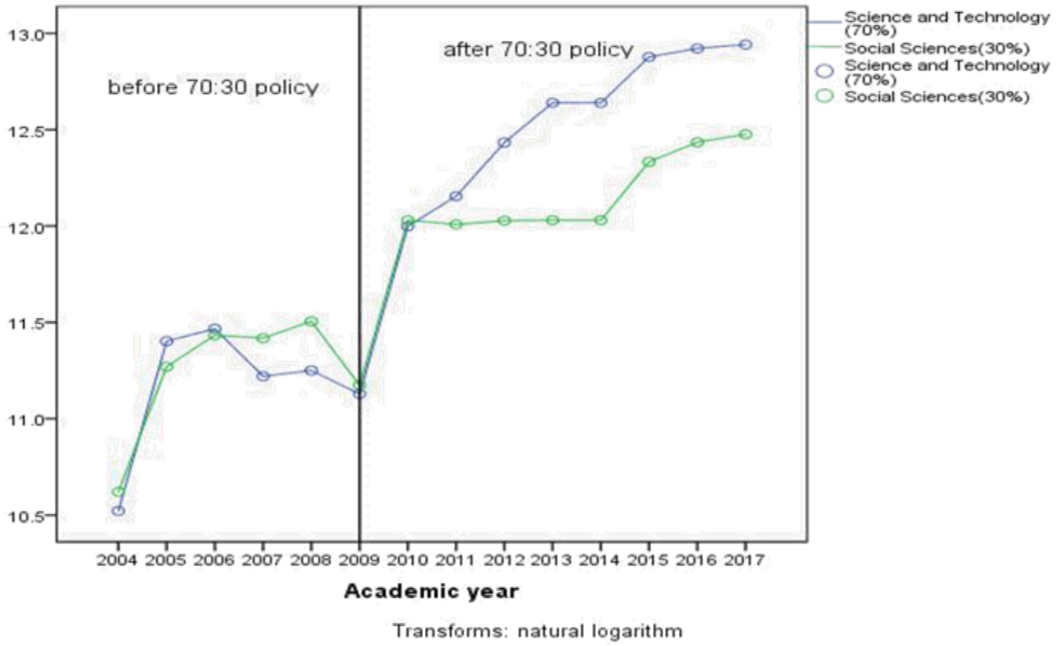


Figure 7: Implementation of macro policy at public universities

Sources: MoE, ESAA &/or EMIS 2003/04-2016/17, & SPSS 24

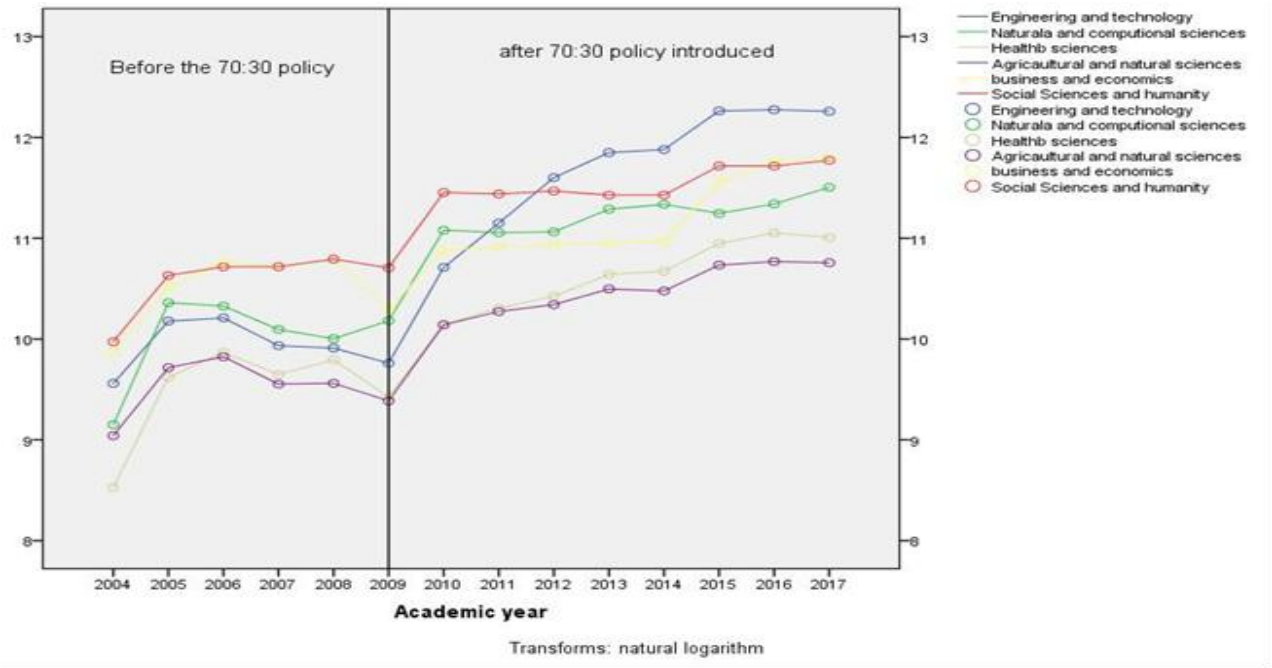


Figure 8:Micro-enrolment policy implementation at public university

Sources: MoE, ESAA &/or EMIS 2003/04-2016/17, & Author's analysis-SPSS 24

The plot of SS was based on the Holt model for an AR (0) or ARIMA (0, 0, 0) white noise, indicating pure linearity before and after the policy, with no transitional effects, suggesting the policy underperformed. Since β1=1, y=0, d=1, or I (1), S&T has one unit root, making it non-stationary after the first difference. SS has β1<1, y<0, or d=0, I (0), implying it has no unit root and is stationary, as shown and coinciding in Tables 32 & 33 in the annex, that is a sleek slope. The policy did not affect SS enrolment, which remained stationary, displaying a constant trend with no significant increase or break after the policy. ACFs and PACFs are available in Figures 49 to 57 in the annex for each macro and micro policy for further analysis and ARIMA diagnostic testing. S&T was non-stationary, indicating a positive beta coefficient (β > 0), which means the series trends upward with positive drift, consistent with the observed trend after 2009/10. Since SS was stationary, its ACF and PACF decayed rapidly, confirming the absence of a trend or drift over time.

Pure linearity occurs when γ tends to 0 or infinity; thus, the γ (γ=0.000) for SS indicates no seasonality or trend per year, as demonstrated in Tables 32 and 33 in the annex. This reflects the pure linearity of SS before and after the policy, with no transitional effect, implying a similar enrolment distribution over time. The α parameter for SS is influenced only by past observations; an α of 0.001 indicates significant smoothing before and after the policy, characterised by a sleek slope. The process can be zero-mean stationary (β0=0, |β|<1) or non-zero mean stationary (β0≠0, |β|<1). Key parameters include the random walk without drift (β0=0, β1=1) and with drift (β0≠0, β1=1). The parameters for S&T also involve β0≠0 and β1=1, indicating a random walk with drift, as illustrated in Tables 32 and 33 in the annex.

The anticipated structural break for S&T from 2008/09 was not immediately apparent; instead, the policy's effect was delayed and manifested gradually. For SS, applying the Holt model (0, 0, 0) to the log-transformed data confirms a linear pattern without any structural trend break, further supporting that SS remained unaffected by the policy. Lagged variables capture this delayed effect, reflecting the impact of education policy interventions. This analysis offers a clear understanding of the pre-and post-policy dynamics of the 70:30 policy, highlighting the importance of lagged impacts and sectoral differences in enrolment behaviour. In a log-transformed model, each unit increase in the log value corresponds to a percentage increase in enrolment. For example, if the log of S&T enrolment rises from 2.3 to 2.6, this indicates less than a third growth in enrolment during that period (since e^ {0.3} ≈ 1.35).

Ethiopia's HE strategy, guided by the 70:30 macro policy, includes six micro-policies targeting specific quotas with set national allocations. An analysis from 2003/04 to 2016/17 illustrates a complex relationship between intended educational outcomes and actual enrolment patterns. ARIMA models specified that the expansion of E&T, MHS, and B&E post-2011 indicates a shift in alignment, accompanied by a drifting trend, although not coinciding with the

policy's effective time point (2008/09). Conversely, SHS and NCS did not effectively drive significant change. While enrolment increased, the distribution across micro policies failed to align optimally with the intended labour-market outcomes.

The plots of E&T, B&E, and MHS followed random walks (0, 1, 0) with drift due to β1=1, y=0, and d=1, indicating cumulative shifts over time, though not aligning with the intended policy timeframe as illustrated in Tables 32 and 33. This demonstrates that the policy interventions affected enrolment (which is non-stationary) over time, but were effective at the policy's effective date (2008/09), indicating that the policy had no immediate effect on enrolment plan implementation in HEIs. Conversely, the plots of NCS and SHS were Holt models (AR0), indicating that these micro policies are stationary and have no effect, because β1 < 1, y < 0, (d=0), or I (0), as shown in Tables 32 and 33. I (0) confirms that no significant structural change occurred at the policy intervention point. Using natural logarithm transformation for analysis, E&T exhibits a drift-driven alignment with policy goals over time, consistent with S&T macro policy (E&T is one of S&T's micro policies). In contrast, others like SHS remained stationary and aligned with SS, unaffected by interventions (SHS is a micro policy of SS). However, MHS was non-stationary and aligned with S&T, while NCS was stationary and unrelated to S&T. Similarly, B&E was non-stationary and mismatched with SS. Trends in HEIs show that some micro-policies expanded and met or exceeded their targets, while others, such as those under ANRS and MHS, lagged despite exceeding their policy allocation. ARIMA models suggest that, despite overall enrolment growth, the distribution of students across various micro-policies has not matched the desired labour-market outcomes outlined in the policy guidelines.

As detailed in Tables 32 and 33 in the annex, the time series modelling indicated that the E&T, MHS, ANRS, and B&E models were best described by a random walk model (0, 1, 0) with one order of differencing, indicating non-stationarity.

Since β1=1, y=0, and d=1 or I (1), this highlights the policy effect. The ARIMA tables display the model parameters and variables, including the dependent variable (enrolment rates) and significant independent variables (micro policies). However, SHS and NCS were best represented by Holt's linear trend model, demonstrating that the random walk model (ARIMA (0, 1, 0) was non-stationary but did not indicate a systematic change over time from 2008/09 onward. The unexpected fit of SHS and NCS to the Holt linear trend model indicated steady enrolment growth before and after the policy

The model estimates for NCS and SHS in log persistence were similar. ESM was modelled by taking the natural logarithm of the time series data as a linear trend. In both NCS and SHS, no difference was observed between the new and previous policies. The ESM provides the best fit for NCS and SHS, as they were linear regression models. The alpha level (α = 0.098) for NCS and SHS was specified. Since β1 < 1, y < 0, and d=0 or I (0), NCS and SHS were stationary, as illustrated in Tables 32 and 33, annex part. The gamma and trend levels for these NCS and SHS were (γ = 0.000009389) and (γ = 0.00002943), respectively, with almost no seasonality or trend. The alpha of NCS and SHS, at α = 0.098, indicates a smoothing parameter. These micro policies are stationary with zero mean. Accordingly, NCS and SHS follow the ESM model, while E&T, MHS, ANRS, and B&E were modelled using ARIMA parameters. Since β1=1, y=0, and d=1 or I (1), E&T, MHS, ANRS, and B&E were non-stationary, signifying a policy effect. The parameters of these micro policies also demonstrate β0 ≠ 0 and β = 1, indicating a random walk with drift, as detailed in Tables 32 and 33.

After 2008/09, enrolment trends diverged from the set quotas, indicating inefficiencies. SHS had the highest enrolment share between 2004 and 2011, which coincided with SS. Still, from 2012 to 2017, E&T enrolments surpassed SHS, reflecting a post-2011 spillover effect, which was attributed to S&T and a move towards prioritising STEM following the 70:30 policy. The policy allocated two-fifths of the highest share to E&T, one-fifth each to NCS and B&E, one-twentieth to ANRS and MHS, and one-tenth to SHS. Nonetheless, SHS

dominated enrolment from 2004 to 2011, with E&T enrolments rising from 2012 to 2017, marking a delayed shift towards the policy's STEM-focused goals. On the contrary, Figure 8 illustrates that agriculture has consistently remained below all the curves in this study, with health sciences trailing closely behind, though the allocation for both is identical (one in twenty shares). Figure 8 indicates that micro-policies have consistently failed to meet national guideline proportions (HEIs failed to meet the policy) , with implications for supplying HRs to various economic sectors since the 2008/09 period. The data shows no systematic changes in the slope at the effective time in 2008/09, implying that these micro-policies have less of an effective effect on enrolment in line with the intended quotas/targets of the policy. The policy's objective was to provide human capital for socio-economic sectors, especially for industrial development based on the target/quota enrolment in the HE, but this aim has not been fulfilled. Certain micro-policies are deterministic random walks with drift, affecting enrolment patterns, but not aligning with the anticipated timing or effective year (2008/09). Visually, Figure 8 shows that both the random walk and deterministic trend autoregressive models display similar upward and non-stationary trends.

Moreover, descriptive analysis from the annex demonstrated that the policy was not implemented in accordance with the 70/30, which indicates the mismatch between the actual enrolment in the HEIs and the target/objective of the government policy allocation. For example, despite the policy's intentions, actual enrolment ratios for S&T versus SS in undergraduate programmes-including regular, evening, summer, and distance-were 48.9:51.1 in 2008/09, 53:47 in 2009/10, and 61.4:3.6 in 2011/12, indicating a gradual shift yet still not meeting the target (more details can be found in Figure 33 in Appendix 3). During the 2010/11 academic year, the intake ratio for S&T to SS in regular government programmes was 58:42, indicating an improvement, but is still short of the 70:30 target. The target of the policy was to shift from the 2003/04 to 2007/08 baseline ratio of 57:43, during the PPC, to 70:30 in 2008/09; however, it was 48.9:51.5 in 2008/09 (can be found in Appendix part figure 33), which indicates it was not executed in line with the 70:30 ratio. That is the discrepancy between the

objective of the policy and enrolment plan implementation in universities. Evening programme ratios improved from 18:82 in 2003/04 to 26:74 in 2008/09, and summer programmes saw S&T enrolment exceed half, as shown in the annexe. These indicate the distribution is not only uneven across programmes, but also a mismatch between the objective of the policy and enrolment plan implementation across programmes in the HEIs. In the 2012/13 academic year, the ratio of new undergraduate enrolments in S&T to SS at Ethiopian government universities peaked at 64.8:35.2, which indicates a mismatch between the target/plan of government policy and actual enrolment in the HEIs (refer to annexe, figure 34).

This ratio experienced minor changes, a decrease in S&T in the subsequent academic years at 63.3:36.7, 61.9:38.1, and 61.4:38.6 in 2014/15, 2015/16, and 2016/17, respectively. This also illustrates that the target and/or objective of the S&T policy allocation was unachieved, and the allocation in SS was over the policy target. These numbers indicate a steady decrease in S&T enrolment compared to SS. Conversely, the enrolment in SS increased unexpectedly, highlighting the difficulties in meeting the ambitious 70:30 ratio set by the national education policy, which indicates low-performing policy in HEIs. The indigent execution, particularly in the calibre of STEM education.

Further descriptive analysis of micro policies, as meticulous in Appendix Figure 35, shows enrolment in E&T rose from 18.2% in 2003/04 to 31% in 2016/17, peaking at 34.3% in 2014/15, and from 2003/04 to 2010/11 consistently below a fifth short of the two-fifths target, with 74.5% of these enrolments in regular programmes. Likewise, the anticipated representation of SHS was one in ten of enrolments; however, the actual numbers varied from 24% to 27.6% before the policy and from 19.1% (almost double) to 30.4% (more than triple) after the implementation, which indicates the SHS has not executed in line with the guideline policy of the quota as illustrated in Figure 35 in the annex section. Still, the government's 2019-2030 roadmap demanded to increase SS intake to two-fifths (MoE, 2017), but the policy remains questionable, including in assigning micro policies to provide the right labour force for different economic sectors.

Gender disparity in Ethiopian HE enrolment remains significant, with female participation lagging that of males, posing a challenge to achieving gender equity (from the appendices, figures 30 to 31 illustrate the enrolment and graduates of undergraduates and postgraduates). Despite initiatives to bridge this gap, the representation of female learners, particularly in STEM fields, has not experienced any growth, with a peak enrolment of only 31% in the 2014/15 academic year in the public universities (can be found in the annex, Figure 34).

6.2.3.3 The Implementation of Macro and Micro Policies on Postgraduate Enrolment in Public University

Postgraduate enrolments in S&T have decreased under the 70:30 policy from 2008/09 to 2016/17, compared to the years before the policy (2003/04–2007/08), with SS enrolments exceeding the designated less than a third. Despite these fluctuations, the policy's goal of balancing postgraduate enrolments between S&T and SS remains unachieved among the intended objectives of the policy, underscoring the persistent challenges in implementing the policy and achieving educational goals.

Figure 9 depicts the enrolment trends in macro (S&T and SS), and Plot 10 indicates micro policies (E&T, NCS, and B&E) were Brown models with AM1 (steady growth, unaffected by the policies), which have no effect on enrolments with sleek parameters before and after the policy. ARMA modelling without order differentiating demonstrates a consistent pattern in enrolments for both S&T and SS, with no significant disruptions or shifts in the enrolment series' logarithm after 2008/09. Before the introduction of the 70:30 policy, ANRS illustrated a transient effect in 2008/09, but lacked lasting impact, particularly evident in NCS enrolment trends. The figure illustrates that there was no systematic change in the slope.

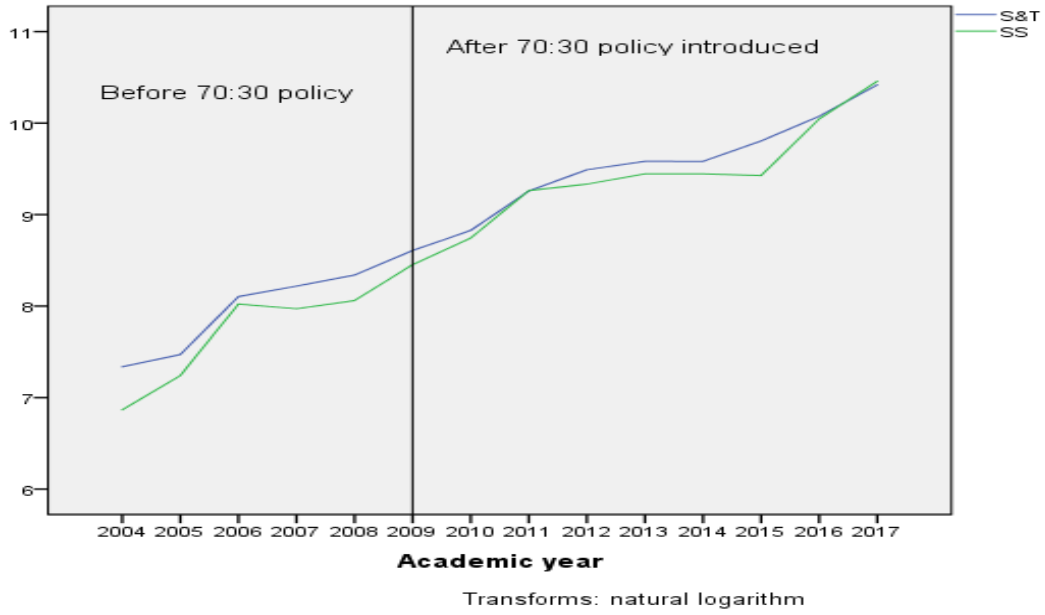


Figure 9: Macro policy -Postgraduate enrolment at public university

Sources: MoE, ESAA &/or EMIS 2003/04-2016/17, & Author's using SPSS 24

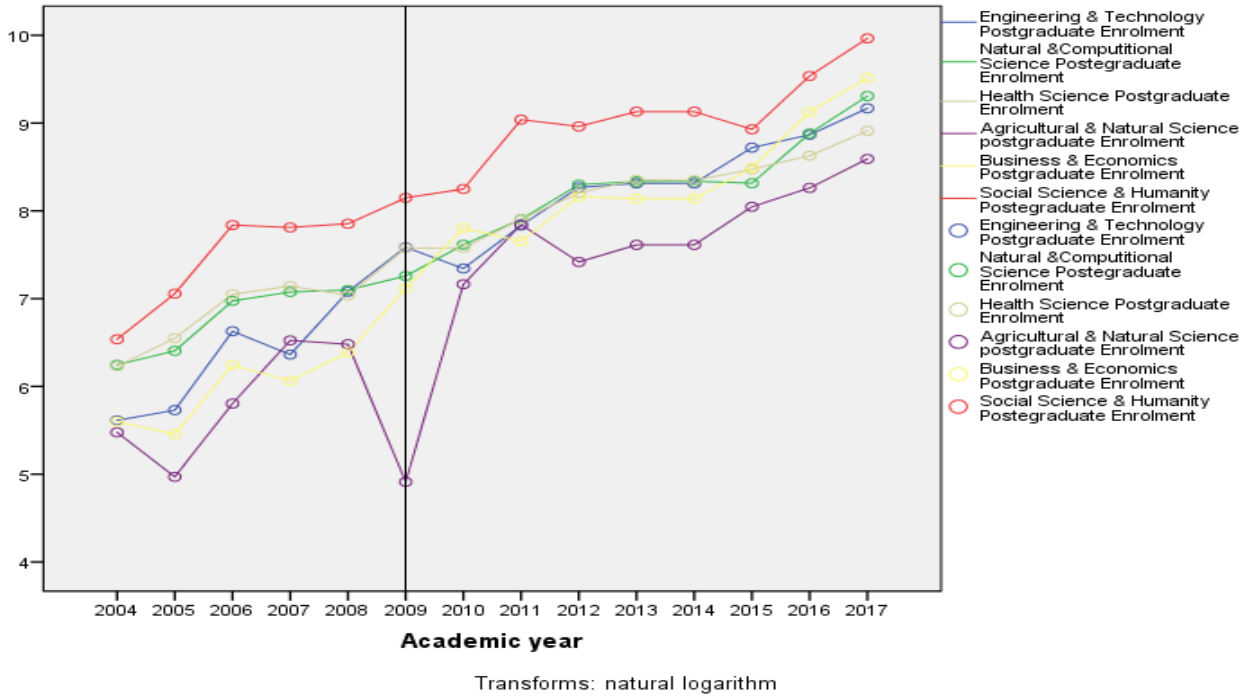


Figure 10: Micro-policy postgraduate enrolment in public universities

Source: MoE, ESAA &/or EMIS 2003/04-2016/17, & Author's using SPSS 24

The rest of the SHS, ANRS, and MHS were modelled as random walks (0, 1, 0) with a 1-step difference plot, but ANRS demonstrated no lasting change in enrolment patterns (no permanent effects), as confirmed by the plot and illustrated in Tables 32 and 33 in the annex. The α=1 and α=.982 for S&T and SS indicate slight smoothing. The alpha level of SS also reflects the most recent past observations estimated for its parameter (the temporary effect), as shown in Tables 32 and 33. The alpha levels of α=.580, α=1, and α=0.953 for postgraduate enrolment of E&T, NCS, and SHS indicate moderate and minimal smoothing, respectively. Since β1<1, y<0, and/or d=0 or I (0) for NCS and SHS-both of which do not have a unit root and were stationary, as presented in Tables 32 and 33-these micro policies have a temporary effect that has been recently moderately weighted. NCS and B&E also receive the most recent observations weighted.

In the health sector, the pre-policy enrolment figures in MHS varied from 15.5% to 20.3% between 2003/04 and 2007/08, and after the policy reached a peak of 15.7% in 2014/15 before declining to 10.9% by 2016/17, as depicted in Figure 40 of the annex. Figure 40 further displays that in the academic year 2014/15, enrolment in E&T reached a fifth, not meeting the policy's target of a two-fifths share. Remarkably, 67.4% of enrolments were in regular programmes. By the academic year 2016/17, SHS led with a 31.2% enrolment rate, followed by B&E at a fifth, while ANRS trailed at 7.9%, as depicted in Figure 40 in the annex. In 2003/04, NCS programmes enrolled the highest proportion of learners at 20.7%, contrasting sharply with 12.7% in 2008/09 (the effect date of the policy), and the lowest recorded during the trend period, as shown in Figure 40.

Gender disparities remained evident in government universities, especially in postgraduate programmes, with female enrolment in S&T consistently trailing behind SS. Male enrolment remained higher than female enrolment, peaking at less than a third in S&T and 29.3% in SS in 2014/15, then falling to 16.5% by 2016/17, as shown in Figure 38 in the annex. These statistics highlight persistent gender gaps, despite slight improvements in female enrolment rates from

2010/11 to 2013/14, emphasising the necessity for concerted efforts to boost female engagement in STEM fields.

Table 27 presents government academic staff by qualification, gender, nationality, and macro (S&T versus SS) and micro policies from 2014/15 to 2016/17, as shown in the annex. Table 27 depicts academic staff qualifications in 2014/15-8.1% with Doctorates, 53.8% with Master's, and 31.4% with bachelor's degrees. In 2015/16, only 6.3% of academic staff in S&T held Doctorates, compared with 3.7% in SS. This is one of the main challenges in implementing the 70:30 policy and reflects a mismatch between the policy's intended outcomes and staff development and conversion.

6.2.3.4 Multiple Regression Analysis of the Policy Implementation

From 2008/09 to 2016/17, data analysis focused on assessing the 70:30 HEP's effect on enrolment, treating the policy as an independent variable influencing enrolment rates as the dependent variable. Before the actual data analysis, diagnostic testing was conducted for collinearity using tolerance and VIF, and for autocorrelation using the Durbin-Watson d-test, as shown in Table 31 in the annex. The multiple regression model was employed to analyse the relationship between the dependent variable (enrolment) and the independent variable (policy).

Table 6: Coefficients of undergraduate macro policy of 70:30

Variable	Standardised Coefficient	T	Sig
	Beta		
S&T (70%)	.671	31.829	.000
SS (30%)	.348	16.489	.000

Source: MoE, 2008/09-2016/17 & Author's computation using SPSS version 24

The multiple regression analysis was employed to assess the effect of the 70:30 macro policy and its subsidiary policies on enrolment rates at government

universities. Beta weights were used to determine the average enrolment increase associated with a one standard deviation shift in each independent variable. The findings revealed significant impacts from both S&T (β=0.671%, p<0.001) and SS (β=0.348%, p<.001) under the 70:30 policy, with p-values below 0.05 having a positive and significant effect on undergraduate enrolment. S&T contributed much more to undergraduate enrolment than SS. The findings indicate that the policy implementation in the public universities was implemented in line with the requirements of the policy, though descriptive statistics and other advanced statistics-RDD and DID-did not evidence. These results highlight the policy's role in influencing enrolment trends across various macro and micro policies within Ethiopian HEIs.

Table 7: Coefficients of micro policies on undergraduate enrolment

Variables	Standard coefficient	T	Sig
	Beta		
E&T (40%)	.472	9.999	.010
NCS (20%)	.113	5.155	.036
MHS (5%)	.098	4.050	.074
ANRS (5%)	.096	3.200	.085
B&E (20%)	.198	8.726	.013
SHS (10%)	.172	5.551	.031

Source: MoE, 2008/09-2016/17, & Author's computation using SPSS version 24

The E&T has the largest standardised coefficient (β = 0.472, t = 9.999, p = 0.010), indicating it contributes most strongly to changes in total undergraduate enrolment. These findings are consistent with the policy intention of placing 40%

of students in the E&T programme. B&E is the second-largest effect (β = 0.198, t = 98.726, p = 013), despite being allocated only 20% in policy. SHS also demonstrates a significant positive contribution (β = 0.172, t = 5.551, p = 0.032). Although the policy allocated only 10%, its contribution appears greater than that of NCS, which was allocated 20%. NCS has a positive and significant effect (β = 0.113, t = 5.155, p = 0.036); however, its influence is considerably lower than expected given its 20% policy share. MHS (β = 0.98, t = 4.050, p = 0.074) and ANRS (β = 0.96, t = 3.200, p = 0.085) are positive but insignificant predictors at the conventional 5% significance level because the p-value exceeds 0.05.

The results indicate a mismatch between the policy allocation targets and the actual execution of enrolment in HE on undergraduate enrolment growth. The beta weight implies that the micro policy quota was appropriately underperformed, particularly for NCS and SHS. ANRS and MHS have the lowest weight and contribution to the dependent variable, which is enrolment, consistent with the intended plan of the policy. The t-test aimed to identify significant predictors. Consequently, the four micro policies (E&T, NCS, B&E, and SHS), with p-values less than 0.05, are considered significant predictors. Meanwhile, the two micro-deposits (MHS and ANRS) are statistically insignificant predictors. The coefficient indicates that the policy has not been implemented according to government guidelines. From this, we can understand that public universities have not implemented the policy in line with the guidelines policy of the government. We can also understand that the policy has neither been allocated appropriately from the previous analysis section for each micro policy nor implemented as allocated.

Table 8: Coefficient of macro policy postgraduate enrolment

Variables	Standardised Coefficient	T	Sig.
	Beta		
S&T (70%)	.487	43134347.460	.000
SS (30%)	.519	45992852.970	.000

Source: MoE, 2008/09-2016/17, & Author's computation using SPSS version 24

The standardised coefficient SS (β= 0.519) contributes slightly more to postgraduate enrolment than S&T (β= 0.487) during the study period. Since beta coefficients are standardised, they can be directly compared. Hence, the higher beta value for SS indicates a stronger relative influence on postgraduate enrolment growth.

The findings indicate that SS has a greater contribution to postgraduate enrolment in the HEIs than S&T, despite being allocated 30% of enrolment under the macro policy. Conversely, S&T, which was allocated 70% enrolment opportunities, demonstrated a slightly lower contribution. This reflects the actual implementation of postgraduate enrolment in the HEIs and does not reflect the policy priority. The results imply that the divergence between the policy anticipated and implementation outcomes in the HEIs.

Table 9: Coefficient of micro policies postgraduate enrolment

Variables	Standard coefficient	T	Sig.
	Beta		
E&T (40%)	.147	1016420.514	.000
NCS (20%)	.165	570613.502	.000
MHS (5%)	.099	586655.861	.000
ANRS (5%)	.086	1547429.612	.000
B&E (20%)	.223	1217356.149	.000
SHS (10%)	.303	2419255.012	.000

Source: MoE, 2008/09-2016/17, & Author's computation using SPSS version 24

All the micro policies and programmes have positive and significant effects on postgraduate enrolment (p = 0.000), indicating that an increase in enrolment

within each programme is associated with an overall rise in postgraduate enrolment at Ethiopian public universities. The standardised coefficients demonstrate considerable variation in the relative impact of different disciplines: the SHS recorded the largest effect (β = 0.303), making it the strongest contributor to postgraduate enrolment. B&E had the second-largest contribution (β = 0.223), followed by NCS with a moderate impact (β = 0.165). E&T also contributed positively, though to a lesser extent (β = 0.147) and had the largest allocations of the policy. MHS had a smaller contribution (β = 0.099), while ANRS showed the least impact (β = 0.086) as both had the identical share and the least allocation of the policy of the government.

These coefficients indicate that the micro policies were not executed based on the national policy guidelines. The results imply a substantial discrepancy between the policy allocation targets and actual postgraduate enrolment in the public universities. For instance, SHS has the highest coefficient, followed by B&E, while E&T has the highest weight according to the national guidelines of the policy. Thus, the values in the study and all the micro policies are statistically significant ($p<0.05$). Therefore, they were to be significant predictors. The government's policy prioritises E&T education and training; however, public universities offer more opportunities for SHS and business education programmes. Similarly, the government's focus is on S&T; nevertheless, government universities enrol more students in SS.

6.2.3.5 The Effect of the 70:30 Policy Implementation on Enrolment in the HEIs

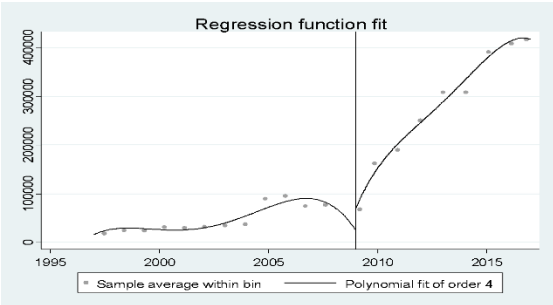
Econometric analysis including the RDD and Triple DID is employed to examine the effect of the policy's execution on enrolment in the HEIs in the following sections.

6.2.3.5.1 Regression Discontinuity Design Model Analysis of the 70:30 Intervention and its Micro Policy Effect on the Enrolment in the HEIs

In this section, the RDD model analysis is used to assess the e of both macro and micro policies' effects on undergraduate enrolment in HEIs.

6.2.3.5.1.1 RDD Analysis of Macro and Micro Policies Effect on Undergraduate Enrolment

Contemporary literature underscores that even rigorously conducted RDD studies, despite internal validity and adequate power, identify the programme's effect solely at the cut-point. Hence, in this thesis, RDD graphical analyses along with data visualisation analysis were employed to compare policy enrolment impacts by contrasting post-policy treatment groups with pre-policy control groups around the forcing variables at the cut-off point (as the policy effect date in 2008/09). RDD's primary merit is its robustness against internal validity threats, facilitating causal inferences where random assignment is impractical. Data visualisation, analysis, and graphical methods were used to examine policy effects on enrolment. Figures 11 and 12 illustrate the effect of macro policy on undergraduate enrolment, revealing that RDD effects are valid only around the 2008/09 cut-off. In line with the insignificant coefficients and large confidence intervals presented in Tables 10 and 11, the figures do not show a clear discontinuity jump at the policy cutoff. This suggests that the observed changes in enrolment at government universities were gradual rather than the result of an immediate policy-induced shift. Therefore, both the graphical and statistical evidence indicate that the causal effects of the policy on undergraduate enrolment were weak and statistically indistinguishable from zero during the study period.



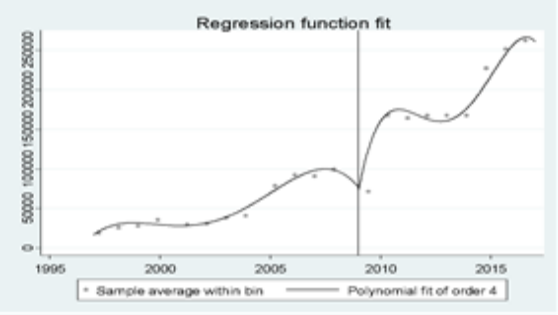


Figure 11: RDD of S & T policy *Figure 12: RDD of SS effect*

Source: MoE, 1998/99-2016/17, & Author's work using Stata version 14

Figure 11 illustrates that, although the policy targeted a seven-in-ten enrolment in S&T, there was an initial decline at the cut-off before consistent growth, in contrast to the fluctuating enrolment in SS. Figure 12 reveals that the SS policy had an insignificant impact at the threshold (cut-off), validating the findings from the ESM analysis. The RDD analysis illustrates that the discontinuities at the cutoff were indicative of policy effects, with the direction and magnitude of these changes reflecting the policy's effect on enrolment in public universities. After the 2008/09 period, S&T enrolment trends linearly, aligned with the seven in ten goals, while the cubic trend of SS enrolment deviates from the less than a third objective.

Table 10: RDD model of S & T policy effect on enrolment

Method			T		P>ITI	
Robust			0.1582		0.8742	
Method	Coefficient	Std. Err	Z	P>Izl	95% of. Interval	
Conventional	10449	92894	0.1125	0.910	-171620	192518
Robust	-	-	0.1365	0.891	-196247	225624

Table 11: RDD of SS policy effect on enrolment

Method			T		P>ITI
Robust			0.1838		0.8541
Method	Coefficient	Std. Err	Z	P>Izl	95% of. Interval

Conventional	-19978	73475	-0.2719	0.786	-163986	124031
Robust	-	-	-0.4087	0.683	-197810	129544

Source: MoE, 1998/99-2016/17 & Author's computation (Stata version 14)

The Tables above present the estimated treatment effects to confirm their robustness. Essential components of RDD include a score, a cut-off, and a treatment. The continuity assumption posits that potential outcomes are continuous with the score at all values, with estimation and inference centred on approximations at the cut-off. The robust T-statistic and p-value test of S&T (T=0.1582) and SS (T=0.1838) were very small, and the P-value (p=0.8742) of S&T and SS (P=0.8541) were large, indicating that the effect of both macro-S&T and SS policy on enrolment was not statistically significant. Conventional estimates of the coefficients were 10,449 and-19,978, indicating a positive and negative effect on enrolment of S&T and SS, respectively, which is consistent with the ITSD and RDD visualisation data analysis. From this, we can understand, if the macro policy has no effect, it will not affect the micro policies as well because these micro policies are under the guidelines of the macro policies. The estimated discontinuity of the S&T and SS effect on enrolment has a positive increase and a negative decline after the policy thresholds, respectively. The RDD results for both S&T and SS consistently show no statistically significant discontinuity at the policy threshold, as all p-values are greater than 0.05. The confidence intervals include zero, indicating that the estimated effects are indistinguishable from no effect. Additionally, the large standard errors and wide confidence intervals reflect low precision and considerable uncertainty in the estimates. While the policy appears to have influenced the direction of enrolment-positively for S&T and negatively for SS-the effects are too weak to be considered statistically reliable.

Figures 13 to 16 represent the micro policy components of S&T. Figure 13 illustrates that the relationship between the enrolment in E&T and its ratings is downward sloping at the cut-off point, indicating a decrease in enrolment.

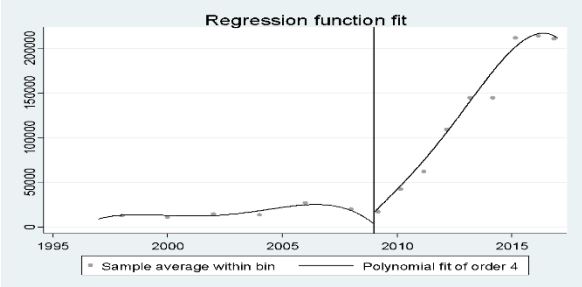


Figure 13: RDD of E & T policy

Figure 13 RDD of E&T policy.
cut-off on enrolment policy effect at the undergraduate of undergraduate

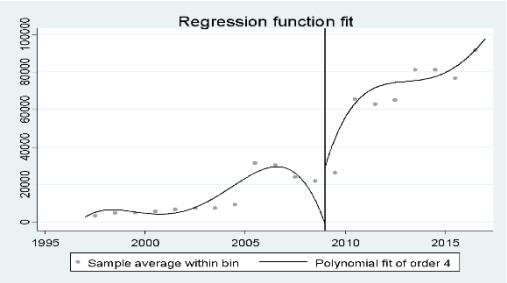


Figure 14:RDD of NCS

Figure 14 RDD of NCS effect at the cut-off on enrolment of

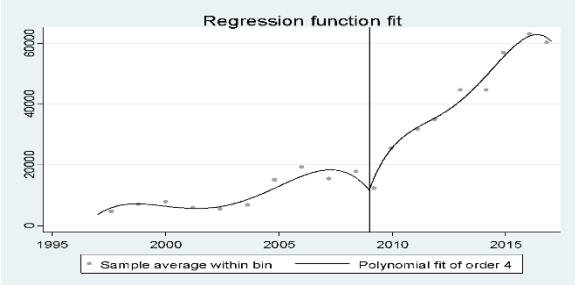


Figure 15: RDD of MHS micro policy

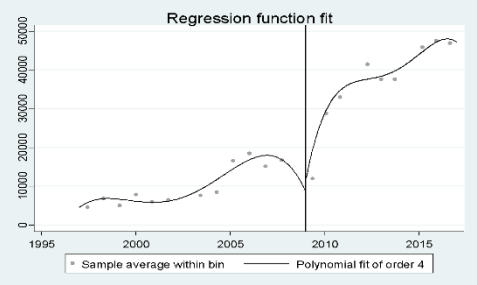
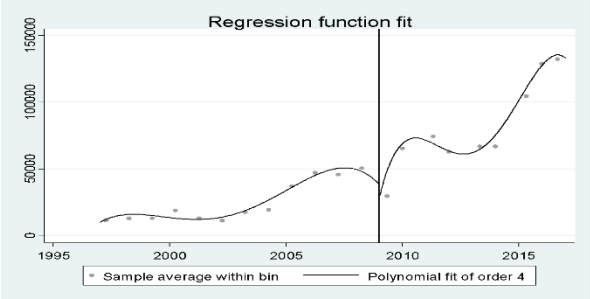


Fig 16:RDD ANRS micro policy

Source: MoE 1998/99-2016/17 and analysis Stata version 14

The Plots reveal no discontinuity between regression lines at the cut-off, indicating that the policy had an ambiguous impact, which coincided with the robust and conventional estimates in Tables 10 and 11. Examination of macro and micro policy figures displays no evident jumps at the cut-off, indicating the policy did not affect enrolment in the HEIs (public universities). Post-policy graphical representations were anticipated to be linear as the same number of enrolments was anticipated in HEIs as per the policy objectives and targets; however, E&T and MHS exhibited downturns around 2015/16 and 2016/17, diverging from linearity, while NCS and ANRS displayed non-linear trends. Figure 14 regarding the RDD results for the NCS demonstration demonstrates an ambiguous effect at the discontinuity point, as enrolment decreased. Comparing enrolment around the cut-off to evaluate the policy's causal effect indicates no evidence of discontinuity in NCS's micro policy on enrolment. Figures 17 and 18

present the RDD analysis of B&E and SHS micro policies within the broader SS context. Data visualisation along with graphical analysis compared enrolment effects at the cut-off point between baseline and follow-up data from policy participants and non-participants. No significant discontinuity in enrolment rates at the cut-off was observed, indicating an ambiguous effect of B&E micro policy on enrolment. The figure displays the estimated discontinuity in undergraduate enrolment at the policy cut-off point (2008/09), providing visual evidence for evaluating the causal effect of the relevant micro policies.



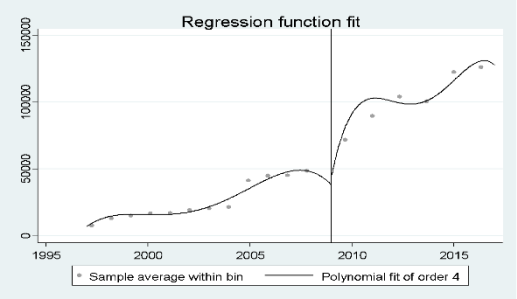


Figure 17: RDD of B & E *Figure 18: RDD of micro policy*

Source: MoE, 1998/99-2016/17 & Author's work using Stata version 14

The results for all micro policies presented non-significant p-values, like macro policy results, indicating no substantial effect on learner enrolment in the HEIs. Despite anticipations of linear trends post-policy implementation (same allocation and/or target for each macro and micro policy and field of study to be enrolled every year in every public university since 2008/09, for example, 70% of learners must be enrolled in S&T/STEM since 2008/09), the enrolment data for S&T and SS exhibits nonlinearity, reflecting spontaneous and discontinuous changes rather than the anticipated policy-induced stability. Hence, the policy has not been executed in line with the objective of the policy.

6.2.3.5.1.2 RDD Analyses of Macro Policy Effect on Postgraduate Enrolment

The analysis examined the effect of macro policy postgraduate effect on postgraduate enrolment. However, if the macro policy of undergraduates has yet

to be affected by enrolment in the HEIs, the micro policy of postgraduates is as well.

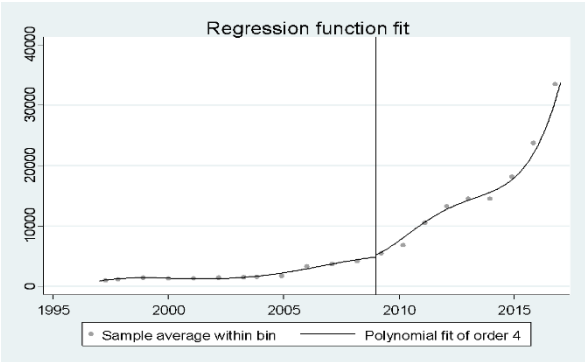


Figure 19: RDD of S & T

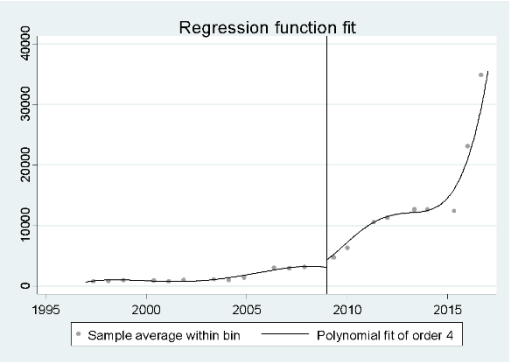


Figure 20: Enrolment postgraduate effect at cut-off

Source: MoE, 1998/99-2016/17 and Author's work using Stata version 14

RDD approximates the regression function near the cut-off using low-order polynomials and evenly spaced data binning. Estimation and inference involve approximating these regression functions to compute the treatment effect on learner enrolment in the government and/or public universities. Despite the policy aiming for 70% enrolment in S&T since 2008/09, RDD graphs show no discontinuity, indicating no effect on enrolment at the cut-off, which agrees with the ARIMA and ITSD analysis. SS also displays no discontinuity at the cut-off, validating ESM analysis findings.

6.2.3.5.2 Difference-in-Difference Model Analysis of the 70:30 Macro and its Micro Policies Intervention Effect on the Enrolment in the HEIs

The 70:30 policy, implemented in government universities, was analysed using a Triple-DID model to assess its effect on enrolment over time. This model compared enrolment trends in public universities (treatment group) before and after the policy with those in private universities (comparison group) unaffected by the policy.

Enrolment data before 2008/09 and after 2008/09 were coded, with public university enrolment marked as 1 and private university enrolment as 0. The

analysis revealed that the policy intervention starting in 2008/09 did not lead to significant changes in enrolment patterns, as shown by the comparative results presented in the above figure and the tables below. As indicated, the DID results align with the Table; there was an enrolment trend over time, as enrolment remained higher in public universities than in private universities in before and after the new policy.

Table 12: DID -Undergraduate enrolment of public & private universities

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	3.4e+04	9.2e+04	**2.3e+05**
	Treatment(T)	1.8e+05	4.62+05	
	Difference(T-C)	1.4e+05	3.7e+05	
S. Error		1.2e+05	7.2e+04	**1.4e+05**
Ltl		1.21	5.12	**1.65**
p>ltl		0.247	0.000***	**0.12**

Source: MoE, 1998/99-2016/17 & Author computation of Stata version 14

Number of observations in DID: 19, R-Square: 0.71, Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

The DID design compares over time enrolment in public university and controls concurrent time trends using enrolment in private universities. Table 12 indicates the coefficient for DID estimation of undergraduate enrolment in public and private universities. The effect is significant at 1% after the policy was introduced in the public and private universities, but it had no effect on the rest. The average DID result indicates that it did not affect it. There was no statistically significant difference in undergraduate enrolment between public and private universities.

Table 13: DID result- S & T policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	9788.500	2.8e+04	**1.8e+05**
	Treatment(T)	8.2e+04	2.8e+05	
	Difference(T-C)	7.3e+04	2.5e+05	
S. Error		8.1e+04	5.0e+04	**9.5e+04**
Ltl		0.90	5.06	**1.87**
p>ltl		0.385	0.000***	**0.08***

Source: MoE 1998/99-2016/17 & computation using Stata version14
Number of observations in DID: 19, R-Square: 0.70, Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

DID indicates that the average treatment effect of the S&T policy affects enrolment at one in ten, with the treatment having a positive policy effect. There was an effect after the policy at 1%, but there is no treatment effect before it. There is a difference between the control and treatment groups. The objective of the 70:30 policy was to enrol seven in ten learners in S&T and the rest less than a third in SS in public universities. The difference of 1% and 5%, was anticipated.

Table 14: DID results- SS policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	2.4e+04	6.5e+04	**4.8e+04**
	Treatment(T)	9.4e+04	1.8e+05	
	Difference(T-C)	7.0e+04	1.2e+05	
S. Error		4.1e+04	2.5e+04	**4.8e+04**
Ltl		1.70	4.70	**1.00**
p>ltl		0.111	0.000***	**0.332**

Source: 1998/99-2016/17 and Author's computation using Stata version 14
Number of observations in DID: 19, R-Square: 0.70, Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

The average DID analysis results of S&T at 10% and the NCS, ANRS, and SHS at 5% have a significant effect on enrolment with positive values. The rest of the results of macro (S&T) and micro policies (E&T, MHS, and B&E) have no policy effect on enrolment. The policy effect is that DID methods found in NCS and

ANRS were 10% before the policy. The macro policy effect of SS may have resulted in better enrolment in public universities than private universities after the policy was introduced. Despite raw data increase in enrolments in the public university (treatment group), the DID estimates do not provide robust statistical evidence of whether the policy has a causal effect. Their robustness modelling approaches provide no robust evidence and uncertainty estimates of the effect.

Table 15: DID results- E & T policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	3473.500	1.0e+04	**9.9e+04**
	Treatment(T)	2.2e+04	1.3e+05	
	Difference(T-C)	1.9e+04	1.2e+05	
S. Error		5.1e+04	3.1e+04	**5.9e+04**
Ltl		0.37	3.82	**1.67**
p>ltl		0.715	0.002***	**0.115**

Source: 1998/99-2016/17 and computation using Stata version 14

Number of observations in DID: 19, R-Square: 0.58, Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

The comparison was between the control and treatment groups before and after the policy. The micro policies have a treatment effect at one in ten except B&E. B&E has not been affected. That is because of the proportionate enrolment in public and private universities. Learners are interested in B&E, and most regular learners were placed based on their interest in government universities. The demand for learners in B&E in private universities is also high.

Table 16: DID results- NCS policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	640.500	316.000	**4.6e+04**
	Treatment(T)	2.6e+04	7.1e+04	
	Difference(T-C)	2.5e+04	7.1e+05	
S. Error		1.4e+04	8354.632	**1.6e+04**
Ltl		1.82	8.51	**2.88**
p>ltl		0.088*	0.000***	**0.012****

Source: MoE, 1998/99-2016/17 and Author's computation using Stata version 14

Observations in DID: 19, R-Square: 0.58 Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<

Table 16, the compares the enrolment of learners in public universities as the treatment group and private universities as comparison groups before and after the policy. The treatment of the micro policy effect of NCS affects 10%, 5%, and 1% of the baseline of the policy, average DID result, and follow-up of the policy, respectively. The effect of NCS enrolment is significant at all levels, with the treatment having a positive policy effect. This is anticipated enrolment in NCS in public universities. About 89% of the regular learners lack interest in policy government intervention. Enrolment in private universities is based on the learner's interest, and learners in NCS colleges are likely to be teaching staff.

Table 17 DID results of undergraduate enrolment of MHS policy effect on enrolment.

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	2923.500	14e+04	**1.3e+04**
	Treatment(T)	1.8e+04	4.2e+04	
	Difference(T-C)	1.5e+04	2.8e+04	
S. Error		1.2e+04	7399.350	**1.4e+04**
Ltl		1.21	3.77	**0.92**
p>ltl		0.245	0.002***	**0.365**

Source: MoE, 1998/99-2016/17 and Author's computation using Stata version 14

Number of observations in DID: 19, R-Square: 0.62, Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

The results of the DID analysis of NCS micro policy on the enrolment process. NCS graduates were anticipated to join the teaching staff. Learners who enrol in public universities do not follow their interests, whereas those who choose private universities based on their interests, yet they demonstrate no interest in NCS

colleges within public universities. The Stata output for MHS's DID analysis, indicated no statistically significant difference between the baseline data and the average DID results. The effect was observed in the follow-up of MHS's micro policy. In the ANRS model, the interaction coefficient indicates the average treatment effect, as outlined in the methodology section. This coefficient is statistically significant across the baseline, follow-up, and average DID for the ANRS micro policy.

Table 17: ANRS policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	2751.500	3356.000	**1.9e+04**
	Treatment(T)	1.7e+04	3.7e+04	
	Difference(T-C)	1.4e+04	3.3e+04	
S. Error		7642.543	4669.671	**8956.243**
Ltl		1.84	7.15	**2.16**
p>ltl		0.086*	0.000***	**0.047****

Source: MoE, 1998/99-2016/17 and Author's computation using Stata version 14; Number of observations in DID: 19, R-Square: 0.81; Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

Table 18: B & E policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	1.4e+04	5.6e+04	**-8.6e+03**
	Treatment(T)	4.8e+04	8.1e+04	
	Difference(T-C)	3.4e+04	2.5e+04	
S. Error		2.6e+04	1.6e+04	**3.0e+04**
Ltl		1.30	1.58	**0.28**
p>ltl		0.214	0.134	**0.781**

Source: MoE, 1998/99-2016/17 and Author's computation using Stata version 14; Number of observations in DID: 19, R-Square: 0.42; Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

The DID coefficient indicates that there is no statistical significance at all. There is no effect of the micro policy of B&E on enrolment. Enrolment in the B&E in both public and private universities is similar. That implies that enrolment in public universities might be identical to private universities. This result is consistent with the analysis of ESM and RDD.

Table 19: SHS Policy effect on enrolment

Outcome variables	***Control & Treatment***	**Before**	**After**	**DID**
Coefficient (leve¬e)	*Control(C)*	9845.500	8136.400	**5.7e+04**
	Treatment(T)	4.6e+04	1.0e+05	
	Difference(T-C)	3.6e+04	9.3e+04	
S. Error		1.8e+04	1.1e+04	**2.1e+04**
Ltl		2.08	8.71	**2.77**
p>ltl		0.056*	0.000***	**0.014****

Source: MoE, 1998/99-2016/17 and Author's computation using Stata version 14; Number of observations in DID: 19*,* R-Square: 0.86; Mean and standard estimated by linear regression, ** Inference: ***p<0.01, **p<0.05, *p<0.1

Regarding the DID estimation results of undergraduate enrolment of SHS, the results for comparing disparate estimation methods for this group are in the above Table. Thus, the DID result of SHS is statistically significant, all with positive magnitude. There is a statistically significant difference between public and private universities at 1%, 5%, and 10% in the baseline, DID, and follow-up policy, respectively, of the policy of SHS. The DID results in a policy effect on enrolment, which is unanticipated because the policy intended to increase enrolment in S&T and decrease SS in public universities.

6.2.4 Output of 70:30 Policy in Supplying Human Resources to Economy

This section assesses the output (graduates) of the 70/30 policy in supplying HR to disparate economic sectors. The section analyses the undergraduate and postgraduate output of the 70:30 policy to determine its effectiveness in achieving

its intended purposes. The objective is to analyse the outputs of the 70:30 policy in supplying HR to disparate sectors of the economy in Ethiopia

6.2.4.1 Output of the 70:30 Macro and Micro Policies Undergraduate Graduate to Supply of Human Resources

Time-series econometric model analyses were carried out on the 70:30 macro and micro policies effect on the HR supply (undergraduate graduate) for disparate sectors of the economy. The output of this policy was graduates in disparate of fields of study. Learners can graduate in three years, like B&E and SHS, except for law and engineering graduated in five years, computer sciences four years, agriculture three years, and some MHS four years except medicine. The first three-year-term learners were to graduate in 2010/11, four years in 2011/12, and five years in 2012/13 since the policy was in 2008/09. The new policy of S&T began to graduate in 2011, like ANRS within three years; E&T mostly graduated within four years in 2012, like computer sciences and IT; five years for engineering in 2013; six years for medicine in 2014. Less than a third (SS) commenced graduating within three years in 2011, except for some fields of study like law.

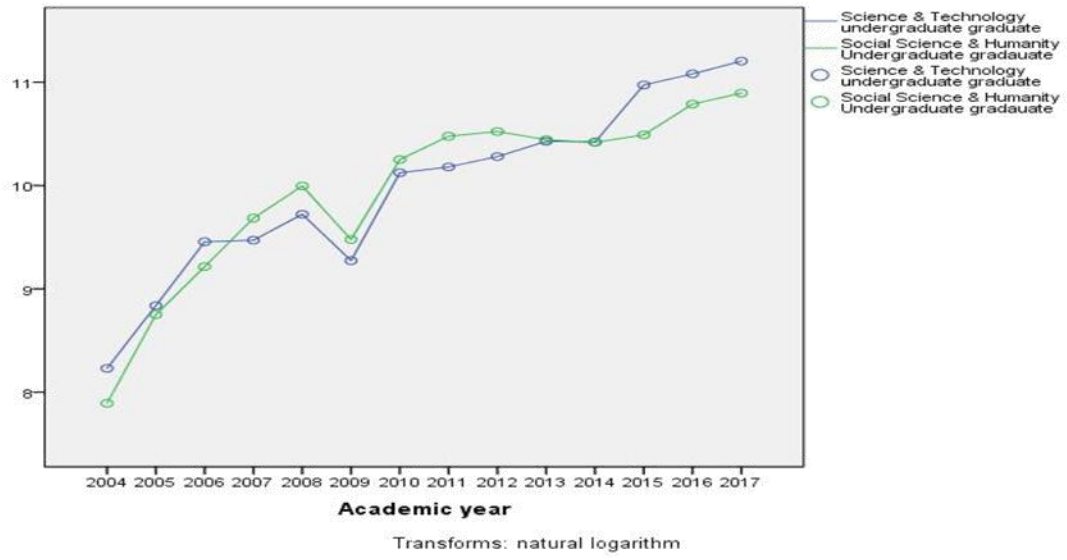


Figure 21: Implementation of macro policy undergraduate supplying HR

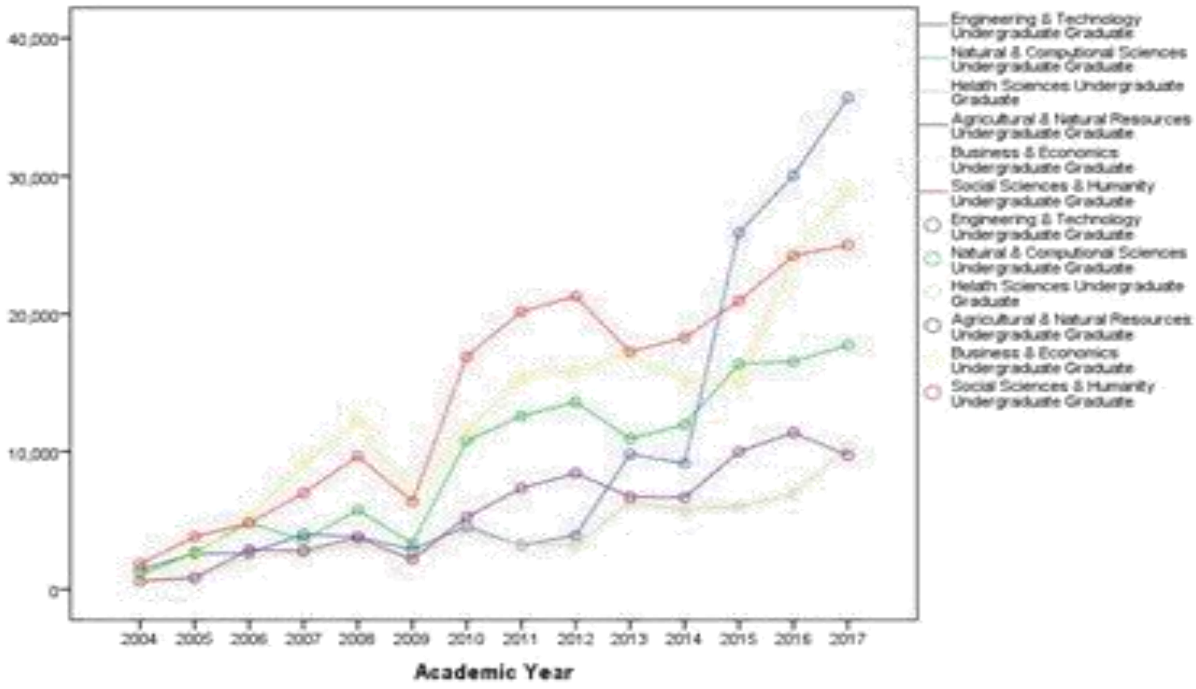


Figure 22: Implementation of macro policy in supplying HR

Source: MoE, ESAA &/or EMIS 2003/04-2016/17, & analysis using SPSS 24

The policy graduates (outputs), over time, delay, and gradually. Figure 21 compares the graduates of S&T (one in ten) and SS (less than a third) before and after the policy simultaneously. The effect of the ESM of both S&T and SS policy has yet to be observed on graduates. Both S&T and SS have no unit root. On the other hand, the data for S&T fits the Brown model plot MA1 with simple exponential sleek, which coincides with E&T (E&T is one of the elements of S&T) presented in Tables 32 and 33, indicate no effect on graduates. The micro-policies of S&T (NCS, ANRS, and MHS) were best fits Holt (AR0) as presented in Tables 32 and 33, which indicates both stationarity and no effect on graduates/outputs according to the policy. The Holt model has two smoothing constants, α and β, which are used in the smoothing equation. One is for the series value (intercept), and the other is for the trend (slope). The data for SS fits the double ESM model (AR0) for graduation time series, with the smoothing

parameters optimised using SPSS software, coinciding with its micro policies (B&E and SHS) as presented in Tables 32 and 33.

The ESM modelled the natural logarithm of the series as a linear trend. The plot indicates that in the undergraduate graduate policy in 2004-2006, the S&T curve was above SS, but in 2007-2012, the SS curve was above S&T; however, the SHS curve was above all from 2010 to 2014. Since 2015, the S&T has been affected slightly more, which concurred with the E&T roused since 2015; however, in 2013 and 2014, the S&T and SS curves tangent to each other. In general, the S&T and SS curves were almost parallel and did not align with the intended policy (plan). There has yet to be a systematic change in slope based on the intended plan. The policy needs to be more efficient in changing the parameters of macro and micro policies on graduate rates based on the policy guidelines.

A comparison was made between the target of the quota (ex-ante) and the output of the policy (ex-post result), but the results indicate that they did not match (as depicted in the annex part in Figure 38). For instance, the ratio of undergraduates in S&T to SS was 58.4:42.6 in 2003/04. In contrast, in 2008/09, it was 45:55. In 2013/14, the undergraduate-graduate programme ratio of S&T to SS was 50:50. In 2014/15, it peaked at a ratio of S&T to SS of 62:38, followed by 58:42. Even though the supply of graduates of S&T was growing gradually, the undergraduate graduates increased sharply after 2014/15. As the plot demonstrates, the HEIs could not provide the required human capital, especially for S&T. An increase in the supply of graduates in S&T lowered the required human capital in technology capital. The graduates need to gain skills. The strategic issue in the relationship between effective learner demand and the conversion is the suitability of preparatory graduates in the sciences stream to meet the two-fifths demand of E&T (MoE, 2008). This, in turn, takes us to the critical issue of the relevance and the quality of science and mathematics education in our secondary and preparatory schools. Thus, the two-fifths proportion for the E&T discipline has yet

to be attained. The input of the policy target (an ex-ante) and the ex-post (the output) of E&T has yet to match based on the plot demonstrated of the time series over time.

In 2013/14, the total number of undergraduate students in E&T in government institutions was 13.6%, which decreased by 0.8% from the previous year's data, as verified in Figure 41 in the annex section. Further analysis from Figure 41, of all academic years, highest point (29.2%) of graduates in E&T was observed in 2016/17, as demonstrated in Figure 39 in the annex section. Consider the additional analysis related to Figure 41, which is provided in the annex section in 2010/11 and 2011/12, SHS had the highest undergraduate graduate share, 32.6% and 32.1% out of the total graduates, respectively. In 2007/08 and 2008/09, B&E contributed the highest graduate share in government institutions with 31.7% and 31.3%, respectively. From 2009/10 to 2011/12, NCS achieved a 20% allocation of the new policy of undergraduate graduates in this discipline. In 2011/12 and 2005/06, MHS reached a high of 10.6% and hit a low of 4.8% of graduates, respectively, considering the additional analysis related to Figure 41, which is provided in the annex section. According to the policy, the proportion for medicine and health is only 5%, which is low to supply HRs for health services with quality for more than 107 million people (2016/17) and 130 million people in 2025. This meets WHO requirements. Female undergraduate graduation in S&T remained notably lower than males across both fields, with the highest rates at 36.5% in 2015/16 and 28.5% in 2016/17, as demonstrated in Figure 40 in the annex section. The regular undergraduate programme saw significant participation, accounting for 73.4% of graduates in 2016/17, with S&T to SS ratios ranging from 61:39 to 47:53 in earlier years. Evening programmes in S&T exhibited lower graduation rates compared to SS, with female representation notably sparse, as demonstrated in Figure 40 in the annex section.

6.2.4.2 Output of 70:30 Macro Policy Postgraduate Graduate to Supply of Human Resources

Graduates in S&T increased in 2009/10-2014/15 and then decreased in the following two years. With this strategy and plan, achieving the 70:30 ratio of postgraduates was not the prerequisite of the guidelines. The postgraduate policy of 70:30 has yet to be achieved. As we can understand from the figure for all the academic years, the postgraduate graduate has yet to achieve the desired 70% in S&T.

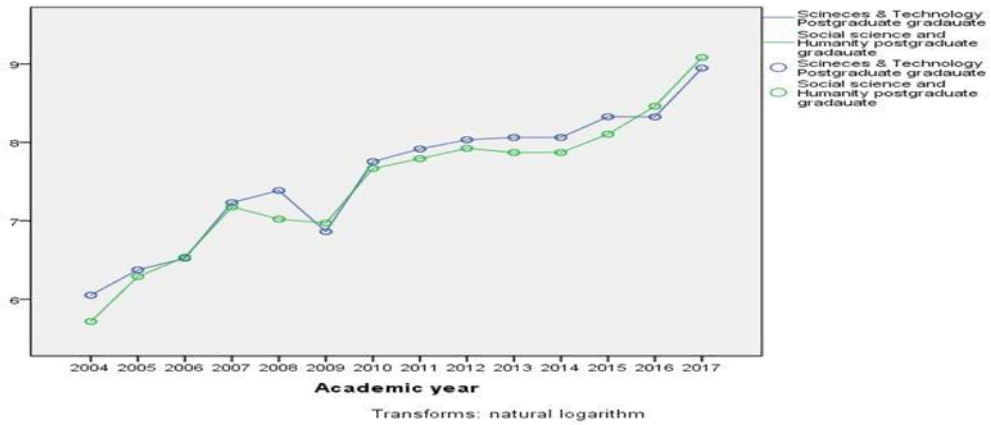


Figure 23: Outcome of macro policy in postgraduate supply of HR

Sources: MoE, ESAA &/or EMIS 2003/04-2016/17, & analysis using SPSS 24

The 70:30 discipline commingle policy is theoretically aligned with Ethiopia's developmental imperatives, yet it suffers from practical imbalances between labour-market supply and demand. Graduates frequently lack essential skills, such as knowledge construction and thesis articulation, indicative of broader systemic failings. Additionally, a pronounced gender disparity exacerbates these issues, with female postgraduate graduates' representation in S&T peaking at a mere in 2014/15 and plummeting in 2003/04, significantly trailing behind male counterparts. This gender imbalance, coupled with the overall inadequacy in postgraduate enrolment, particularly in S&T, underscores the critical need for a strategic overhaul to realise the policy's objectives effectively.

Figure 24 delineates the proportions of postgraduate graduates across various micro policies, revealing that SHS consistently held the highest proportions,

peaking at three to four times 10%. In stark contrast, ANRS exhibited the lowest proportions post-2008/09, hitting a nadir in 2008/09. This dip, whether due to data anomalies or temporary factors, suggests ANRS's trend stationarity with transitory effects. Conversely, E&T's postgraduate proportions were notably inconsistent with national policy guidelines, peaking at 19.3% in 2005/06 and plummeting to 6.1% in 2010/11 the sectors were illustrated in the annexed section of Figure 45. SHS graduates ranged from 27.2% to 45.8% throughout the period, consistently exceeding other sectors as demonstrated in the annex part in Figure 45. The NCS sector, however, failed to meet the national policy's fifth target. MHS and ANRS exceeded the policy's one in twenty allocations, highlighting disparities in alignment with national educational objectives. These findings underscore the varying impacts of micro policies on postgraduate outcomes, with abrupt, gradual, and temporary effects influenced by sector-specific conditions and study terms. The data reflects a complex landscape where educational outcomes in sectors like agriculture are particularly volatile, necessitating a nuanced understanding of policy impacts and data integrity.

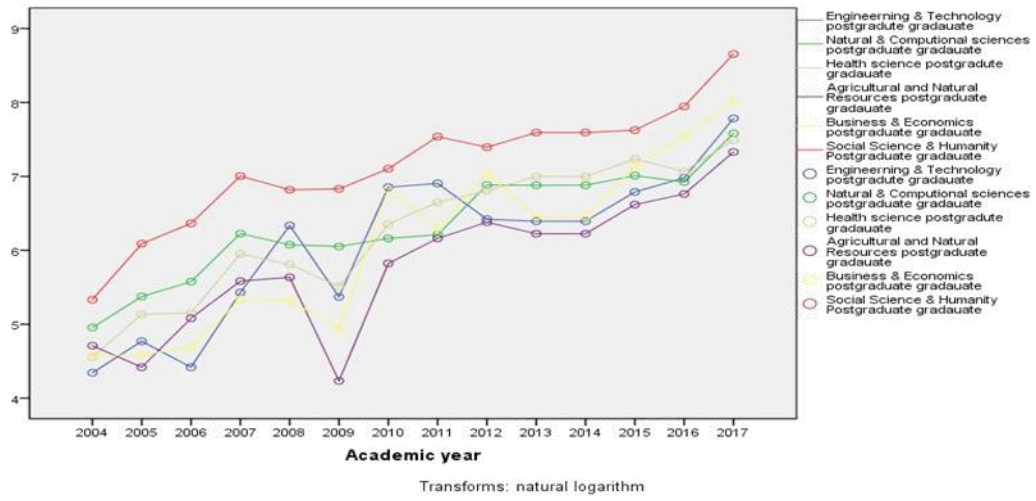


Figure 24: Output of Micro policy at postgraduate in supplying HR

Sources: MoE, ESAA &/or EMIS 2003/04-2016/17, & Author's work using SPSS 24

ANRS is a non-stationary series characterised by random walks with drift exhibiting a sporadic movement around a level. Many educators agreed that agriculture production could increase where education has been an input variable, and this approach is common in disparate studies that measure labour productivity in agriculture. In Ethiopia, where more than 80% of the people depend on agricultural activity, qualified agricultural educators are necessary to conduct research, modernise agriculture, and introduce technology. Demand for instructors in E&T is a challenging factor in the conversion plan, making it difficult to meet instructor demand. Universities anticipated contributing to national development in general and their surrounding communities by disseminating research knowledge to governments, communities, and industries. Limited resources can impact the quality of training and education, thereby affecting the qualifications and the calibre of graduates produced.

The implementation of postgraduate enrolment in S&T (Brown) aligned with the undergraduate graduates in S&T and coincided with those in E&T; however, it did not match the undergraduate enrolment (random walk) of S&T, as presented in Tables 32 and 33. However, S&T postgraduate graduates followed the Holt model coincided with micro-policies for undergraduate graduates of S&T (NCS, ANRS, and MHS) were the best fit, with the Holt model, and coincided with postgraduate graduates of NCS and MHS-stationary, which indicates the policy did not affect enrolment and graduation. In contrast, postgraduate graduates of ANRS and E&T, which are part of S&T, followed a random walk. SS postgraduate enrolment and undergraduate graduates aligned with Brown, concurring with undergraduate graduates of B&E and SHS. Undergraduate enrolment, on the other hand, followed the Holt model and aligned with postgraduate graduates of B&E and SHS, indicating a linear relationship before and after the policy, as presented in Tables 32 and 33.

6.2.5 The Outcome of the 70:30 Policy Effect on the Employability of Graduates

The employment and unemployment rates of graduates reflect the direct positive and negative impacts of the policy, respectively. This section presents the analysis of statistical data, including the descriptive statistics and logistic regression of the outcome of the 70:30 policy effect on the employability of graduates.

6.2.5.1 Descriptive Statistics Analysis of the Employment Status of Graduates of the 70:30 Policy

The effect of Ethiopia's 70:30 policy on graduate employment is a significant aspect of its development. UNESCO has highlighted concerns regarding the employment of graduates in jobs such as typing and sewing, noting the need for skills assessment within six months after completing courses. Hence, this study is considered (Wolf, 2005) the assessment of graduates' employability within six months and above. In line with the 70:30 macro policy since 2010/11, as the policy started with graduation. This subsection conducts quantitative data analysis to examine policy effects on employment and/or unemployment. Descriptive analyses were carried out to assess the employment status of graduates.

A descriptive analysis (per cent) was conducted to analyse the employment status of graduates of the policy, based on clustering of macro and micro policies, which were collected in 2015/16. In this analysis, the summary is based on graduates' employment status and unemployment, focusing on macro and micro policies. The statistical data were collected from the HESC, one of the organs of the MoE of Ethiopia. Accordingly, the researcher analysed graduates' employability based on the clustering of macro and micro policies.

Table 20: Macro & micro policy effect on graduate employment (2016)

Policies		Employed	Unemployed
Macro policies	S&T	62.6%	37.4%
	SS	70.9%	29.1%
Micro policies	E&T	63.2%	37.0%
	NCS	59.2%	42.8%
	MHS	80.5%	15.3%
	ANRS	41.9%	54.7%
	B&E	81.7%	13.4%
	SHS	55.1%	44.9%
*Total **and/or Overall Pearson r***		*65.3%*	*34.7%*

Sources: MoE/HESC, 2016 and Author's computation

The analysis covered 3,670 first-degree undergraduate graduates from cohorts between 2010/11 and 2013/14 regarding their employment status. It found a higher unemployment rate among S&T graduates at 37.4%, compared to 29.1% for SS, contradicting the belief that S&T fields pose a greater risk of unemployment (MoE, 2008). Conversely, learners in SS were more favourably placed according to their preferences than those in S&T, which might be linked to their employment outcomes.

Regarding the micro policies, the highest percentage of employed graduates is in B&E, followed by MHS and E&T. Graduates in B&E often secure around 80% of positions, which might be aligned with their preferences in their fields of study, and MHS have good performance in NLA results. In contrast, graduates in E&T and SHS face employment challenges. The ANRS has the worst (41.9%) job placement within the labour market. Conversely, fields like accounting, finance, and economics within B&E were in high demand in the labour market. The 70:30 policy document indicates that graduates in medicine and the E&T domain were generally considered to have better employment prospects both within and outside Ethiopia (MoE, 2008). However, the findings align with the MHS but contradict the assessment of E&T. Conversely, graduates in SS and NS face

limited employment opportunities domestically and similar constraints abroad (MoE, 2008), which is consistent with the current findings, especially for NCS, but inconsistent with B&E. Nevertheless, the data reveal that 37.0% of E&T graduates remain unemployed. The table illustrates that agriculture graduates have the highest unemployment rate of approximately 54.7% and the lowest share of enrolment, identical to MHS of all micro policies, though about 80% of the population depends on agricultural economic activity, and agriculture provides employment opportunities in a short period.

In general, among the graduates in the sample, 65.3% were employed, while 34.7% were unemployed. Among those who were unemployed, 67% reported that their unemployment was due to the inability to find a job. This finding highlights important implications for policy relevance, labour-market demand, and HR planning regarding supply and demand. The findings and analysis also indicated a varied effect of university generation on graduates' employability. Unemployment rates were observed among graduates of the first, second, and third-generation universities, at 22%, 32.5%, and 38.2%, respectively. The findings indicate that the university generation has a varied impact on graduate employability.

Table 21" Employment generation by universities (2015)

Generation of University	Employment status	
	Employed	Unemployed
First-generation	79.9%	22.0%
Second generation	67.8%	32.5%
Third generation	61.8%	38.2%

Sources: HESC/MoE, 2016 and Author's Computation *using SPSS version 24*

The recent graduates' samples from third-generation universities who completed their studies in the 2013/14 academic year. In contrast, about 52% of graduates from first-generation universities completed their studies between 2010/11 and

2012/13. The findings indicated that the university's generation variably affects graduate employability, which has implications for HE policy. As a result, third-generation universities' graduates face a perilous unemployment rate. Furthermore, the data also illustrated that it has a varied impact on employability among regions due to disparate resources and business areas.

6.2.5.2 Logistic Regression Analysis to Assess the Effect of the Policy on Graduate Employment

Binary logistic regression was carried out to evaluate the policy's effect on the graduates' employment. We often use marginal effects or odds ratios to better understand the effects of independent variables (policy) on dependent variables (employment)

Table 22: Fitted binary logistic model-effect of policy on graduate employment

Characteristic		B	S.E.	Wald	Df	Sig.	Exp(B)
Gender	(Female)	.067	.104	.415	1	.520	1.069
	Male (Ref.)						
Age	Constant			1.907	2	.385	
	Below 25	.075	.291	.067	1	.796	1.078
	25-35	-.068	.277	.061	1	.805	.934
	More than 35						
	(Ref.)			1.907	2	.385	
Micro policies	Constant			120.552	5	.000	
	E&T	-.279	.155	3.258	1	.071	.757
	NCS	-.238	.132	3.269	1	.071	.788
	MHS	.910	.260	12.221	1	.000	.403
	ANRS	-.510	.254	4.018	1	.08	1.665
	B&E	1.271	.131	93.805	1	.000	.281
	SHS (Ref.)	0b	.	.	0	.	.

Source of data: HESC and computation using SPSS version 24

The binary logistic regression analysis in Table 23 aims to assess how different demographic characteristics and micro policies affect graduate employability. This analysis evaluates the significance and strength of each factor's relationship with the likelihood of employment. The dependent variable is employment status (employed versus unemployed), and the model estimates how independent variables such as gender, age, and policies impact employment.

Gender is one of the policy aspects. Despite a high disparity in enrolment in HEIs, the coefficient for females is 0.067 with a p-value of 0.520, indicating that gender has a statistically insignificant effect on employment status, which warrants further investigation. Although the sex composition in Ethiopia is nearly balanced (females are slightly dominant), there was a significant disparity in HEI enrolment (males dominate over females), which could be one reason. Conversely, affirmative action is another factor.

Age is one factor in the policy because it can influence the employment opportunities of university graduates. The three age groups specified were below 25, 25-35, and >35 (as a reference category). However, one of these age categories demonstrates a statistically significant effect on employment status since all p-values are >0.05. The odds ratios for individuals under 25 (Exp (B) = 1.078) and those aged 25 to 35 (Exp (B) = 0.934) indicate slight variations in employment likelihood compared to the reference group, but these variations are statistically insignificant.

The policy is an independent variable. Graduates of the MHS (of the micro policies of STEM/S&T) are 2.484 times more likely to be employed, with a p-value of 0.000, indicating that this was a statistically significant predictor of employment outcomes, which correlates with their performance on NLA results; they have relatively good performance. Conversely, graduates from the ANRS programme are less likely to secure employment, which is contrasted with their preferred fields of study, as more than 74.2% of learners were placed without

their interests and/or self-selected profession. B&E micro policy has a significant effect on employment outcomes (p = 0.000), with an odds ratio of 3.565, which is associated with their preferred fields of study, as they have been placed based on their preferences for fields of study. Graduates of the B&E micro policy were over 3 times more likely to be employed, indicating a dominant effect on employability. SHS is a reference category with no coefficient. As the reference group, SHS serves as the baseline to which other policies are compared. The policy has a statistically significant effect on the graduates of B&E (part of SS) and MHS (one component of S&T/STEM) in getting a job. The rest of the micro policies (E&T, NCS, and ANRS) have a statistically insignificant effect on graduates' job prospects. This suggests that learners who are placed in the mainstream based on their preferences and/or interests have a higher chance of getting a job, for example, graduates of B&E. On the other hand, learners who have superior performance in NLA and entrance to HEIs have gotten jobs, for example, graduates of MHS. Multinomial logistic regression was also conducted to examine the outcome variables (employment versus unemployment) of micro policies, age, gender, and time effect (independent variables) on self-employment and time to getting a job. It involves modelling the log-odds of the outcomes as a linear combination of predictor variables.

Table 23: Policy effect on self-employment

Characteristics		B	Std. Error	Wald	Df	Sig.	Exp(B)
Self—employed	Intercept	—3.109	.768	16.377	1	.000	
	E&T	.522	.378	1.900	1	.168	1.685
	NCS	.194	.372	.271	1	.603	1.214
	MHS	—.621	.770	.650	1	.420	.538
	ANRS	—.587	1.063	.305	1	.581	.556
	B&E	**.742**	**.361**	**4.219**	**1**	**.040**	**.476**
	SHS (Ref.)	0[b]	.	.	0	.	.
Time to get first job categories							
over a year	Female	—.292	.217	1.814	1	.178	.747
	Male (Ref.)	0	.	.	0	.	.
	E&T	—.389	.311	1.560	1	.212	.678
	NCS	.030	.259	.014	1	.907	1.031
	MHS	**1.257**	**.516**	**5.940**	**1**	**.015**	**.285**
	ANRS	—.016	.746	.000	1	.983	.984
	B&E	**1.257**	**.258**	**23.812**	**1**	**.000**	**.285**
	SHS (Ref.)	0[b]	.	.	0	.	
Under a year	Intercept	—.354	.442	.641	1	.423	
	Female	—.003	.110	.001	1	.975	.997
	Male (Ref.)	0[b]	.	.	0	.	.
	Below 25	—.475	.258	3.387	1	.066	.622
	25—35	.017	.234	.005	1	.943	1.017
	More than 35 (Ref.)	0[b]	.	.	0	.	
	E&T	.109	.198	.300	1	.584	1.115
	NCS	.512	.184	7.750	1	.005	1.668
	MHS	—.523	.276	3.597	1	.058	.593
	ANRS	1.042	.438	5.670	1	.017	2.835
	B&E	.066	.152	.188	1	.665	1.068
	SHS (Ref.)	0[b]	.	.	0	.	.

The fitted multinomial logistic regression model in Table 23 examines two key outcomes of self-employment and time to get a first job. The analysis explores the effects of micro policies and demographic factors (gender) of graduates on

employment outcomes. Only graduates of B&E have a statistically significant positive impact on self-employment (Exp (B) = 2.101). The micro policies (E&T, NCS, ANRS, and SHS) have a statistically insignificant effect on the self-employment of the graduates. It was anticipated that S&T/STEM education policy graduates would have a positive effect on self-employment, considering the implications their STEM fields for the contemporary work environment, like digital technology, technology, digital business and digital entrepreneurship for the gig and/or digital economy.

ANRS significantly shortens the time to employment (Exp (B) = 2.835), as do ANRS programmes for securing employment within a year, which might be appointed by the government for agriculture extension and teachers, respectively. The graduates of ANRS have the lowest share of enrolment in the HEIs of all micro policies, though the government allocated the lowest share, identical (5%), for MHS. An ex-ante evaluation was not accounted for while formulating the policy, hence policymakers were urged to perform comprehensive ex-ante evaluations before enacting policy changes, considering the difficulties faced by graduates' employability, such as unemployment due to policy inflexibility, insufficient and less effective HR planning and development.

The policy has a statistically significant effect on the graduates of B&E and MHS in getting a job within a year again, as indicated by $p < 0.05$, like their effect on employment opportunity, which was consistent with their effect on employment and self-employment as well. Likewise, the policy has a statistically significant effect on getting a job within a year. However, the rest of the variables have a statistically insignificant effect on the graduates obtaining a job, both under and over a year, though UNESCO (2015) recognises that assessment should be conducted after six months of completion of their training. Still, learners of B&E and MHS who have been placed based on their preferences and have performed well in the entrance exam/NLA, respectively, have better employment opportunities and can secure a job relatively on time. This indicates that the placement of learners based on their preferred fields of study and good

performance at NLA and/or the entrance exam has been associated with their employment opportunities.

UNESCO (2015) noted that assessing participants' skill utilisation six months post-course completion, which is included in this analysis. Furthermore, UNESCO identified an effect on employment at the course's conclusion. The HESC (2016) alumni study, focusing on key industries or employers, deployed questionnaires to assess graduates' employability based on skills and competencies. Skill shortages often impede economic growth and productivity; they also constrain HCT. Therefore, over 187 organisations from both the public and private sectors were deliberately chosen. These organisations were deemed capable of employing or engaging HEI graduates. Employers were asked to evaluate the significance of various skills, qualities, and relevance necessary for graduates' daily tasks within their organisations. The findings demonstrate that 56% of employers believe HEIs should be informed about industry demands. HESC (2016) reported that more than half of the employers (52%) considered the graduates unprepared for industry roles. The efficiency level of HR employment indicates that overall, employment is 65.3%.

The HE expansion in the Ethiopian context presumes that HE graduates develop the capacity to create jobs. However, very few graduates reported their private businesses (self-employment). In an alumni study, only 3.6% were self-employed. Mekelle University’s tracer study indicated that only 3% engaged in a self-created job. That is scanty for the sustainability of the graduates of policy, which is the aspect of effectiveness; hence, this policy's ineffectiveness. Entrepreneurial courses in HE may be related to self-employment. Self-employment is related to graduates' skills and their fields of study, which need further study. Self-employment development as a means of alleviating issues of graduate unemployment. The issue of unemployment through jobs created by public entities. Fresh graduates will assist in their jobs as self-employed. Self-employment development and the possible factors for self-employment require investigation for the government and policymakers to make informed decisions.

Employers raised concerns about the HEI's awareness of the industrial requirements across all employability skills. The rationale for the macro distribution of undergraduates in S&T has been considered a transformation from agriculture to industry. The policy intention was to produce skilled labour for burgeoning manufacturing. Employers disclose that low productivity and work culture are among the challenges that prevent industrial parks from utilising their total capacity.

6.2.5.3 The Relationship between Graduate Employment Status and Students' Placement Fields of Study

Pearson correlations between graduate employment status and field o -study placement were conducted. Table 24 below shows the correlation between the explanatory (policy placement) and the outcome variables (graduates' employability).

Table 24: Pearson Correlation between graduate employment & field of study placement

Variables	1	2	3	4
Unemployed graduates	-			
Employed graduates	-0.99**	-		
Graduates were placed without their first-choice fields of study	0.58	-0.58	-	
Graduates were placed with their 1st choice fields of study	-0.58	0.58	-1.00**	

Note: values represent Pearson product-moment correlation coefficients (two-tailed), N=8 and ***P<0.01*

Table 24 displays a moderate positive correlation between graduate unemployment and graduates placed in fields not their prior or preferred choice ($r \approx 0.58$), while a moderate negative correlation exists between graduate unemployment and those in their first-choice fields of study ($r \approx -0.58$). This indicates that graduates placed and studied in their prior preferred fields were

more likely to have better employment opportunities. As clearly shown in the placement and choices analysis, most students-especially STEM students-were assigned to fields outside their prior preferences, often due to government-mandated placements (state led-admission-forced placement). The moderate link between unemployment and placements outside students' prior preferred fields recommends that misalignment between preferences and actual fields of study may hinder employment prospects. Conversely, placement in a student's first-choice field appears to support better employability of graduates. Hence, enhancing the alignment between students' preferences/talents and their chosen fields of study could improve employment outcomes and mitigate graduate unemployment.

6.3 Findings and Qualitative Data Analysis

This section presents a qualitative data analysis that complements the quantitative findings, using ATLAS.ti software with advanced data visualisation, analysis of a network, coding, and quotation. First, it discusses the demographic characteristics of the interviewees, followed by the presentation and analysis of the study's findings. These are organised around the objectives outlined in Chapter 1.

6.3.1 Demographic Characteristics of the Interviewees

Only 38 (73.4%) of respondents out of 73 were included in the analysis because some responses reached saturation and redundancy during coding, while others did not respond or reply. Table 28 shows the demographic profile of interviewees across four dimensions, including gender, qualification, field of study, and position. The demographic profile illustrates a predominantly male sample at 29 (76.3%), with females comprising 9 (23.7%). In terms of qualifications, 30% of respondents have a PhD, the majority (60.5%) hold master's degrees, and the rest hold bachelor's degrees (10.5%). The interviewees' roles vary, with HR positions (26.3%) being the most common, representing respondents from federal institutions, each spanning various economic sectors, government positions, and professional associations related to the six micro policy

perspectives. The rest include academic roles such as lecturers (13.1%) and department heads (10.5%), and 10.5% from each position, like deans, researchers, and directors, reflecting a diverse range of professional experiences.

6.3.2 Relevance of 70:30 Policy for Human Resources Development

This section aims to evaluate the relevance of the 70:30 policy for HRD in HEI using data visualisation with ATLAS.ti software to analyse stakeholder interviews regarding relevance indicators for HRD in HE, a central category interconnected with various subthemes, categories, codes, sub-codes, and code occurrences. The relevant recruitment policy for HRD, including the demand and supply of HR across different economic sectors, was analysed qualitatively. In Figure 25, ATLAS.ti's code network and code occurrences were used to examine KII regarding policy placement within the core category, specifically relevant indicators for HRD in HEIs, such as demands from learners and employers, and the related learner recruitment policy. The figure illustrates a discrepancy between the policy placement in the main category and certain codes, which conflict with most other codes and are linked to rare codes. The data visualisation with ATLAS.ti network of code occurrences related to learner placement and relevant learner recruitment by the government contradicts learners' interests or preferences, as well as their performance in the NLA assessment and entrance exams for HEIs. The timely S&T policy also revealed a mismatch between industry growth and the number of graduates; even though GER is low, the industry could not absorb the graduates of E&T, especially engineering graduates. Furthermore, the data visualisation of the code occurrence network demonstrates that university-industry collaboration is fragile, particularly in areas such as internships, traineeships, practicums, and apprenticeships.

Figure 25 demonstrations that learners were coerced and pushed into various fields of study (macro and micro policies) by the government, mainly pushed into S&T without their interests, and were admitted to HEIs despite deficient performance in NLA and entrance exams of HEI (learners have limited

foundations in STEM at lower schools), which implies a less relevant recruitment policy, especially to advance in S&T for HRD. Learners were not only required to study macro and micro policies but also to specialise in specific fields of study, regardless of their interests and preferences. The government's policy placement decisions often contradicted the learners' self-selected profession. Learners were not only placed without their choice of fields of study, but also without their chosen university.

The policy document states that the education supply must precede learner demand (MoE, 2008). However, the central theme of the recruitment and placement policy in Figure 25 was the misalignment of macro and micro policies with the demands of learners and employers. This visual network would display codes representing various aspects of learner disinterest-leading to diminished relevance, subsequent unemployability, and lack of demand -- and how national or institutional policies influence these, including the minimal participation and consultation of stakeholders, particularly learners, parents, universities, schools, and employers. This policy does not apply to the current situation and therefore needs revision. Considering the economic conditions for industrial development through S&T HR in the previous government plan, it was relevant, but at present, it needs to be revised based on the interests and employment opportunities of graduate learners and industry growth. There was a mismatch in growth between industry and S&T graduates, especially since industry could not absorb the graduates. S&T, most learners did not study what they aspired to, and they were compelled to pursue their studies due to the policy; as a result, even though they completed the course, the outcomes were unsatisfactory. The other codes contradict the relevance of the policy for HRD inconsistencies, with a feeble curriculum, less relevance, no evidence of market demand, not studied, and untimely policy because the learners were not prepared well and industrial growth could not absorb them, especially the two-fifths of E&T. Thus, the policy has no and/or less relevant learner recruitment policy. The policy was less relevant, particularly for most engineering and NS learners, who lack computational skills and robust foundations. As a result, they often do not enjoy studying and are

placed in fields where they are placed. The 70:30 macro policy commenced at the very beginning of preparatory school grade 11 and continues to HEIs. The micro policies commence at the HEI entry level, based on the macro policies. Learners express a reluctance to join the NS stream, because they are aware of their weaknesses in mathematics and computation, as they have a limited foundation of STEM education. It needs to focus on boosting and fostering skills in these areas, starting in lower schools and continuing to HEIs. As a memo of the ATLIS. ti, indicated very few respondents suggested the policy is relevant, and some of them specified it is relevant to the labour market, depending upon their professional perspectives and departments, like B&E, which is consistent with the quantitative results. The respondents agreed with the 70:30 policy, but they were inconsistent with the quantitative results.

The learner placement policy outlined the discrepancy between learners' choices and their placed programmes, placing them in the field where they performed poorly on entrance exams. This was worsened by the 70/30 policy, which enforces strict ratios for the placement of learners within every macro and micro policy, without paying meticulous attention to individual learners' choices and inclinations. There were two contradictions regarding the placement of learners into diverse macro and micro policies. The learners prefer their areas of study before being enrolled at the university; however, placement by the government overrides. The strategy of placement did not take into consideration the interests, talents, abilities, and motivations of learners. This discrepancy was risky, especially in NCS and education programmes, as it places learners who were uninterested and with low scores on NLA, creating a vicious circle for education institutions, as they often join the teaching profession. The key informants disclosed that the 70:30 policy placement and its subsidiary policies have unintended consequences. They observed that learners were coerced into S&T fields regardless of their preferences, which may not motivate them to study hard and may destructively affect HRD. Placing learners in disparate study programmes without considering their interests and academic undermines the

relevance and quality of education and leads to unemployment and underemployment. This impacts the economy by contributing to a complex unemployment issue, especially in HRD.

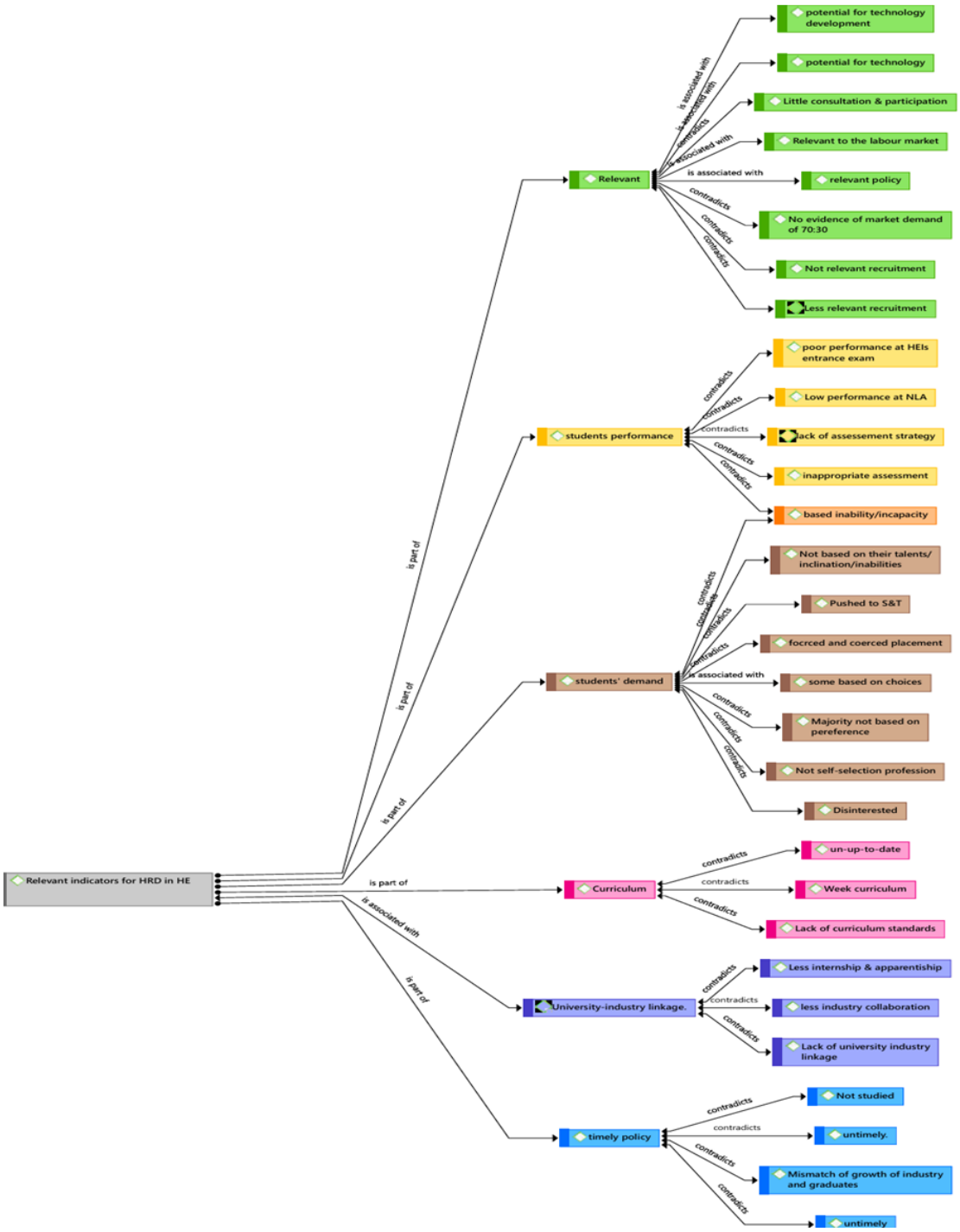


Figure 25: Relevance indicators and placement policy for HRD

Sources: analysis using ATLAS.ti 8-network

The ATLAS.ti, a network of coded visual data, reveals destructive associations-where policies failed to meet the needs of learners and the labour-market demand, contributing less to supply HRD. The implication was that the placement policy relies on extrinsic motivation due to the policy, leading learners not to study diligently, which in turn negatively affects their academic performance. The policy document claimed an alternative where learners make their own choices, which would create demand, and in response, the supply would expand based on the significance of those choices (MoE, 2008); however, this was not realised or implemented.

Figure 71 shows the ATLAS.ti network of hyperlinked quotations (annex) network of hyperlinked quotations (annex) shows that the relevance of the 70:30 policy contradicts itself; some criticise the policy, contradict the policy, and others justify and discuss it, considering it irrelevant. Key informants questioned the goals of the 70:30 policy, due to a lack of evidence supporting labour-market demand for such a ratio of S&T to SS (macro policy) graduates and its micro policies. There was insufficient attention to the dynamics of HR demand and supply across different economic sectors. Although the policy was vital for industrial growth under the previous government’s plan, its ongoing relevance needs to be re-evaluated, revised, and reviewed, considering the changing political and economic landscape, the employment status of graduates, the country's status, and evolving needs of industrial growth consistent with the current government’s plan (must-have policy). The policy was poorly planned, with inadequate research, and worsened the mismatch between industry needs and HR supply. Despite inadequate implementation, the policy could potentially have positive implications for S&T, creativity, and innovation but underestimates the role of innovation from SS, which is part of the ecosystem. Data analysis from interviews also revealed that the field of study influences graduates' employability.

6.3.3 The Implementation of the 70:30 Policy in the HEIs in Ethiopia

Stakeholder interviews, especially with policy implementers and practitioners in HEIs, revealed differing opinions on the relevance and implementation of the 70:30 policy, as shown through data visualisation analysis using ATLAS.ti, including network, code, and quotation analysis. In addition to a less relevant recruitment policy, as depicted in Figures 27 and 28, the less effective implementation of policies in HEIs presents a challenge for HRD, as discussed in detail. The policy implementation network contradicts its relevance to HRD in relation to the policy's objectives. The ATLAS.ti network also highlights a lack of a proper implementation plan linked to specific codes, including inadequate stakeholder participation and consultation, shortages of facilities, infrastructure, and resources, and a lack of S&T institutionalisation and system. These issues affect the quality of training and education. Resources and other equipment are key factors influencing policy implementation in HEIs.

The data visualisation analysis with ATLAS.ti code and network in Figure 26 demonstrates the implementation of the policy in the HEIs, using the main category, codes, and networks. The code and network of codes provide a detailed coding of the data and provide a clear visualisation of key findings from qualitative research. The 70:30 policy aimed to develop the country's industry through S&T HR; however, implementation in the HEIs was less relevant. The network codes visualisation in ATLAS.ti indicates inefficient resources for effective implementation.

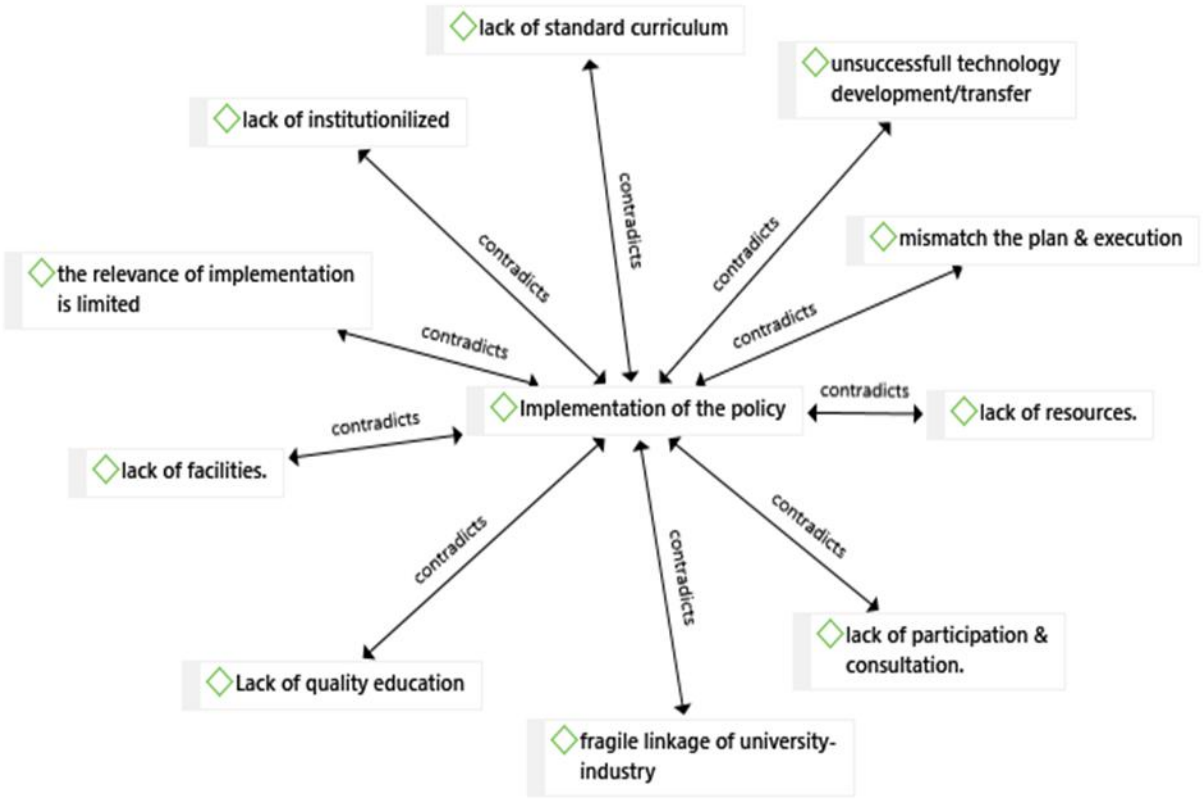


Figure 26: Implementation of policy on HEIs

Source: Analysis using ATLAS.ti 8

The link between universities and industries was feeble; there was poor quality of education and training, the relevance of implementation was limited, and there was a mismatch between the plan and its execution, among other factors, as shown by the ATLAS.ti code and network. The policy document also did not specify the coordination between universities and industries. Although the policy intends to promote industrial development through S&T HR and foster creativity and innovation, its implementation remains in and/or less effective. Challenges in implementing the policy within the HEIs have hindered the realisation of effective collaboration and policy execution.

There was a gap between the policy's targets and their implementation in the HEIs. The policy sets targets for each macro- and micro-level policy concerning learner enrolment in the HEIs; however, the actual enrolment has fallen short of

these targets. For practitioners and policy implementers challenges in policy implementation were not only due to a lack of resources and infrastructure, but also difficulties in meeting the enrolment objectives, which reflect similar quantitative results.

In addition to the network coding analysis, the hyperlinked quotation of data visualisation within ATLAS. it provides a structured analysis of the 70:30 policy implementation in HEIs as the central node, which demonstrates relationships with multiple hyperlinked quotations forming a network of justifications, contradictions, and criticism. For example, it was justified that the 70:30 policy aimed to meet the ruling party's objective for industrial development in line with the GTP and ADLI, without evidence-based research or sufficient analysis (no ex-ante and an ex-post study). It was not considered whether the universities had the resources to implement it. The policy failed to consider economic trends in line with the industry's capacity and growth to absorb graduates, especially S&T graduates. Policy implementation needs political and government commitment, including allocation of resources. On the other hand, the lack of stakeholders' participation in policy design, including learners, teachers, employers/industries, funders, and/or institutions, and the lack of involvement in its design and in obtaining feedback, especially with the country's current situation. In general, the network of codes and hyperlinked quotations implied that it has inefficient and ineffective implementation of the policy in the HEIs.

There are several contradictions when comparing the intended policy goals to their outcome. For instance, the hyperlinked quotation highlights that what is taught in universities mismatches with what industry needs, leading to graduates who are not well-prepared for real-world jobs. Frail university-industry linkage, and policy failure due to lack of infrastructure and effective training and execution of the policy, penurious quality education as a result, and limited job creation, skills, employment, and self-employment of graduates. The impact of the policy

on the economy is one of the criteria, as the graduates were jobless and unemployed.

Figure 28- the hyperlinked quotation of Implementation of the policy hyperlinked quotation of data visualisation with ATLAS.ti, the policy faces criticism regarding its effectiveness and execution. A lack of consideration for employment before implementing the policy, and it was not aligned with job market needs; the role of HEIs in the policy's failure in implementation; and a lack of infrastructure for STEM education, leading to low-quality S&T graduates. The policy was executed with the massive intake of learners in S&T without quality education, infrastructure, and learner interests. The policy was intended to enhance technology transfer and industrialisation; it failed due to low-quality education and being misaligned with industry demands. The policy aimed to develop technology transfer and innovation through HR; the underinvestment in resources led to poor-quality graduates, rare technological transfer, and a lack of practicality.

The network of codes and sub-codes and hyperlinked quotation results indicated mismatches between policy implementation and its objectives and a lack of institutionalisation, which led to destructive implications for the policy for the supply and demand of HR. To make an effective and relevant policy, the use of evidence and research outcomes, forward and outward thinking, joining up across institutions, and participatory and collaborative working are needed. Coordination and systems, including the roles of government, universities, faculties, industries, beneficiaries, and funders, are paramount. The shortage of facilities and resources, such as qualified teachers and teaching materials, infrastructure, and limited stakeholder participation and consultation, including direct beneficiaries (like learners/graduates, employers, and policy practitioners and implementers), leads to a lack of S&T institutionalisation, resulting in the policy having diminished relevance.

The implementation of Ethiopia's 70:30 policy faced challenges. A lack of a standardised curriculum and outdatedness in line with the 70:30 policy, which undermines the policy's effectiveness. The feeble curriculum leads to ineffective teaching strategies and the learning process. Addressing these issues requires a collaborative approach that includes the industrial, institutional, governmental, financial, scientific, and educational sectors to improve educational quality and align graduates' skills with national development goals.

Entrepreneurial education and training are essential in HEIs for promoting innovation and technology transfer, as emphasised in the GTP II (2015/16-2019/20) (MoE, 2015). The lack of adequate university facilities, infrastructure, and resources has undermined and affected the quality of education and training (as depicted in the Figure ATLAS.ti network of code and hyperlinked quotation) and the ability of the 70% cohort in S&T to innovate. Inadequate educational materials, qualified teachers, and teaching resources worsen as learner numbers outstrip the capacities of institutions, especially in E&T. Engineering colleges and S&T universities face these shortages, which compromise the goals of educational policies and hinder the development of skilled HRs vital for national progress. These factors have adversely affected HRD, including graduates' employability and self-employment.

6.3.4 The Output of the 70:30 Policy in Supplying Human Resource to Different Sectors of the Economy in Ethiopia

Aligned with the 70:30 policy, KII were conducted with stakeholders, especially employers and the HR unit of different economic sectors, regarding the supply of HR and demand across different economic sectors. The ATLAS.ti network indicates that the discrepancies may reflect a gap between the policy's design and the evolving demands of the labour market and supply to beneficiaries, casting doubt on its relevance to HRD. Nevertheless, those key beneficiaries and stakeholders were not involved. Despite the policy's aim to promote industrial development, its relevance diminished due to the lack of consultation and involvement of employers and industries in its formulation, as well as the absence

of beneficiary participation. This raised questions about the policy's effectiveness in addressing the supply and demand of HR, leading to the failure to achieve its intended objectives.

Data visualisation with ATLAS.ti, a network of categories, codes, and sub-codes, indicates the supply and demand of HRs across the major economic sectors. This policy allocation for HR leads to disparate supply and demand mismatches in each sector, which indicates less relevant policy implications for HRD and HR planning. The analysis indicates that some sectors might face an oversupply and some an undersupply of HRs, which also indicates a discrepancy between quotas of the policy guideline and outputs and/or market demands. The main intention of the government policy is to provide HR in S&T for public industries, but it underestimates the labour-market demands. The analysis indicates there were inconsistencies between the quotas for each major economic sector and the demands of these sectors, as well as the output of the policy. It examined the alignment of HR supply with actual demand in these sectors and the role of policy interventions in this dynamic, which led to disequilibrium. In ATLAS.ti 8, commence analysing the graph using open coding techniques. In the open coding, identify key elements in the policy that relate to HR supply and demand in each sector, for instance, oversupply, which is HR surplus in some sectors where HR exceeds the demand for jobs in some sectors.

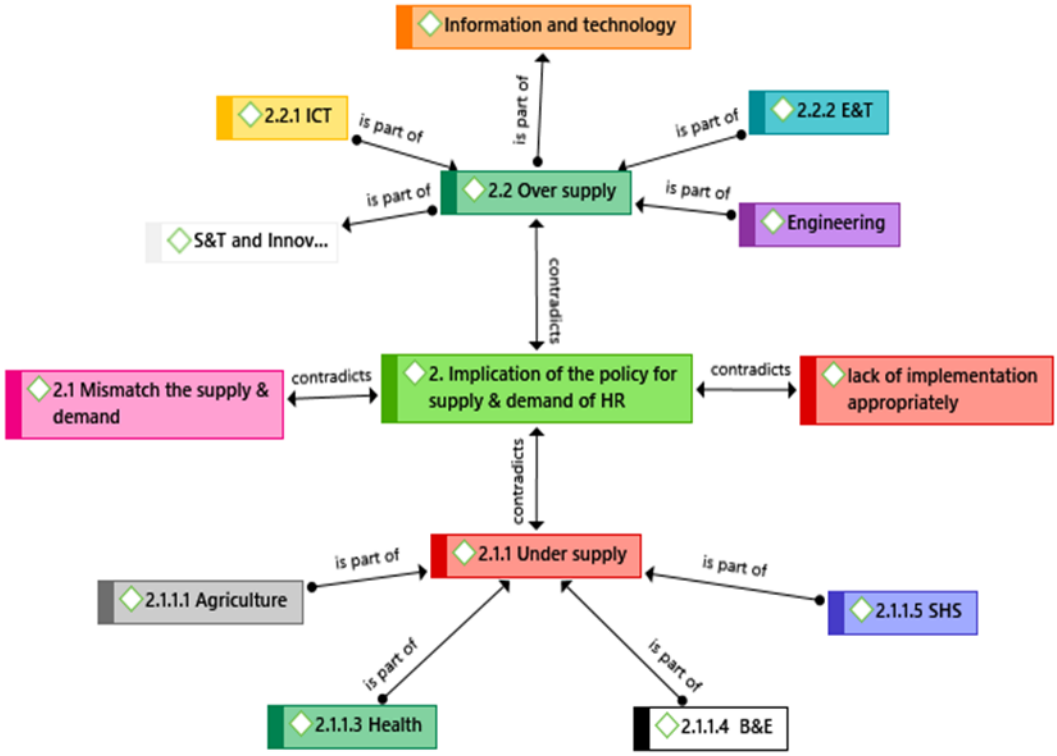


Figure 27: Supply & demand of HR for sectors of economy

Source: Analysis using ATLAS.ti 8

The subcategories have been coded into broader sectors to provide structure, addressing sector-specific undersupply of STEM trends in areas such as agriculture and health, as well as SS areas like B&E and SHS, and, on the other hand, oversupply (like E&T, S&T, IT, and engineering), mismatch, and lack of implementation. The policy has not only issues of planning HR in terms of supply and demand but also mismatch between the target objectives of the policy and its execution. These codes reflect the sectoral demand dynamics of disparate economic sectors. HR demand was fluctuating; it is growing in some sectors and shrinking in others. For instance, there was a potential oversupply of HR in the industry side of the E&T domain, including manufacturing, due to the quota policy and educational institutions producing more graduates than the sector can absorb. Despite a policy allocating 40% of E&T to these areas, a target has not yet been met. ATLAS.ti demonstrates that there was a mismatch between the industry growth and the E&T graduates. At present, the country is experiencing

political instability; hence, construction and industries are declining and/or not expanding as projected according to the 70:30 policy initiation. The additional networking of category and its codes in the ATLAS.ti figure indicated a mismatch between supply and demand and contradicted the policy's plan implementation in HEIs.

Once coded, the relationships between and among codes in terms of sectors, supply and demand, and policy can be visualised through code networks in ATLAS.ti. For example, code co-occurrence networks of STEM would demonstrate where HR supply surplus co-occurs with industry or supply shortage co-occurs with some specific subsectors, providing a clear view of sector-specific imbalances. For instance, there might be an oversupply of engineering and IT, resulting from the policy's focus on technical education, especially in the E&T domain. On the other hand**,** the 70:30 policy might not prioritise some sectors as a key area, leading to HR shortages in health and agriculture. While the manufacturing sector requires a steady inflow of HR, automation and shifts in industrial dynamics could mitigate the demand for skills, exacerbating the oversupply issue. In this area, the 70:30 S&T/STEM policy's emphasis on technical education could lead to more graduates entering the industry than the market can absorb.

Ethiopia's rapid population growth necessitates greater HR needs for professional health services and education, potentially leading to significant HR shortages in these sectors. Macro and micro-policies may not adequately address the demand and supply for each economic sector, further exacerbating the mismatch. The ATLAS.ti analysis indicates a potential need to adjust the 70:30 policy to allocate an adequate plan for HRs, especially the micro policy; for example, it only allocates 5% for sectors like agriculture-which supports over 80% of the Ethiopian population and depends upon agricultural economic activities-and 5% for health services, which cater to more than 107 million people (2017). The health and education sectors, crucial for HCD, require a consistent supply of qualified HR and may be undervalued in current policy frameworks. These areas

require more attention in educational policy. E&T leads to a surplus of graduates in these fields, potentially overlooking 40% of E&T learners. Regarding the SS, especially B&E, it was an undersupplied, in-demand field of study yet in both learner and labour markets. Utilising the ATLAS.ti 8 networks, the researcher has identified key disequilibria in HR supply and demand across economic sectors, significantly influenced by the 70:30 macro and its micro policies. This analysis discovered critical mismatches between educational outcomes and market needs, which is important for policymakers.

The ATLAS.ti network visualisations presented in Figure 28 output the policy as a core category and the analysis of positive and negative codes, and their corresponding sub-codes co-occurrence networks, and illustrate the complex network between the policy's allocation and its outputs.

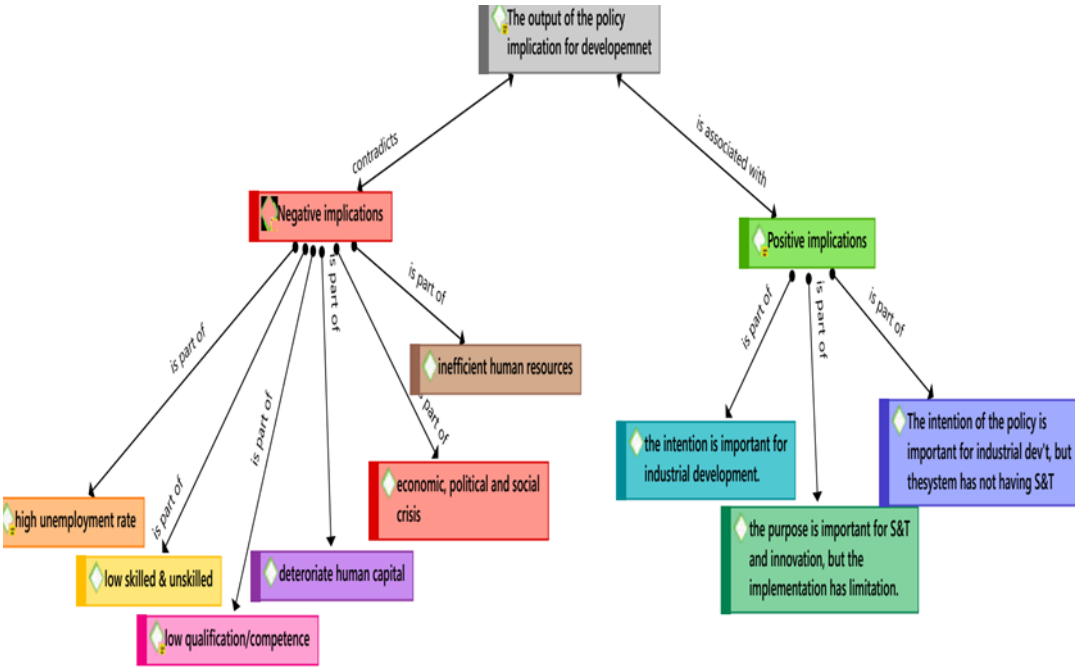


Figure 28: Effects of policy on HR development

Source: Analysis using ATLAS.ti 8

Figure 28: A network of codes provides data visualisation with ATLAS ti, showing how individual codes are interconnected to reflect the broader output of the policy

implications. When analysing the networks in ATLAS.ti 8, the interview results revealed that the outputs (graduates) of the policy implications are the core category and its codes (positive and negative implications), along with sub-codes for each implication. The negative implications included high unemployment, economic, social, and political crises among graduates, inefficient HR, deteriorated human capital, and low qualifications and skills of the graduates. ATLAS.ti allows the inclusion of codes from participants to support each code, giving voice to the stakeholders' perspectives. For instance, the positive implications of the policy include: The purpose is important and has potential for S&T, tech industries, and innovation, but the implementation has limitations, and the system lacks S&T institutions. This has lacked engagement and coordination among stakeholders, institutions, industries, businesses, organisations, and departmental facilities. Political commitment is essential for effective policy implementation, which implies that the policy implementation is.

The categories, codes, and sub-codes of ATLAS.ti networks in Figure 28 were interconnected through a network of codes. The country's policy of having an industrialised nation requires equipped HR in S&T. However, well-structured institutions cannot train and produce qualified professionals in S&T. There was no demand assessment on the relevance of the policy, especially supply and demand projection; as a result, unemployment became a grave issue. The policy has some negative implications on economic development because there were high unemployment rates and jobless graduates, especially in S&T. Graduates' skills were limited, and most were below the standard. HEIs are not producing qualified and skilled graduates. Thus, the general implications can be pernicious for HRD. Hence, the accumulated output of the policyhas led to a high unemployment rate, poorly qualified graduates, and low-skilled graduates that can deteriorate human capital and labour force productivity.

The MoE and HEIs are required to work in consultation with stakeholders, industries and employers to ensure that citizens obtain relevant and quality

education. A question was asked about the effect of the policy, and the interviewees were divided into main categories based on them as discussed and revealed in Figure 28.

One of the purposes of the policy of S&T was to advance technological development and transfer to industries once graduated; however, HEIs have not been doing so. Though the intention of the policy is important for industrial development, practically on the ground (from the interview), we can understand that the graduates could not have the required skills in technology, technology transfer, and S&T due to the ineffective implementation of the policy. Extensive interviews with key policy beneficiaries and implementers at federal and institutional levels revealed that Ethiopia's S&T policy was not research-based or participatory, lacked impact studies, and was dominated by ideological and/or political decisions without empirical research and evidence. The interviewees from industrial development parks and university-industry linkage argued that the number of graduates and vacant jobs was incomparable, and several applicants needed more capacity. The industrial park prioritises light and labour-intensive industries. However, it implies a mismatch between market demand and the supply of HR.

6.3.5 The Outcome of the 70:30 Policy Effect on the Employability of Graduates

For the visual graph (Figure 29: effect of the 70:30 policy on employability), data analysis was performed using ATLAS.ti 8. The employability of graduates is a category and is networked visualisation with subthemes, memos, codes and sub-codes co-occurrences that represent factors influenced by the 70:30 policy. The network of codes and sub-codes co-occurrence and categories in ATLAS.ti enhances the structured processing of qualitative data in terms of contradictions, associations, and parts that affect the employability of graduates. While the creativity and innovation of graduates are associated with their low levels of technology, they perform poorly and cannot transfer technology into the industry,

implying the policy is ineffective in industries and economic/business sectors. There were contradictions where employers felt graduates were underprepared, had low technical skills, soft skills (like communication skills, creativity, professionalism), and other employability skills categories (Figure 29).

Categories, codes and sub-codes co-occurrences, for example, the level of skills of graduates, with codes breaking these down into more sub-codes co-occurrence aspects, such as low social, employability, technical skill, and soft skills. These categories and codes, and sub-codes co-occurrences represent key determinants of employability for the labour-market relevance of the policy with industry demand. ATLAS.ti memo from Figure 29, a network of codes, also indicated that a mismatch between the employer and/or industry required and the skills demonstration of the graduates was part of the skill levels. The visual graph highlighted how disparate elements (e.g., employability factors, including skill, knowledge, quality, professionalism, employment level, creativity, innovation, and technology levels of graduates) were interrelated, providing a comprehensive network of the holistic effect of the policy on graduate outcomes.

The codes in the network visual help to understand the primary concerns of the effect of the policy on employability in terms of successes and failures regarding the policy's implementation and its real-world effects on the demand of employers, graduates' job market performance, and their employability skills. The generation of codes allows for a deeper dive into specific aspects of the policy, for example, regarding the employability level and knowledge of graduates. A code under the employability level has revealed a pattern of joblessness, high unemployment levels, and a mismatch between the vacancies and graduates. An excess of E&T graduates' applicants to industries without having the required knowledge, and technical skills, was among the evidence of the policy's ineffectiveness. Lack of relevant policy and appropriate implementation may be among the reasons.

The data and network visualisation analysis with ATLAS.ti network of code and sub-codes co-occurrences Figure 29 indicates the structured approach of the 70:30 policy effect on the employability of the graduates. The network of the codes above reveals that the 70:30 policy is largely less effective for graduates' employability. The combination of categories, codes, sub-codes co-occurrence, networks, and data visualisation analysis representations demonstrates that while certain practical skills are enhanced, HEIs fail to broadly prepare graduates for the labour market. Specifically, the policy's overemphasis on technical skills and knowledge, and soft skills indicates limited graduates' readiness in areas requiring S&T.

The 70:30 aims to favour S&T over SS.; however, Figure 73 (annex) highlighted contradictions, criticisms, justifications, discussions, and continue to challenge the policy's assumed positive effect. The government believes that innovation and creativity come only from S&T fields of study; it fails to recognise the social innovation for business, democracy, political, social structure, and governance. The 70:30 policy aimed to foster technological innovation but failed to consider the role of SS. The goal of the 70:30 was to promote innovation and industrial growth by increasing the number of graduates in S&T. Innovation is not limited merely to S&T, and it undervalues the innovation from SS. Enrolling in S&T could not guarantee, and is insufficient for innovation

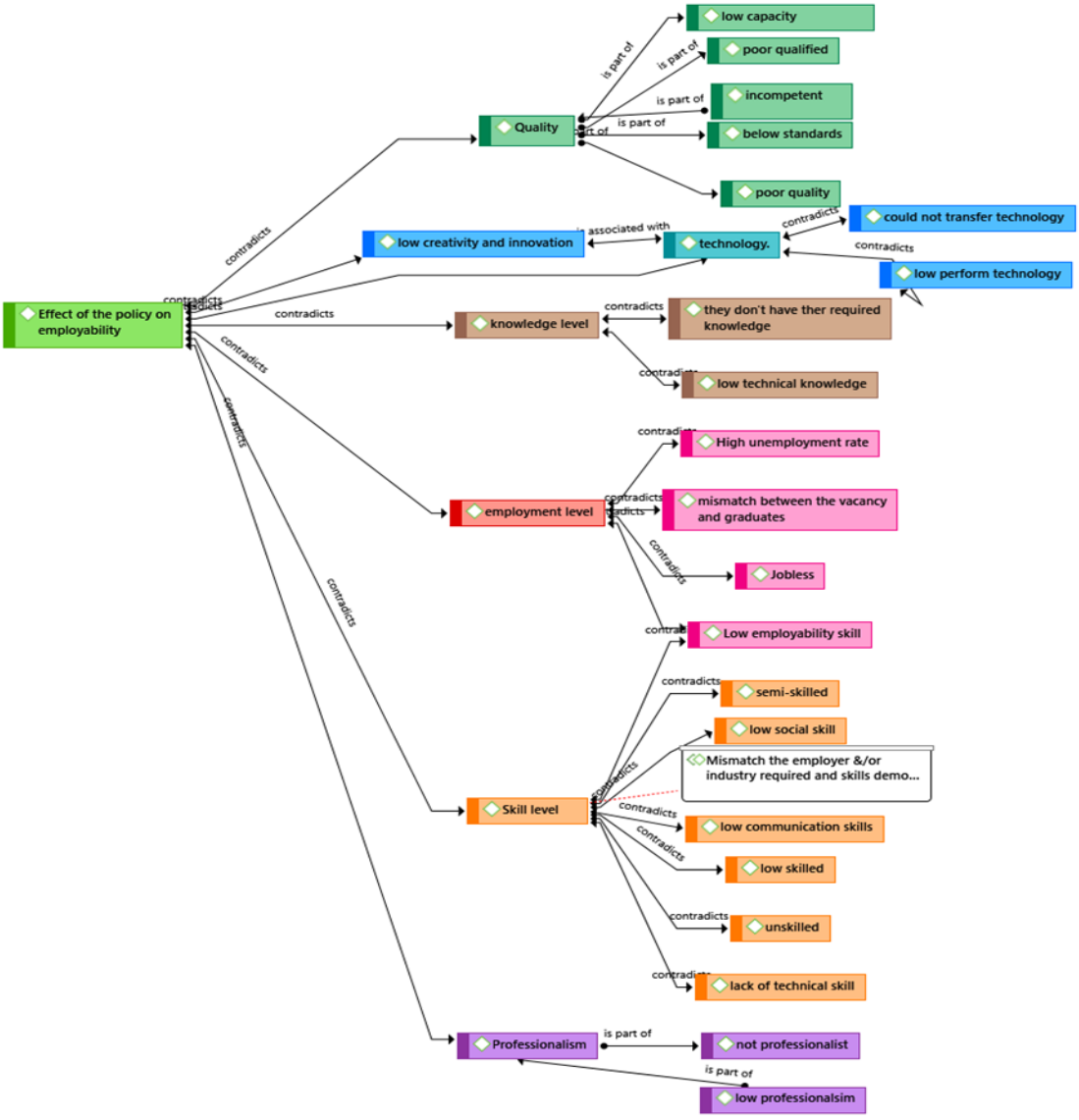


Figure 29: Policy effect on employability

Source: Analysis using ATLAS. ti 8

Moreover, the hyperlinked quotation of the network diagram contradicts its assumption, including the penurious quality of education, mismatched jobs and HR, and market demand. The goal of the policy focused on S&T was for industrialisation, but criticisms and discussions revealed structural flaws that limited its positive impacts. Though learners who have potential are placed into S&T, graduates have lower skills compared to SS; instead of boosting innovation

and economic growth, the policy risks creating more joblessness and unemployment, and talent misallocation undermines its success. E&T graduates were unemployed despite the focus on S&T and inequality in talent distribution into S&T and SS.

The high unemployment rate is one of the factors for the uprisings. Political instability in parts of the country is inspired by the unemployed graduates of HE, among others. The unemployment rate is among the challenges facing Ethiopia due to political, social, and economic crises. The graduate unemployment and underemployment rate remained challenging for the country. Further, it is disclosed that employers are complaining about the lack of skilled labour, and poor work ethics and/or work culture. There is a discrepancy between the skills demonstrated by graduates and the requirements of employers. The knowledge and skills acquired in S&T technically can extend the employment opportunities of graduates (MoE, 2008); the findings indicate that they do not have the required skill sets of S&T and innovation. S&T is not only for innovation, but also for SS. The 70:30 policy was to facilitate employment opportunities; the education should be relevant and of quality (MoE, 2008). However, employability is also highly associated with the quality of education in HEIs.

From the ATLAS.ti network, the key informant viewed that we need an environment that attracts competent HR since we persistently observe that the system is catching up with many low professionalism, joblessness, incapability, and incompetent graduates. Thus, it is almost only possible to ensure economic growth, especially, with qualified and skilled HR, especially S&T, to supply disparate sectors of the economy; other resources are passive agents, and HR is an active agent, but not only S&T/STEM; it also needs SS, which is part of the ecosystem. This is something that the challenges of the existing systems of hiring people are.

The policy aims to promote industrial development through S&T HR. However, the low employability of graduates can be attributed to factors such as poor

learner performance in national assessments, inadequate preparation for S&T and STEM education at lower levels, and the absence of STEAM education; learners being pushed into S&T fields without interest, less effective implementation of the policy, and insufficient resources in HEIs are among the challenges. In Ethiopia, the absence of practical components in coursework curricula may hinder the preparation of learners with skills applicable to industry, as outlined in graduate profiles.

The skills of unemployed workers match the skills required in the labour market, are one of the challenges, i.e., structural unemployment. Due to the current situation in Ethiopia (war and conflict), many businesses, public, and firm areas are closed, even though some of the workers are qualified to be hired by organisations, i.e., there is frictional unemployment. The unemployed graduates were either searching for jobs or waiting. Thus, the recession and downturn of the economy are among the challenges. The other main challenge is a mismatch between the demand and supply, which implies cyclical unemployment, the fall of business, and economic downturns in the country's economy. Sometimes, a state of full employment refers to the natural unemployment rate. Recently, technological unemployment has started, and more future implications for high-risk unemployment due to the advancement of technology and machines to replace humans.

Ethiopian HEIs are anticipated to produce graduates equipped with problem-solving (one of the objectives of Ethiopian education), creativity, critical thinking, and analytical skills. However, these competencies are frequently lacking among graduates. To overcome this, STEAM education policy fosters this; however, Ethiopia does not yet do this and groundless of STEM. The industrial sector in Ethiopia faces high employee turnover and a significant shortage of skilled labour, affecting both quality and volume. Ethiopian HEIs struggle to align educational outcomes with market demands, resulting in graduates who are underprepared for professional challenges. The interdisciplinary nature of STEAM education, which fosters creativity and critical thinking, is crucial for

producing graduates capable of thriving in a dynamic economy. The advent of recent technologies mitigates the demand for low, semi-skilled, and inept labour, posing a peril for youth employment. Therefore, HEIs must not only develop disciplinary competencies but also focus on cultivating skills essential for future economic competitiveness, such as creativity, critical thinking, and teamwork.

6.4 Summary and Interpretation

The summary integrates the quantitative and qualitative findings along with their interpretation. It addresses each of the intended objectives of the study as presented below.

Relevance of the 70:30 policy for HRD:

Both qualitative and quantitative results are consistent, indicating that the admission policy was poorly aligned with HRD goals. Both sets of data show that most learners were pushed into S&T/STEM fields against their preferences, and this mismatch harmed HRD outcomes. On average, 70.1% of S&T/STEM learners were placed in fields unrelated to their interests or initial choices, highlighting disconnect between education policies and learner preferences. Placing learners outside their talents and interests negatively affected their motivation and long-term career performance.

Although the objective is to increase S&T and innovation in line with STEM, it underestimates the importance of SS innovation. Additionally, many learners were admitted to HEIs despite scoring below the 50% threshold in entrance exams, suggesting the policy's limited relevance for HRD. The goal of the 70:30 policy was to support the country's industrial development through S&T HR, but there was a lack of university-industry linkages, stakeholder participation, S&T systems, and institutions.

A severe mismatch existed not only between the supply and demand of HR across various sectors but also between student demand and labour-market needs, reducing the policy’s relevance for HRD. STEM graduates show deficient

skills. Placing learners in fields without considering their interests and performance undermines HRD relevance and aggravates unemployment and under employment challenges. State-led admission, planning, and labour demand did not match. Overall, these results imply a less relevant recruitment policy, a mismatch between HR supply and demand, poor performance at NLA, and students' weak foundation in mathematics and sciences at lower school levels. All of which hinder advancement in S&T at HEIs and negatively impacting HRD. Therefore, all these factors are misaligned with HRD objectives in S&T.

Implementation of the policy in the HEIs: The qualitative and quantitative results specify that the 70:30 policy implementation in public universities has failed to meet the plans/objectives. Indeed, the results demonstrate that both the macro and micro policies were not executed according to the planned ratio as outlined in the policy. Though the policy lacks appropriate implementation, ideally, it is associated with fostering industrial development, S&T, and innovation. A wide gap exists between the targeted policy allocation and the real enrolment in the HEIs since the targeted 70% enrolment in S&T has not been realised. The discrepancy between the policy's targets as outlined in the national guidelines policy and its actual performance in enrolment is ineffective. Limited resources and lack of preparedness among learners were some of the factors that hamper the implementation of the policy and negatively affect STEM enrolment in HEIs. These realities on the ground lead to the impacts on the HRD in S&T, which are critical for nurturing competent HR. One major challenge for the effective execution of the policy in the HEIs is resource limitation, including qualified HR, learning materials, infrastructure, and instructional resources. The quality issues are not only at school, but also in the university, and the rapid expansion of universities and the shortage of resources and qualified STEM lecturers result compromise on quality. These factors affect the quality of education and training. Hence, the GER in Ethiopian HEIs indicates a minimal level of HRD. In general, the policy implementation is less effective and inefficient. The policy's target to

raise female enrolment in S&T from 29% in 2008/09 to 40% in 2014/15 has not been realised, especially in STEM disciplines, highlighting persistent inequities.

Supply of HR to the economy

Qualitative and quantitative results were triangulated to indicate that the policy and HEIs have not provided relevant HRs and there was a mismatch in HR demand and supply in disparate sectors of the economy. Less efficient and effective policies of HEIs to attain and achieve the target of the policy to produce output and/or graduates per ratio have been observed. The policy has not affected the production of the output and/or graduates per the policy target. Inefficient resources and infrastructures for policy implementation in the HEIs are also one of the challenges. HEIs could not supply HR as per the policy ratio (plan). The mismatch occurred not only regarding student preferences for specific fields of study, but also among employers and industries. Penurious quality education is one of the issues in supplying skilled HR.

Employability of the graduates

The findings from both quantitative and qualitative analyses, along with replicated tracer and alumni studies, indicate that the policy has only a minimal positive impact on the employability of the graduates. The research findings also indicated that 70% of learners studying S&T intended to increase skilled and productive graduates to serve the industrialisation plan of the country; however, the results demonstrate that undergraduate graduates were entering the industries without the required skillsets. The finding is the mediocre quality and low skill of the graduates of the HEIs. The findings of binary logistic regression demonstrate that only B&E and MHS have a statistically significant effect of the policy on the graduates' employment; however, the rest of the micro policies have a statistically insignificant impact on employment opportunity. The important findings for policymakers are that learners who were placed based on their preferences, for example, B&E and have good academic performance at NLA, for instance, MHS

were associated with better job opportunities. These findings can guide policymakers in refining and prioritising employment policies to improve the employment rates of graduates effectively, with relevant education policy.

Overall, the policy generated negative outcomes, including high unemployment rate and poorly qualified and low employability skill graduates, which can deteriorate human capital in general and labour force productivity in particular. Graduates have not acquired the necessary skills in S&T or innovation. Graduates do not have cutthroat and cutting-edge skills. Another finding indicates that the unemployment rate of undergraduate graduates is one of the negative direct impacts facing today's Ethiopia. Weak industrial absorption and job absorption /labour market. A tiny self-employed graduate is also a factor in the sustainability of the policy. The study findings underscore alarming levels of unemployment among graduates, reflecting policy ineffectiveness and inefficiencies that perpetuate structural, frictional, cyclical, and technological unemployment, adversely affecting the economy.

CHAPTER SEVEN

Discussion

7.1 Introduction

The preceding chapter presents the quantitative and qualitative findings and data analysis. Though the 70:30 policy has not been comprehensively evaluated in prior research, the current findings are compared with the existing literature, theoretical frameworks, and studies conducted during the policy's introduction, alongside a desk review of tracer and alumni studies on employment of graduates of universities to identify similarities and differences based on each intended objective of the study. Consequently, the discussion is structured around the intended objectives of the study.

7.1.1 Relevance of 70:30 Policy in Human Resource Development

Most learners gained admission to HEIs, despite scoring below the 50% threshold on entrance exams and performing poorly in NLA and/or HEIs entrance examinations, consistent with the findings of numerous studies (Belay et al., 2016; Nega, 2009; Leka, 2009; Shebeshi et al., 2009). As per the 70:30 policy, learners should make their own choices (which shall be the demand) and expand the supply (MoE, 2008). The results indicate that most learners were pushed into S&T regardless of their own demands, adversely affecting HRD, which is inconsistent with HE theories, for example, STE (Mankiw et al., 2013).

A severe mismatch between demand and supply of HR is another major finding that diverges from established economic models (World Bank, 2019; Nancee, 2017; Borjas, 1996). The government underestimates the role of SS for development, despite strong student demand for these fields of study. Policy relevance is hindered by inadequate assessment practices, low performance on

NLA, and placement of learners into fields of study without considering their interests/preferences in fields of study, a mismatch between students' interests and field assignment, indicating less relevant recruitment policies to advance S&T for HRD. These diminish academic performance and motivation to study diligently to achieve learners' ambitions. The findings of this study contradict the existing literature (Maltese & Cooper, 2017; Oxford University, 2017; Lange, 2013; EC, 2011; Subotnik et al., 2010; Aviv University, 2000). Ultimately, this indicates that the placement policy has negative implications for HRD. The findings also show inconsistencies with the literature review (UNISA, 2018; Ziegler et al., 2017; Mankiw et al., 2013; EC, 2011; White, 2007).

This gap between learner choice and actual placement results is consistent with several studies in Ethiopia (e.g., Nega, 2009; Shebeshi et al., 2009). The findings of the study were hostile to existing and recent literature, indicating an urgent need to reassess the placement policy to better match learner interests with labour-market demands. In accordance with the 70:30 policy, HE's mission is to deliver relevant and quality education, conduct research and technology transfer, and serve the community (MoE, 2008); however, HEIs fail in these roles to fulfil their mission. The misalignment is especially pernicious in NCS and education programmes, where disinterested learners with low scores of NLA were frequently placed, resulting in subpar university performance, and these findings coincide with some researchers' findings (e.g., Nega, 2009; Shebeshi et al., 2009), which creates a vicious circle in all education institutions. This misalignment undermines the quality of HE and HRD, hindering institutions from effectively fostering the skills and talent development necessary for a cut-throat market workforce. Total Quality Management (TQM) has been dominant in HEIs as a model of quality assurance; however, this has not been realised in Ethiopian HEIs. These findings align with Nega's (2009) research in Ethiopia. Most learners were pushed into S&T against their interests, which contradicts the existing literature (Argyropoulou & Kaliris, 2018; UNISA, 2018; Maltese & Cooper, 2017; Mankiw et al., 2013; Lange, 2013; Subotnik et al., 2010; White, 2007; Subotnik & Arnold, 1995) argues that learners must be placed based on their interests,

preferences, and talent development in the STEM field. However, graduates of STEM have deficient skills for the 21st-century industry. On the other hand, due to economic recession and talents often do not know their abilities and talents to decide which professional ambition they will select (Argyropoulou & Kaliris, 2018). Literature reviewed as emerging discussions are about the implications of STEAM versus STEM, S&T versus SS, and STEM versus AHSS for innovation and contribution to development. All these programmes and/or policies have their implications for innovation and development. The EHE policy is focused on S&T/STEM versus SS, which is implemented in the HEIs. The 70:30 policy ratio is unique and sporadic in Ethiopia and unfounded in the literature in other countries.

Limited participation and consultation with stakeholders are another challenge for the policy. The 70:30 policy document indicates that only a white paper was distributed to all public universities (limited to presidents, academic vice presidents, and deans of E&T faculties), and feedback was obtained from ministries (MoE, 2008), but there was no comprehensive study or evaluation. In developing countries, participation from at least teachers, parents, learners, and employers is anticipated (Haddad & Demsky, 1995); nevertheless, the findings indicated that these groups are critical for policy relevance, yet their participation was noticeably absent.

Although pragmatism was the foundation of the country's education system during the EPRDF era, its practical implementation has been very limited. The current findings also contradict Plato’s principle of specialisation, which is based on the idea that each person is born with a natural talent suited for a specific craft or social role (Oxford University, 2017). According to pragmatists, naturalists, and progressivists, learning by doing (UNISA, 2018) aligns with a kinaesthetic learning style. In pragmatism and progressivism (UNISA, 2018), learning revolves around problem-solving, which relates to the andragogy theory of HE, yet HEIs in Ethiopia primarily offer pedagogical courses and employ teaching strategies rather than andragogy. Furthermore, realism asserts that genuine

knowledge is acquired through empirical experience (Oxford University, 2017) and self-realisation, while existentialism asserts that learners must remain free to choose their academic institutions—principles that are directly contradicted by forced central placement policies.

Neo-liberal HE policy emphasises privatisation, commercialisation, decentralisation, and corporatisation by limiting the state's role. In contrast, the developmental state model asserts a critical state role in advancing HE mainly for industrial development. Under a developmental state framework, university admissions, programme ratios (e.g., STEM versus SHS), and training priorities are determined centrally to align with labour-market and industrial demands (Abe, 2006; Ashton et al., 2001). This framework aligns with the state-led admissions implemented across public universities, but diverges sharply regarding labour-market integration, student choice, and actual industrial demand.

Although the 70:30 policy was developed in line with the developmental state principles, the empirical findings demonstrate systematic inconsistencies, as HEI failed to supply professional HRs and skilled manpower for industrial expansion. The 70:30 policy focused on STEM for the country's industrial and/or manufacturing development, yet actual execution remained limited to health and agriculture disciplines. This contradicts the neo-liberal policy, which focused on agriculture, education, and health (Potter et al., 2018). Neo-liberal policies have also been criticised for restricting AHSS education in some countries (Anwaruddin, 2014; University College Dublin, 2006; Kwiek, 2012); creating adverse consequences for the future of democracy, social, and political development in these countries.

Both Neo-liberal and neo-development states coincided with manufacturing/industrial development; however, they have limited democratic, social, and political development, as both have limited the AHSS. S&T is one of the essential lacunae in classical theory (Jhingan, 2012). In line with the

developmental state, the 70:30 policy interruption overrides the interests, preferences, and talents of the students, which is consistent with a command economy. HES remains under government control, determining admissions, curricula, and institutional missions to align with industrial and ideological objectives (Martin, 1998).

In East Asia, the alignment among state planning, quality secondary education, and HE capacity, students choosing their fields of study, and aligned labour-market demand, graduate absorption in the industry, and state-led admissions and skill formation is effective. Though state-led admission in Ethiopia, these factors are absent and poor in Ethiopia, which has led to less effective policy. The policy document indicated an alternative where learners make their own choices (MoE, 2008); nevertheless, the learners did not have this chance. Less relevant policy for HRD due to lack of market demand, quality of education, university-industry linkage, S&T systems and institutions, equilibrium demand and supply, relevant recruitment policy, and stakeholder participation.

7.1.2 Implementation of the 70:30 Policy in HEIs

The policy has not been executed according to the intended ratio or target and objective since its inception, reflecting less effective execution and hindering the achievement of the 70% of S&T (STEM) enrolment target in HEIs, consistent with current reports (MoE, 2022, 2023). The policy aimed to develop skilled HR to advance the country's industrial development through S&T HR. However, its execution faced challenges, such as a limited number of applicants for S&T programmes, the underperformance of the learners and the policy's objectives within HEIs, a lack of quality education, a lack of efficient resources, and insufficient university capacities, consistent with previous findings (Geda, 2014; Semela, 2011). High gender disparity across fields also remains evident and consistent (Tareke, 2024; Chalchesa, 2012). Discrepancies exist not only between the execution of educational policy and labour-market demands, but

also between the targets/objectives of the government policies and actual enrolment in the HEIs, which indicates a misalignment that affects sectors vital to Ethiopia's socio-economic development, similar to prior studies (Abraha, 2015) related to agriculture and other key industries, such as vocational training (Szirmai, 2015). For example, the limited effectiveness of practical training in the health sector continues to raise concerns, despite efforts by HERQA, FMoH, and Jhpiego to strengthen HRs through USAID-funded projects (HERQA, 2014). Ethiopia's health sector suffers not only from a shortage of skilled medical and public health professionals, but also from brain drain, making it challenging to meet WHO-recommended health workforce standards, with only 0.7 health workers per 1,000 people-below the WHO benchmark. This shortfall in inadequate healthcare delivery is particularly evident in rural areas, where 83% of the population remains underserved (MoH, 2016). An additional challenge is the brain drain of health workers and graduates, which worsens these issues and highlights systemic deficiencies in healthcare HRD, alongside a pressing need for targeted policy measures to correct HR imbalances and enhance healthcare access nationwide (MoH, 2016). Not only in the health professions but also in technical skills, even when local talent is developed, developing countries face intense competition from advanced economies, often resulting in a brain drain as trained professionals seek better opportunities abroad (World Bank, 2025).

The quality of education and training was a common issue. These results align with broader trends in Sub-Saharan Africa, highlighting the need for comprehensive approaches to enhance the quality of education and provide effective STEM education (Bell et al., 2012; Kwapong et al., 2015). The swift growth in enrolment places is in line with the 70:30 policy pressure on the sustainable financing of HE, intensifying the trade-off between quality and access (Yigezu, 2013). Insufficient instructors' input in policymaking and discrepancies between preparatory and university curricula in Ethiopia (Asgedom, 2009; Shebeshi et al., 2009). From international experience, execution gaps remain due to communication breakdowns, resource limitations, and misalignments with

local contexts (Stoker, 2017). The convoluted nature of policy implementation, compounded by decentralised decision-making and bureaucratic obstacles, lack of quality education and training, emphasises the systemic difficulties that impede the effective execution of policies in Ethiopian HE, as recent literature (Stoker, 2017). These insights, informed by various scholarly views, emphasise the challenges of collaboration or cooperation among stakeholders, for example, lack of coordination, a strategic plan, and implementation of stakeholders (like lack of university-industry linkage, government-university coordination) in executing the 70:30 policy, lack of industry-specific strategies to better harmonise educational outcomes with economic and developmental goals.

Lack of standard curriculum development and/or outdated curriculum, along with feeble policy execution, negatively impacts graduates' practical skills and overall HRD in HEIs. These findings align with previous research (Shebeshi et al., 2009) during the introduction of the policy. HEIs in Ethiopia face numerous challenges in producing competent graduates, including not only unqualified teachers, but also instructors dissatisfied with their salaries and incentives, and difficulties in instructional practices generally (Berhanemeskel et al., 2025). In education, financial incentives and behavioural strategies targeted at teachers have been effective in expanding recruitment and reducing turnover in schools facing difficulties in attracting staff, while also increasing teacher quality (World Bank, 2026); nevertheless, these remain major challenges in Ethiopia. In doing so, teachers may not have access to continuous professional development and in-service training in the teaching profession, which may result in a negative impact on quality education. Stakeholder consultation and participation are essential for curriculum development and policy relevance, but achieving uniformity in university curricula remains a substantial challenge (Shebeshi et al., 2009). These challenges may lead to long-term issues in the quality of education and training resulting in skill deficiencies of graduating learners. Such challenges could also create complications for the education sector at the national level, which may remain unresolved for a long period (Berhanemeskel et al.,

2025). The educational sector struggles with course duplication due to a lack of standard and up-to-dated curriculum, which leads to a lack of focus on creativity and innovation, and the absence of a STEAM programme, despite the known benefits of promoting critical thinking and innovation (Corlu et al., 2014; Madda, 2013; Gulbrandsen & Aanstad, 2015; Smith, 2015). Furthermore, insufficient consultation with university communities and educators in policymaking, along with minimal industry involvement in curriculum development, presents challenges to STEM education in Ethiopia, which is consistent with some researchers' findings (Belay et al., 2016; Kahsay, 2012; Leka, 2009). Taking cues from Singapore's integrated national policy and HCD framework, a tripartite strategy of key stakeholders (government, university and industry) could provide a comprehensive approach to align educational outcomes with labour-market demands and promote national development objectives (EBR, 2018). Ethiopia must learn a lesson from this. Nevertheless, Ethiopian HE confronts interconnected challenges that affect the effective implementation of the 70:30 policy, such as insufficient resources, infrastructure and facilities, especially in S&T/STEM disciplines and policy execution since 2008/09 like the previous studies before the policy (Ashcroft & Rayner, 2011; Yizengaw, 2003, 2005) and during introduction of the policy (Kahsay, 2012; Shebeshi et al., 2009; Woldetensae, 2009). This finding aligns with the World Bank (2025), which noted that students in developing countries often face limited access to advanced technical training, under-resourced educational institutions, and insufficient digital infrastructure. The Ethiopian public HE has insufficient resources to implement the 70/30 policy. General-education pipelines also affect who reaches STEM seats (MoE, 2022, 2023), lack of quality education. The tripling of undergraduate learner numbers and/or bustling without a corresponding increase in resources and infrastructure raises concerns about its quality of education and training, which is inconsistent with the limited innovation and employability objectives of graduates, which is consistent with previous studies (Shebeshi et al., 2009; Nega, 2009; Asgedom, 2009; Belay et al., 2016). The result also agrees with the research conducted before the 70:30 policy (before 2008/09), which

underlined deficiencies in programme quality and relevance (Ashcroft & Rayner, 2011; Yizengaw, 2005; Yizengaw, 2003), which worsen HR planning and development challenges in developing countries where the number of underqualified graduates exceeds economic growth (Jhingan, 2015). An assessment of the practical implications of prioritising S&T/STEM over SS under the 70:30 strategy indicates pitfalls for multidisciplinary HRD and the profession. It underestimates SS's innovation and the lack of inclusive education and innovation, which led to a lack of social, political, and democratic development in the country, as the country currently has challenges. Botswana's international university initiative for S&T and Uganda's strategic focus on S&T curricula is aligned with their economic objectives (Damane & Molutsi, 2013; Ssempebwa & Ssegawa, 2013).

Comparable difficulties in incorporating emerging STEAM education into educational policies are evident in other countries, including Ireland (Clarke, 2019). STEM leads in enrolment distribution (MoE, 2022, 2023), but Ethiopia has not introduced STEAM. Moreover, nations like Botswana and Uganda are creating specialised institutions and curricula to enhance scientific innovation and industrialisation (Damane & Molutsi, 2013; Ssempebwa & Ssegawa, 2013), indicating potential experience for Ethiopia from similar strategic investments. Several researchers in Ethiopia (Kahsay, 2012; Shebeshi et al., 2009; MoE, 2008) echo these findings. Recent reviews and empirical studies in HEIs indicate that Ethiopia still prioritises STEM-weighted intake, although actual enrolment commingles fluctuate below the 70% STEM target due to preparation gaps and attrition, particularly in engineering (Tareke, 2024; Tegegn, 2024). GER is one indicator of development; however, in Ethiopia during the transition government (1991), the GER was only 1% (Yizengaw, 2003; Yizengaw, 2005; Loukeris, 2005; World Bank & UNESCO Institute for Statistics, 2025). Thus, the EPRDF government had proposed reaching a middle-income club by 2025 to achieve at least 22% GER along the 70:30 policy; nevertheless, the GER progress was 10.2% in 2016/17, 9.4% in 2015/16 (MoE, 2016, 2017), and 10.4% in 2018

(World Bank & UNESCO Institute for Statistics, 2025), and after 2018 due to data and reporting gaps, projection made approximately 14% in 2025 (Global Change Data Lab, 2025), suggest that Ethiopia's tertiary GER might not reach and achieve its target. In 2009, the GER of HE was 3.6% (UNESCO, 2010), behind Africa (SZIRMAI, 2015). Despite enormous efforts to expand HE during the past decade, Ethiopia still has the lowest GER compared to Sub-Saharan Africa (Yigezu, 2013). The Ethiopian GER for HE increased from 3.6% (1999/00) to 5.3% (2008/09)-almost close to the African average of 6% in 2000. Despite considerable expansion from 2003/04 to 2016/17, Ethiopia's HE sub-sector still falls short of the Sub-Saharan African average GER (Yigezu, 2013). These trends are consistent with broader regional patterns highlighted in UNESCO-IICBA's country brief, which notes that Ethiopia continues to expand HE access, but still faces gender and equity disparities (UNESCO International Institute for Capacity-Building in Africa, 2023). School enrolment and the average years of education completed (educational attainment) have risen sharply in most low- and middle-income countries (World Bank, 2026); however, Ethiopia has not realised this.

The world's and Africa's average HE enrolment rates were 32% and 8%, respectively (Molla & Cuthbert, 2016). The GER of HE in 2010 was 21.4% in developing countries and 69.7% in developed countries (Szirmai, 2015). However, Ethiopia's GER and knowledge economy are limited; for example, in 2017, Ethiopia ranked at 0.463, placing it 173rd out of 189 countries (UNDP, 2018), and in 2024, 0.492, ranking 176th out of 191 countries, which indicates among the lowest HDI (UNDP, 2024). This has implications for the knowledge economy, index, HCD, HCT, and HRD. Currently, enrolment in education is one of the indicators used to construct HDI, and HDI is among the best indicators of development. These points show that HRD and HCT in Ethiopia are low. In the current government (PP) after 2018, the situation worsened, with GER declining; for example, in 2023, 2024, and 2025, only 3.3% (30,034) of learners out of 896,520, 3.2%, and 8.4% (8929) among a population took the exams and achieved the minimum score of 50% required for university entry, implying a very

low GER (MoE, 2024:25). Ethiopia has limited HCT, inconsistent with Szirmai (2015). HCT is part of neo-classical theory at the microeconomic level. In 2018, GER was 10.4% (World Bank & UNESCO Institute for Statistics, 2025). After 2018, during PP, due to a lack of data and reporting gaps, UNESCO UIS projected that tertiary education GER would be approximately 14% in 2025 (Global Change Data Lab, 2025), suggesting Ethiopia might not reach its target of 22% to qualify as a middle-income country. These points indicate that the current government does not seem committed to providing access to education nationwide. Still, Ethiopia's GER in HE remains low, which has many implications for economic development. Human rights education also has implications for a healthy democracy.

7.1.3 Outputs of 70:30 Policy on different Sectors

When learners make a choice, the supply of education must anticipate learner demand (MoE, 2008). However, there was not only a mismatch between learner demand and market demand, but also disparities between HEIs' supply of HRs and the targets and/or objectives of government policies. There were also disparities in the supply of HRs across economic sectors, for example, undersupply in some sectors and oversupply in others. This result concurred with some literature; for example, some metal factories had difficulty finding electricians, financial experts, and metal engineers (EBR, 2019). This contributes to the challenge of finding a skilled workforce in areas such as industrial management, finance, IT, and engineering in the industrial park of Ethiopia, likewise (EBR, 2019; Shebeshi et al., 2009). The policy needs to be revisited; for instance, the B&E fields are now in demand, while E&T has an excess supply and/or a mismatch with the growth of industry and E&E graduates.

The Ethiopian 70:30 policy claims that good education and skills in S&T can be reputedly employed anywhere (MoE, 2008). However, the export-led labour-intensive industrialisation in Ethiopia has several hurdles-one of which is a need for more skilled labour (EBR, 2019). In Ethiopia, the inferior quality of HE and the lack of quality of STEM education from school to HEIs were likewise (Belay et al.,

2016). It was also noted that before the policy of 70:30, the HRs in Ethiopia were required for development, but the issues of relevance and quality of education were not studied (Yizengaw, 2003).

Female undergraduate graduation rates in S&T remained notably lower than those of males across both S&T and SS, especially in S&T, consistent with findings from other Ethiopian studies (e.g., Chalchesa, 2012). The current findings align with existing literature that consistently demonstrates males dominating STEM fields while females excel in AHSS (Chang & Tzeng, 2018; García-Holgado et al., 2019; Chang & Hu, 2019; Jacob, 2020), thereby influencing gender disparities in entrepreneurship. In Ethiopia, the E&T plan is ambitious and bustling, and it aims to ensure sufficient intake capacity in engineering; this result aligns with the findings of researchers (e.g., Kahsay, 2012). Human capital accumulation and technological change are interconnected. However, in the least developed countries, overall lowering of academic standards tends to decrease the efficiency of undergraduates and graduates employed in both the private and public sectors, which does not bode well for the development of dynamic leadership essential for economic growth; this results in wastage of HR (Jhingan, 2015).

Still, they bring in expatriates for higher-level positions, as the local HR requires more knowledge (EBR, 2019). The cumulative effect of these constraints and challenges leads to a decline in the quality of S&T education and HRD in Ethiopia. There is a critical need to improve curriculum content and align it with job market requirements (Berhanemeskel et al., 2025).

The programme must identify and address the nation's health priorities, the current and emerging roles of practitioners, and the professional and legal requirements for practice (HERQA, 2014). In 2009, globally, as estimated by WHO, 68% of births were attended by skilled health personnel, but in impoverished countries, particularly in Sub-Saharan Africa, the figure is

significantly lower (Potter et al., 2018). Although more diverse and specialised qualifications would be required, HEIs can respond more flexibly to local labour force needs and must recognise that, in development work, it is impractical to ignore or dismiss the influence of the national agenda, local civic pride, and tradition (Ashcroft & Rayner, 2011).

Low level of agricultural productivity has contributed to food shortages and overall food insecurity due to skill and labour constraints and slow adoption of technology (IUCEA & World Bank, 2018). Although Ethiopia has an ADLI, Ethiopia's main issue in industrialisation is low agricultural productivity, which leads to limited availability of raw materials (EBR, 2018). The study demonstrates that several factors have extended the programme and training process and professional competence of agricultural graduates (Belay K., 2008). Technology remains a long-standing challenge for smallholder farmers facing low productivity. This is partly because courses with agricultural content are rarely taught in secondary schools and HEIs (Szirmai, 2015), which aligns with current findings in Ethiopia. In Ethiopia, the provision function can be enhanced when education is introduced as an input variable, and this approach is more common in studies measuring labourers' productivity in agriculture (Desalegn, 2018). Supporting farmers in installing small industries and adding value to their products could gradually promote industrialisation, allowing them to serve both local and export markets (EBR, 2018). Ethiopian universities are to respond to the agricultural transformation that leads to agricultural-led industrialisation, and implementation should address these realities (Olkaba, 2019). A significant obstacle to the rapid development of Ethiopia's agricultural sector is the shortage of skilled and experienced labour (Belay K., 2008).

According to the World Bank, the standard ratio of an extension worker to farmers is 1:800 (Benor et al., 1984), and FAO recommended that one extension agent should serve a maximum of one thousand (1:1000) farm families in developing countries (FAO, 1997); nevertheless, Ethiopia has not achieved these targets.

The need for a high-level agricultural HR remains urgent and critical (Belay K., 2008). In East Africa (Ethiopia, Uganda, Tanzania, and Kenya), through case studies, smallholder farming accounts for about 75% of agricultural production and over 75% of employment opportunities; however, the contributions of smallholder farming and agriculture in general to Eastern Africa's recent rapid growth have remained limited (ADB, 2010). Measures needed to improve the productivity of smallholder farmers include easier access to land, training to enhance skills and promote technology adoption and innovation, and the removal of obstacles to trade (ADB, 2010).

Technology transfer is among the dimensions of the EHE (Woldgiyorgies, 2015), but it needs to be implemented in practice. The identified shortages across engineering, science, and medical professions highlight a growing need for a highly trained pool of qualified experts specialised in the STM discipline (Belay et al., 2016); however, there were many challenges to delivering quality STEM education in Ethiopia. The poor quality of S&T/STEM education is attributed to a lack of qualified academic staff and inadequate resource facilities, as noted in the recent study (MoE, 2017). The current findings align with other Ethiopian studies conducted before the 70:30 policy, such as Ashcroft and Rayner (2011), which critique the education framework of Ethiopia, which, despite offering bachelor's, master's, and doctoral degrees, lacks intermediate qualifications and fails to meet the country's HR needs. This deficiency was clearly demonstrated by the disparity in doctorate holders per million people, for example, with Ethiopia at 87 compared to South Africa's 818 in 2016 (EBR, 2017). The implementation of the 70:30 policy was further hampered by inefficient resources and disconnect between policy formulation and execution, consistent with contemporary literature (for example, Stoker, 2017). Therefore, enhancing agricultural productivity and developing a skilled HR capable of manipulating cutting-edge technologies are crucial tasks for Ethiopia (EBR, 2019). The success of the transformation plan, including the development of the EHE, depends, among other factors, mainly on the supply of qualified instructors (MoE, 2008).

STEM would bring about positive long-term impacts in Ethiopia (Belay et al., 2016); however, STEAM is preferable for modern economic development, which has not yet been introduced in Ethiopia. Based on an economic plan, the output for various sectors of the economy projected for the forecast years is among the HR requirement approaches (Jhingan, 2015). The 70:30 policy evaluation has neither a goal-based nor the CIPP models. The industrial park prioritises light and labour-intensive industries in Ethiopia. On the other hand, industries have started using machines to displace workers and have no minimum wage. The industrial parks faced an oversupply of HR with low skills and limited capacity, especially among the graduates of the policy domain under 40% (E&T). The focus of policymakers on innovation and economic development has facilitated a science research model where impact involves spin-out companies, patents, and returns, while 'innovation' is inextricably linked to the notion of technology transfer (Clarke, 2019); however, from the current study, it is evident that the graduates lack the necessary skills in creativity (lacks the highest elements of Bloom's taxonomy), S&T, and innovation.

7.1.4 Outcome of the 70:30 Policy on the Employability of Graduate

It found a higher unemployment rate among S&T/STEM graduates compared to SS, contradicting the government's belief that S&T fields offer greater employment opportunities (MoE, 2008). Conversely, learners in SS are more favourably placed according to their preferences in their field of study compared to S&T, which aligns with their employment outcomes. In Ethiopia's evolving context, the employability of S&T graduates depends not only on their field but also on the quality and training of their education, differing from that of SS graduates (MoE, 2008). Employment rates reflect how well HE aligns with labour-market demands and the number of graduates each year (Dunga, 2013), but issues of unemployment and underemployment persist (Szirmai, 2015; Fourie & Burger, 2015), which leads to widening income inequality and poverty. In line with the developmental state, South Korea, Japan, Taiwan, and Singapore

demonstrated that a HE successfully supplied the skilled HR for their rapid industrialisations (Abe, 2006; Ashton et al., 2001). However, in Ethiopia, skills–job mismatches (World Bank, 2022, 2021; Nancee, 2017). Education qualification provides a signal from potential employees. University degree or HE certificates indicate that they have acquired some useful knowledge and skills. Human capital has improved the health and longevity of people for productivity, to be scientific, and contribute to economic growth.

STEM labour misalignment and the mismatch between skills supplied and industry demands (Teshome, 2024), women are less likely to access quality employment (Yizengaw, 2024), and graduate employability continues to weaken (Yimer, 2024). Globally, 40% of employers report difficulties in finding recruits with the right skills (ICFGEO, 2017), and neo-liberals face insecurity regarding job prospects (Potter et al., 2018), echoing the concerns of the 70:30 policy about potential unemployment among S&T graduates in line with the developmental state. With many of the world's low-skilled jobs most vulnerable to automation, developing economies face greater risks of technology-induced unemployment (ICFGEO, 2017). The modern workplace is increasingly technology-driven, with new and improved machines often replacing (displacing) workers (Vally & Motala, 2014), but very recently advanced technologies like AI are also displacing workforces. Likewise, technology has reduced the amount of labour needed (Mankiw et al., 2018). Ethiopia has limited human capital for innovation, consistent with Schumpeter (Smith, 2015; Oketch, 2014). Ethiopian policy is insufficient to foster innovative and entrepreneurial graduates. This perspective challenges the Schumpeter-neo-classical economic theory regarding the role of entrepreneurs in economic development. While Schumpeter’s theory is primarily for developed countries, the role of innovative entrepreneurs is also relevant for less developed countries because entrepreneurs in these regions do not necessarily require significant capital to succeed. This highlights not only the policy's failure but also raises questions about the ideology.

The findings demonstrate that agriculture has the highest unemployment rate, even though agriculture is the primary source of employment and income over a brief period (Szirmai, 2015; Fourie & Burger, 2015). This is a potential strategy for Ethiopia because more than 80% of the population relies on agricultural economic activities. The allocation of policy quotas and actual enrolment in agricultural programs at HEIs remain among the lowest. Education often perpetuates the low status of physical labour, particularly agricultural labour (Szirmai, 2015). The graduates prefer to reside in cities rather than rural areas where services are most needed (Jhingan, 2015). This is one of the reasons for the alarmingly high unemployment rate among agricultural graduates in Ethiopia. In Africa, the growth in output per breadwinner fell from 4.0% in 2014 to 1.2% in 2015. The forecast for 2016 was 2.3%, which was below the global average of 2.7% and the estimate for Southeast Asia and the Pacific at 3.8%, according to the United Nations Economic Commission for Africa (UNECA, 2018). Meanwhile, sectors like agriculture, mining, manufacturing, and construction are anticipated to observe a decrease in employment share from 2010 to 2030, while the service sector is anticipated to increase its share (Fourie & Burger, 2015; Knox et al., 2008). Likewise, Ethiopia needs to consider it in its policy.

The findings also indicate that university generation (first, second, and third) has a varied effect on graduate employability. This is consistent with research studies conducted in Nigeria (e.g., Adeyemo et al., 2010). The current findings indicate that the employment status is 65.3%, 51.4% (Bahir Dar University, 2013), 45% (Mekelle University, 2015), 41.9% (Axum University, 2017), 33% of STEM (Hawassa University, 2015) and 54% of engineers (ECEA, 2018) after six months. This also indicate varied effects on employability of the graduates. The purpose of the policy was to produce skilled STEM labour for burgeoning manufacturing. However, employers disclose that low productivity and a penurious work culture among the graduates of the 70:30 policy is one of the biggest challenges to the companies in the industrial park that prevent them from utilising their total capacity (EBR, 2017). On the other hand, Geda's (2014) results

indicated that the learners were unsatisfied with their learning competencies and experience, which affects their employability. The data indicated that employers could not obtain readily available skilled labour in Ethiopia (EBR, 2017). Besides, graduates need practical skills and training, job-specific, related to the workplace (Ashcroft & Rayner, 2011). Several companies in the industrial parks post vacancy announcements daily, but the number of newly incoming labour forces is limited due to, among other reasons, the minimum wage (EBR, 2019).

The tracer studies conducted by different universities collectively underscore a significant disconnect between the competencies acquired by STEM graduates and the demands of the contemporary job market, as evidenced by the findings from the current and past studies (Bahirdar University, 2013; Hawassa University, 2015; Mekelle University, 2015; ECEA, 2018). Graduates' self-assessment of their competence is only 32% of essential employability skills, revealing substantial deficiencies in critical areas such as teamwork, communication, IT, and independent research work (Bahirdar University, 2013; MoE, 2017). These deficiencies were further worsened by minimal exposure to practical experiences due to the weak university-industry linkage. In Ethiopia's industrial parks, over half of the workforce consists of inadequately educated women with lower education levels, leading to lower wages (EBR, 2017) because there is no minimum wage policy.

Table 27 from the annex part illustrates that the employment rate for Aksum University (2017) graduates (one of the second-generation universities) is approximately 50%. In terms of micro policies, for example, the employment rates for ANRS, B&E, E&T, and SHS graduates hover around this figure. Except for the College of Agriculture, which has a slightly higher rate of 55.6%, the employment rates across other colleges are similarly close to 50%. In East Asia, as industry demand grew (manufacturing, export-oriented industries, technology), graduates from E&T disciplines were absorbed effectively, contributing to structural economic transformation (Lee, 2012). However, in Ethiopia, E&T graduates, who are anticipated to contribute to the construction

sector, face unemployment due to the sector's downturn, as reported (2019, EBR). Conversely, the graduates of the College of Health Science have better employment prospects, as the analysis shows; graduates who have good performance at NLA and/or entrance exam, have better employment opportunities relatively. In developing nations like Ethiopia, job creation is a political issue and/or government role, as high rates of youth unemployment pose a grave threat to political and economic stability. The country's recent instabilities, especially youth unemployment (EBR, 2019). The widespread unemployment among university graduates contributes to political instability and has indirect effects on tax payments and returns, thereby impacting policy for unemployed graduates. The findings also indicate that the generation of the university has a varied effect on graduate employability. This is consistent with research studies conducted in Nigeria (Adeyemo et al., 2010), where a university's reputation serves as a measure of the employability of science graduates. The field of study also markedly influences their labour-market outcomes, as found in Australian graduate research (Adeyemo et al., 2010).

Lack of an S&T training system in collaborative university-industry in Ethiopian HEIs, in general, has shortcomings in competence, skills, knowledge, and abilities, which have been consistent with research studies (MoE, 2017; Ashcroft & Rayner, 2011; Shibeshi et al., 2009) and inconsistencies with the theories of HE of HCT and STE (Mathis et al., 2014; Mankiw et al., 2013). East Asian HES has expanded its focus on S&T while ensuring the quality of education and student preparation, particularly in mathematics and science (Abe, 2006; Marginson & van der Wende, 2009). However, Ethiopia lacks these factors, which lead to a deficiency in its ability to advance in S&T in HE. The current findings indicate that graduates are deficient in cutting-edge skills and technologies. Problem-solving is one of the objectives of HEIs in Ethiopia; however, HEIs usually give and utilise pedagogical sciences courses and teaching strategies rather than andragogy, which is less relevant to developing problem-solving, systems, and critical thinking skills. The current findings agree with Berhanemeskel et al. (2025). Ethiopian HEIs' instructional practices were

found to be mainly limited to the tradition of imparting knowledge at the cost of developing graduates' competence to think critically, develop experiences, and solve problems.

The findings were consistent with the study by Hawassa University (2015), which found that STEM graduates are more likely to experience unemployment than others within the broad subject grouping. STEM graduates are anticipated to have technology-derived self-employment. Ethiopian HEIs are expected to produce graduates equipped with problem-solving, creativity, critical thinking, and analytical skills, among the objectives of HEIs. However, these competencies are frequently lacking among graduates. Stroud and Baines (2019) highlight that STEAM curricula integrate these skills through art and functional application projects; hence, Ethiopia must introduce STEAM education. Despite the emphasis on employability skills in modern education (Vally & Motala, 2014), Ethiopian HEIs struggle to align educational outcomes with market demands, resulting in graduates who are underprepared for professional challenges.

CHAPTER EIGHT

SUMMARY, POLICY IMPLICATION, CONTRIBUTION TO THEORY, RECOMMENDATION AND CONCLUSION

8.1 Introduction

The previous chapter discussed the findings, along with the similarities and differences in the existing literature. The first section summarises the study's main findings by revisiting its objectives. The second section outlines the policy implications, including macro policy, gender equity, and micro policies; the supply of relevant HR; and policy impacts on employment and unemployment. The contribution of this study is discussed in Section 3. Recommendations for policy and practice are presented to various stakeholders, and future research directions are described in Sections 4 and 5, respectively. Finally, the thesis concludes with a summary of the key findings.

8.2 Summary Findings

8.2.1 Relevance of 70:30 Policy in Human Resource Development

The purpose of the 70:30 policy is to promote industrial development through S&T HR. Although the policy's implications for industrial growth via S&T and innovation are crucial, it has faced challenges such as learners at lower school levels (especially in mathematics and science) being unprepared, poor results, and underperformance in the HE entrance exam (with scores below 50% at NLA). Most of these learners, about 70.1% of STEM learners, were not placed based on their prior interests or chosen fields of study. The poor performance of learners at NLA and those placed without their preferences suggests a less relevance recruitment policy for advancing in S&T for HRD. While the policy has potential implications for S&T, the tech industry, technology development, and

transfer, less relevant learner recruitment remains a challenge to effective HRD. Learners have a limited foundation and insufficient preparation in STEM, especially in mathematics and sciences. STEM graduates often lack essential skills. Additionally, there has been no STEAM education at the lower school and higher education levels to foster advancement in S&T and innovation. This has serious implications for STEM versus STEAM policies and programmes in HEIs related to HRD. The government emphasises the STEM tech economy but underestimates the role of innovation from SS, particularly due to a lack of inclusive innovation and education, despite both being essential parts of the ecosystem. There is also disconnect between macro and micro policies- a mismatch between the supply and demand for HR across different sectors of the economy. Furthermore, there are weak links between universities and industry, S&T systems and institutions, and limited stakeholder participation in policy processes. Quality education remains a concern, especially as rapid expansion impacts the overall quality of education and training. These factors undermine the HRD objectives of HEIs, particularly in S&T/STEM, which diminishes the country's HRD efforts. Ultimately, this hampers economic growth by producing inefficient HR and increasing graduate unemployment.

About 89% of NCS learners (undergraduate) joined public universities against their interest. They were forced to study without intrinsic motivation-this might have negative implications on the quality of education in all educational institutions and HRD because NCS graduates are anticipated to teach in secondary schools, colleges, and universities, which has implications and a vicious circle for the quality of education in all educational institutions. Likely, E&T and ANRS have grave implications for industry and agricultural development, respectively. However, B&E, law, and medicine are in-demand fields of study for learners and market needs, though quotas are restricted according to the policy. The implication is less relevant to policy quotas because learners have demanded these fields but have restricted quotas.

Though the policy has a less relevant learner recruitment policy, rethinking it ideally and potentially fosters industrial development, S&T, and innovation in line with STEM. The policy has no policy process, particularly an ex-ante and post-analysis and/or study.

8.2.2 Implementation of the 70:30 Policy in the HEIs

There has been a wide gap between the implementation of the role of HEIs based on the national guideline policy ratio formulated and the target/plan, which results in less effective implementation of the policy in the HEIs. The targets and objectives of the policy have not been achieved in the HEIs.

The 70:30 policy implementation in public universities has not met its formulated quota. The desired 70% enrolment in S&T remains unattainable. Conversely, undergraduate enrolment in SS has ranged from two to three times to almost half, while the postgraduate enrolment has exceeded the national policy quota by three to four times since 2008/09. This discrepancy implies that the policy has underperformed according to the targeted ratio since its inception. The study revealed that implementing this policy has been full of challenges in terms of resources, infrastructure, and poor quality of education. E&T faculties of public universities have suffered from the admission of students beyond their capacities and faced an acute shortage of HRs and other resources and infrastructure. This has negatively affected the quality of training and education in equipping S&T, the skills of graduates, and their employability. There was no collaborative and coordinated work to implement the policy. There was no strategic plan or implementation for the collaborative work of stakeholders to execute the policy, such as the university and the government. There was a lack of S&T systems and/or institutions and a standard curriculum to equip learners in S&T.

Under the 70:30 policy, E&T accounted for 40%, making it the dominant share; however, this target has remained unachievable. Moreover, it has saturated the market labour before reaching the policy quota's enrolment target, and without acquiring the necessary knowledge and skills of the graduates. There is a

mismatch between E&T graduates and industry growth. Although 5% was allocated for each ANRS and MHS, actual enrolment/implementation was not in line with the policy quota guidelines in the HEIs. Referring to the policy, 20% is allocated for each NCS and B&E; nonetheless, implementation has not been carried out based on the prerequisite quota of national policy guidelines. According to the policy, 10% of SHS is the quota; however, enrolment is two to three times higher for undergraduates and three to four times higher for postgraduates in the HEIs of the new policy set by a national guideline. The econometric time-series models indicate that the policy has not significantly affected undergraduate and postgraduate enrolments (implementation) and graduation rates (outputs). The policy was inefficient and less effective.

8.2.2.1 The Effect of the Policy on Gender Equity

In Ethiopia, the sex ratio is nearly balanced (females slightly dominant). According to the GTP I & II (2010/11 to 2020/21), female enrolment in HE, especially in S&T, was one of the priorities in line with the 70:30 policy. In 2017, however, women comprised only 35.7% of the undergraduate learners in public and private universities, with female postgraduate learners making up a mere 17.8%. On average, from 2003/04 to 2016/17, 30.8% and 18.5% of undergraduate and postgraduate enrolment were in the public university. Although the target (plan) was to increase female participation from 29% to 40% from 2010/11 to 2015/16, this target remained unmet in public universities. Female participation in S&T and SS undergraduate programmes ranged from 21% to 31% and 30.3% to 43.5%, respectively. This implies that females are more favourable in SS/AHSS and males are more favourable in STEM, consistent with the literature of the different countries (as reviewed in the literature).

8.2.3 Outputs of the 70:30 Policy on Sectors of the Economy

The government's policy on the need for graduates in the stream of S&T is essential from the point of view of the country's strategic plan to realise the ADLI

economy. There was a mismatch between the demand and supply of HRs to disparate sectors of the country's economy. In agriculture, health, B&E, and SHS have undersupplied HRs. On the contrary, ICT, S&T, and E&T, especially engineering fields of study, have been oversupplied in the labour market because the industries could not absorb the undergraduate graduates. For that reason, there is a mismatch in the growth of graduates and the industry due to political instability, government positions, and underinvestment. These factors not only diminished the policy relevance to HRD but also the supply of HR. On the other hand, the government still must have more clarity on the supply and demand of HR, including relevant policy and its implications, which need further study.

The share of HRs with E&T (40%) out of 70% was excessive, and industries could not absorb the E&T undergraduate graduates. A 5% quota is assigned for each MHS, with ANRS having the lowest quota, which appears insufficient to provide HRs for the health sector with quality service to more than 107 million people (2016/17) and 130 million people (2025), 80% of whom depend on agricultural economy activity. Although agriculture is the backbone of the country's economy, it has the lowest learner enrolment proportion among all enrolments under the micro policies, indicating a lack of relevance. Ethiopia has not achieved the World Bank's standard ratio of extension workers to farmers, which is 1:800, and the FAO (UN) recommends that one extension agent should serve a maximum of one thousand farm families (1:1000) in developing countries. The agricultural sector lacks qualified and experienced HRs to adopt technology for transforming agriculture (agricultural-led industrialisation) and to ensure their employability. The quality and relevance of programmes represent the challenges facing agricultural education, while information, innovation, innovative technology, and knowledge are prerequisites for farmers to adopt technology.

Ethiopia has a health workforce of 0.7 per 1000 people, which is low compared to the WHO recommendation of 2.3 health workers per 1000 people (MoH, 2016). The quality and coverage of health services have been constrained by a lack of professionalism, skill gaps, and an undersupply of HR. Consequently, the policy

has a less relevant quota for supplying HR to the health sector. B&E is a required/demanded field of study that is undersupplied by HR graduates. On the contrary, finding skilled HR is challenging.

8.2.4 Policy Outcome on Employability of Undergraduate Graduates

In this section, the policy outcome effect on employability includes employment versus unemployment and the employability skills of the graduates, which have direct and indirect impacts on the country's economy, as summarised below.

8.2.4.1 Impact of the Macro and Micro Policies on Employment of Graduates

The government's policy on the need for graduates in the stream of S&T is essential from the point of view of the country's strategic plan to realise industry lead economy; however, the marketability of the fields is problematic, these findings concurred with previous study (Olkaba, 2019). The preference for a learner's field of study and performance on NLA influence their employability. This finding has implications for policymakers and decisionmakers in policy re-planning. The graduates placed in their preferred fields of study tend to have better employment outcomes, while those placed outside their preferences face more challenges. Graduates in B&E were placed based on their preferences, and MHS learners with good NLA performance have better employment prospects. Those pushed into STEM and other micro-policies without aligning with their interests face higher risks of unemployment or insecure jobs, contributing to wider income inequality and poverty. Students placed without interest or talent, especially with poor NLA performance, are at greater risk of unemployment and hindered career development. About 70.1% of learners pushed into S&T/STEM programmes without their preferences, whereas approximately 71.4% of learners were placed in SS based on their prior preferences. Graduates in S&T face higher unemployment risks compared to those in SS. Different university generations (1st, 2nd, and 3rd) have varied effects on graduates' employability.

The findings have important implications for policymakers to understand that macro and micro policies and their fields of study determine and have varying

effects on the employability of graduates. The high unemployment crisis among graduates is one of the inefficiencies of HR. There was a mismatch between the supply and demand of the labour market for disparate economic sectors, which led to the low employability of the graduates. Although the government believed the 70:30 policy would promote industrial and manufacturing growth through S&T HR, it lacked university-industry linkage, especially an underestimate of labour-market demand. Only 3%-3.6% were self-employed, which is a minute sustainability of the policy (indicates policy ineffectiveness), though the STEM graduates are anticipated to have self-employment, including digital business and technology. Graduates were employed in fields unrelated to their educational background, for example, nearly 50% and 31.5% of graduates from some universities, indicating less relevance to policy and underemployment.

The findings of logistic regression displayed that only B&E and MHS have a statistically significant effect of the policy on the graduates' employment, and only B&E positive effect on self-employment. The findings for policymakers are that learners who were placed based on their preferences and who have good performance at NLA were associated with better job opportunities.

8.2.4.2 Impact/Effect of the Policy on Skills of the Graduates

The outcome is very low employability, including graduates who are poor in quality, with numerous skill gaps and skill-job mismatch, as well as inadequately prepared in S&T. They have not gained the necessary skills in S&T and innovation. Although creativity is the most important domain of cognitive learning objectives to be achieved in HEIs, the current study showed that graduates may lack creativity skills, which are essential for innovation. Industries and manufacturing sectors require more skilled HR in S&T/STEM; however, graduates struggle to transfer and implement technology effectively. Employers and various economic sectors have observed that graduates entering the workforce lack the necessary S&T skillsets.

The University's supply of graduates at a ratio of 70:30 to various economic sectors has limited the knowledge, skills acquired in S&T/STEM, which has technical, soft, and technological restrictions on their employment opportunities. On the one hand, the E&T micro policy has become saturated without providing the necessary employability skills. Within this micro policy, the negative implications include the unemployment of undergraduate graduates, which is due not only to the saturation and oversupply of E&T but also to the limitation in the knowledge and skills acquired in S&T that have hampered their employment opportunities. Particularly, the graduates of E&T do not possess the desired technological skills, and they cannot handle the skillset necessary to transfer and perform technology in the industry. On the other hand, weak industrial absorption. The study findings indicated a wide gap between employers ' expectations and the graduates' performance. While S&T, including E&T, is crucial for industrial development, much work is needed to supply skilled graduates in the S&T and/or E&T domain, as they have a deficiency of technical knowledge and skills, soft skills, and technology.

The mission of HEIs was to produce professional and skilled graduates in S&T to support the country's industrial development plan. However, the study's findings indicate that graduates lack relevant employability skills and professional readiness. The feeble linkage between universities and industry is one of the reasons for the high unemployment rate among graduates. Employers feel that HEIs need to better understand industrial demand. They observed that graduates were unprepared for industry work. Evidence from employers displays a gap between their expectations and the skills graduates possess. Graduates need critical thinking, problem-solving, creativity, digital skills, and innovation skills, which are essential for 21st-century industry development. As a result, unemployment among HEI graduates due to a lack of employability skills is a significant issue. Many employers also complain about the lack of skilled labour in the market. There is a mismatch between education policies and employment opportunities. Seventy percent of learners studying S&T aim to increase

education and employment opportunities aligned with the country's industrialisation and manufacturing development plans. However, the policy's implications confirm very low employability, as HEIs fail to produce graduates who are ready for the job market. This results in high unemployment rates and graduates with low employability skills. The mismatch between the demand and supply of HR is a contributing factor. Additionally, the admission policy of the EHE conflicts with market demand for graduate employability. The output of the policy indicators lacked skill quality versus quantity.

8.3 Policy Implications

This study is unique and has unexplored policy implications based on the findings. The 70:30 macro policy implications, implementation, the policy implications for gender disparity and equity, micro policy implications, policy implications for supplying HRs to various economic sectors, and policy implications for the employability of graduates are critical areas addressed in the subsequent sections.

8.3.1 The 70:30 Macro Policy Implications

Ethiopia is the second most populous country in Africa; its population mainly consists of young and youthful people. This segment of society requires education, training, health services, and employment opportunities. An increase in the number of educated youths should enhance the country's HR and human capital. Ethiopia has the lowest GER of HEI despite efforts over the past two decades aligned with the 70:30 policy. A population with low GER indicates a raw labour force that is poorly trained, lacks investment in education, is insufficiently skilled, and/or lacks S&T and innovation. The low GER has grave implications for the country, which must invest in human capital and HRD through education and training to promote economic growth. The insufficient GER of HEIs impacts HRD, human capital, the knowledge economy, and related indices. GER is not only one of the indicators of HDI, but it is also one of the indicators of development.

Although Ethiopia's GER for HE increased from 1% (1991/92) to 10.2% (2016/17) and 10.4% (2018) (World Bank & UNESCO Institute for Statistics, 2025), it remains among the lowest in the world, indicating socio-economic development challenges. Ethiopia might not meet its goal of reaching a GER sufficient to attain lower-middle-income country status by 2025, aiming for 22% by that year. Ethiopia's tertiary GER (after 2018, not only due to lack of data and reporting gaps, but projection also made ~14% in 2025), as well as the current government's limited commitment to investing in education-possibly the worst (3.2%-8.4% of total expenditures on exams admitted to universities)-might prevent reaching its target. This has implications for declines in indices across the pillars of HR, S&T, and innovation. It also affects the foundation of the knowledge economy. Therefore, the GER and HDI suggest that HRD in Ethiopia is very low and negatively impacts economic development. A low GER can have long-term adverse effects on economic growth and progress. Furthermore, education is meant to enable citizens to participate actively in political development; however, the low GER hampers this and may contribute to the current political crises in Ethiopia. The HEIs' implementation and 70:30 policy relevance do not support the goal of turning Ethiopia into a middle-income country by 2025, as HEIs produce less relevant, professional, and skilled HR, particularly in S&T for various sectors of the economy, mainly due to the current government's very limited enrolment in HEIs.

The policy implementation faced challenges because resources, infrastructure, and facilities were inadequate for effective execution. The 70:30 STEM scheme was rolled out hastily, without necessary preparations such as technological infrastructure and staff development. The implementation of policies in HEIs overlaps with national guideline policies. Poor implementation has negative effects on HRD. Teacher education was not adequately qualified and was converted to the 70:30 model. The quality of education impacts the successful implementation of HRD policies. There was a lack of strategic planning and proper execution of the policy.

The policy is stubborn in the macro and micro policies quota and has not had a relevant study since 2008/09. The 70:30 policy is unique in Ethiopia, unfounded, and sporadic in the literature in other countries. Likewise, the annual intake of the 70:30 policy needed an assessment study of the demand and supply of HR projects for each sector of the country's economy. The background of the policy was merely political decision-making, not research-based evidence. It was not a basis for consultation with stakeholders, beneficiaries, and participation in sectors of the economy, which indicates a less relevant policy and collaborative work.

Most learners are placed without considering their interests (forced placement by the government), which results in extrinsic motivation and negative effects on their fields of study, performance, and work. In contrast, fewer learners placed based on their prior preferences in fields of study, fostering intrinsic motivation to learn, enjoy, perform well, and succeed in their careers. The difference between extrinsic and intrinsic motivation has important implications for HRD. Intrinsic motivation affects deep learning, persistence, creativity, and talent development. However, the policy has low relevance because 70.1% of STEM students are placed outside their prior interests, which impacts HRD principles and career-related motivation and performance. This situation leads to a lack of inclusive education and innovation. STEAM education is emerging, and AI and machine learning are outstanding challenges for the displacement of workforces.

The purpose of the 70:30 policy, especially S&T, is to promote industrial development and transform Ethiopia from an agrarian to an industrial economy through the developmental state model. The developmental state has limited the university's autonomy. The policy was introduced by Meles Zenawi, the late prime minister. It is a political decision that requires strong political commitment. Progress has yet to meet its goals. There must be alignment between industry and HR supply. Since 2015, political instability, war, and conflict have hindered industrial progress and policy implementation, leading to a lack of investment. After the tenure of the late Prime Minister Meles Zenawi, the policy has not fully aligned with the country's industrial growth due to changes in the political and

economic landscape. Less and/or unprofessional cadres have been the implementers of the developmental state, which has grave implications for strategic execution and drawbacks. The government's commitment and the role of professional HR are crucial in implementing a developmental state; however, since 2018, the current government's ambiguous ideology and programmes have perplexed and quandary/quashed the implementation of the 70:30 policy and its objectives. The goal of turning Ethiopia into a middle-income country by 2025 has not been achieved, as the low and less professional could not support it, mainly due to political instability, conflict, wars, and crises. The current government's approach to linking existing theory and ideology with policy and strategy planning is perplexing. Since Meles' death, the country has faced a crisis of political instability, along with war and conflict, lack of investment in education, which has severely impacted HRD and the economy. The current government seems to be maintaining the status quo of Derg's educational system. Hence, rapid policy change is also one of the challenges as education policy and HRD need long-time. HEIs have the mission to implement policies that supply skilled HR professionals for various economic sectors, mainly focusing on industrial and manufacturing development. However, despite this mission, graduates tend to be less professional. While effective policy implementation and amendments may influence future HRD in S&T and innovation, the current 70:30 policy approach may not adequately address industrial development. The policy aims to foster technology development, transfer, and the growth of the tech industry, but it lacks proper execution and underestimates social innovation, which has no practical implications for inclusive education and innovation. This is especially concerning given the prevalence of low-skilled HRs in S&T and high unemployment rates. Social innovation in health, democracy, social, political, and education sectors to solve social issues and political crises has been undervalued. Both technology-driven and social innovation lead to ecosystem-driven innovations, which should be recognised as important. The process of policy, consultation, and stakeholder engagement in formulating and implementing policies has been insufficient in responding to key developments in Ethiopia, such as improving scientific

resources-especially in agriculture, education, health, S&T, and HR across various economic sectors-if educational policies had been aligned with these phenomena.

The policy must be properly enforced to ensure that employable graduates receive the education and training necessary to compete in the international labour market. In accordance with the 70:30 ratio, HEIs should have accelerated the country's development by providing relevant and competent HR who can contribute to national growth. However, graduates need to possess essential skills. The S&T policy lacks sufficient S&T institutions and systems, has weak university-industry connections, and suffers from inadequate quality education and training; as a result, graduates are not well equipped with the S&T skillsets. They lack cutting-edge skills and technologies and cannot stand out in the competitive international labour market.

There is less effectiveness and inefficient implementation of policies in the HEIs. The less relevant recruitment policy and the mismatch between students' interests and field of study assignments have negative implications for advancement in S&T for HRDs. Additionally, the policy's implications have led to poor qualifications, low levels of technical and soft skills among graduates, and inefficient HR practices. In conclusion, all these factors indicate the devaluation of HRD and have implications for HCD. Graduates lack technical skills (due to deficiencies in the psychomotor domain of learning achievement), creativity (resulting from inadequate performance in the cognitive domain), and a work culture and ethical practice (reflecting shortcomings in the affective domain of learning achievement). The inappropriate policy implementation affects not only the unemployed and inept but also impacts the political landscape and the overall economy of the country. There was no M&E of the policy. The policy has practical implications, particularly the lack of appropriate and standard STEM education, and raises concerns about the future of STEAM education. This has consequences for current and future S&T, innovation, and economic development.

8.3.2 Policy Implications for Gender Disparity and Inequity

The population structure in Ethiopia indicates that females are slightly more numerous; however, there is a gender disparity in enrolment in the HEIs. Although programmes provide special attention to girls' participation in HE in general and in S&T in particular, the enrolment of females remains too low, especially in S&T. This has implications for inequity in enrolment in the HEI. This illustrates that the implications of the 70:30 policy have not affected gender enrolment and graduation based on the intended plan. However, it has increased the number of female enrolments and graduates.

8.3.3 The Micro Policy Implications

STEM education in lower schools is penurious in Ethiopia, which has implications for HE for STEM policies and curricula. Importantly, STEAM education has not yet been introduced, which has future implications for micro policies and curricula in the HEI and basic lower schools as well.

Engineering and Technology (E&T): The implication is that Ethiopian experience could be higher in areas associated with the growing industrial sectors, which require high skills in S&T, particularly in E&T. Postgraduate programmes in this discipline would demand that they contribute to the availability of skilled professionals with specialised knowledge who are innovative and boost productivity in the industry. The undergraduates, not only because of the saturation and oversupply of E&T in the labour market, but also because of their technical knowledge and skills acquired in S&T and innovation, have technically limited their employability. The industries of Ethiopia might not absorb the undergraduate graduates of E&T, and they cannot transfer and apply technology to the industry. Mismatch between the growth of industry and graduates of E&T. About two-thirds of learners were pushed to public universities without their prior interest, self-selected fields of study. This might have implications for the employability of graduates and HRD for the industry.

Agriculture: The implication is that one in twenty out of seven in ten graduates in agriculture could not assist more than four-fifths of the nation's farmers through research, technology, training, and agricultural extension. The sector has an undersupply of HRs, including constraints on qualified, skilled, and experienced HRs. Low-skilled graduates and low-level technology adoption is among the reasons for the low level of agricultural development. The implication is that large-scale and smallholder farmers are traditionally disadvantaged due to a lack of skill and agriculturally advanced technology. Three-quarters of learners were admitted to the college of ANRS without their prior interest in fields of study, which has grave implications for HRD. Even though agriculture should provide the principal source of employment, the unemployment rate for undergraduate degrees was high.

Health: According to the policy guideline, the proportion of MHS is only one in twenty, which appears to be a low HR supply to cover the health services of one hundred seven million people in 2016/17. The employment opportunities for graduates in this discipline have good market demand, but qualifications and professionalism must be studied. About half of the learners were admitted to the MPH College without their prior preferred fields of study. In general, the policy implication for providing HRs for health sector development in Ethiopia needs to be higher, as well as the supply of HRs. This has one of the implications for the productive HCD. The demand and learners' performance at the entrance exam of HEIs, which has a positive implication for their employment opportunities, are relatively good.

Natural and computational sciences: This micro policy has low learner demand to be admitted with their interest. On average, 89% of NCS learners joined public universities without interest and/or self-selection profession. This has grave negative implications for the HRD and/or HCD and the employability of graduates. As a result, the undergraduate unemployment rate in this discipline was high. The graduates from this discipline frequently join secondary, college,

and university as teachers. This programme might have negative implications for the quality of education in all institutions and create a vicious circle.

Business and Economics: Though the allocation of the policy for B&E is one-fifth, the undergraduate enrolment in B&E has ranged from 14.1% to 21% since 2008/09. Most of the B&E learners have been admitted to public universities with their prior preferred fields of study, which has implications for the B&E demand, business management, and relatively good job opportunities. In general, B&E has undersupplied HRs, and the market demands fields of study.

Social and Human Sciences: Though the allocation of the policy for SHS is one in ten out of under one-third, the actual percentile of the undergraduate enrolment indicated two to three folds and the postgraduates three to four folds of the allocation of the national setting guideline of the policy from 2008/09 to 2016/17. The implication of SHS (undergraduate graduates) has a high unemployment rate, for example, over two-fifths in 2015 and about half in 2017. Over half of the learners went to the SHS College without their prior interest. The cut for SHS enrolment in the HEIs and the lack of SHS integration into STEM may have implications for social innovation, democratic, political, governance, management, humanitarian, and social development, which need further research. Further research is needed, as this may have been contributing to the current political crisis in Ethiopia.

8.3.4 Policy Implications for Demand and Supply of Human Resources

A mismatch was observed between the demand and supply of HRs for the disparate economic sectors of the country, which has practical implications for the cyclical unemployment structure. The implication is that there needs to be a relevant policy to supply HR to the various economic sectors. This has implications for inefficient HRs. There also needed to be a better match between the HR and industry employers' requirements. About less than a third to half of the graduates of some universities are employed in fields unrelated to their

educational background or fields of study, which has implications for less relevant policies to the labour market.

The policy states that learners must choose, and the supply of education should anticipate learner demand (MoE, 2008). However, the findings reveal contradictions: learner demand that does not align with their choices, less effective and inefficient policy implementation in HEIs (which does not follow the government's plan, even though the policy was set in advance in ratio-the government overrides the placement), and a mismatch not only between learner demand and market demand but also between the demand and supply of HR across various economic sectors, with some sectors being under-supplied and others over-supplied. It exists between the policy documents, which states that learners must demand fields of study, and contradicts the government's decision to set ratios for each macro and micro-level policy and fields of study.

8.3.5 Policy Implications for the Employability of Graduates

Policy implications and Effect/Impact on Employability Skills of Graduates: Seven in ten learners studying S&T planned to increase the skills and productivity of graduates to serve the industrialisation plan of the country. However, the undergraduate graduates were coming to the industries without acquiring the required skillsets of S&T. Graduates are unequipped in S&T appropriately, especially if they have deficient skills needed for the 21st-century skills and/or industry, the skills required for a 21st-century knowledge-based economy, digital literacy, and/or digital and advanced technology. The findings have crucial implications for policymakers/decisionmakers and stakeholders that the learners placed according to their prioritised choices and had a good performance at NLA were relatively likely to have better employability opportunities. On the contrary, those placed without regard to their preferences and indigent performance in assessment face a higher risk of unemployment. The findings suggest misalignment between graduates' skills and labour-market demands.

The skills of the graduates are mismatched with the skills required and/or the demanding labour market, which has skill-mismatch implications for structural unemployment. The 70:30 policy is intended to supply HRs in S&T and innovation for industrial development; however, graduates cannot transfer and apply technology in the industry. The study implies that it is arduous to find skilled HR for industrial development. Graduates need to gain social, soft, technical, and professional skills. University graduates need higher employability skills. The penurious performance of learners on the entrance exam of HE (including the assessment strategy) is one of the indicators of ill-prepared learners (poor STEM readiness in school) needing a basis for S&T.

Policy implications and Effect/Impact on Unemployment**:** The undergraduate unemployment crisis is one of the critical challenges facing Ethiopia today. The rapid and continuous expansion of HEIs in accordance with the 70:30 policy aims to address high-skilled labour requirements of the manufacturing and industrial economy, and to increase opportunities for both education and employment for graduates throughout the country. Nonetheless, the implications indicate that high unemployment, underemployment, and/or disguised crisis. This implies not only structural unemployment but also frictional and cyclical unemployment. Advanced technology, like machines and AI, is starting to be utilised and will be replacing HR, with future implications for technological unemployment. The high unemployment crisis has created negative implications (impact) on political instability, low returns of cost-sharing and investment, and economic and social issues in the country. That affects the human capital and economic growth of the country, which has perilous implications. The main aim of the policy of 70:30 was in favour of S&T to produce skilled graduates to be involved in the industry and manufacturing sector, which is to transform from an agrarian economy to an industrial economy. As a result, Ethiopian industries have constraints on skilled employees who need assistance to perform and transfer technology into the industry and/or manufacturing.

31.5% to 50% of the graduates (employees). Some universities are unrelated to their educational background or fields of study. This has implications for underemployment and less relevant policy to the labour market. The self-employment of undergraduate graduates was also very low (3.0% to 3.6%), which indicates very low sustainability policy and policy ineffectiveness, which has implications for entrepreneurs in small and micro-enterprise economies. The graduate may lack entrepreneurship courses, training, and financial support for self-employment. STEM graduates have not shown digital business and technology-derived self-employment. To do that, graduates should have acquired the necessary technological and digital skills. Entrepreneurship is associated with self-employment and the skills of the graduates.

Though a youth population is the backbone of the economy, without education and jobs, it inevitably leads to instability. Thus, the negative implication (impact) is that a high unemployment rate is one of the factors for the uprisings; as a result, political instability in disparate parts of the country is likely inspired by the unemployed graduates of HE, among others. That is one of the causes of the country's unrest currently, mainly since 2015. The underestimation of SS education can have significant consequences for social, democratic, and political progress.

Overall, HRD has implications for disparate trends in different sectors, such as the economy, human capital, education, employment, innovation, S&T, health, industry, social, political, cultural, and democratic development.

8.4 Contribution of this Study and its Implications

This study contributes to theory, educational philosophy, knowledge, policy, S&T, and innovation, and methodological approach, along with its implications.

8.4.1 Contribution to Theory, Practice, and its Implications

This study relates to multiple theories of development because HRD and education policy are multidimensional-the 70:30 policy effects on HRD and has implications for development. Its implementation affects existing theory. Findings indicate that policy implementation and outcomes are neither HCT of education (i.e., a lack of capacity, skills, and ability among most graduates) nor STE (i.e., the policy placement is unrelated to most learners' natural ability, interest, and talent), leading to misalignment, inefficient skills, and a high risk of underemployment and unemployment, which result in low productivity and returns. The current study confirms that Ethiopian education has not achieved the endogenous theory of human capital as the main driver of economic growth, innovation, job market mismatch, and inefficiency. Ethiopia shifted to capitalism-neo-liberalism from 1991 to 2003/04, allowing private universities and resulting in several private institutions. Another important finding is Ethiopia's very low GER rate, which negatively affects the HDI and is among the lowest worldwide, impeding economic development, contradicting neo-classical theory.

The 70:30 policy failed for HCT because of misalignment of the education policy, the process of skill development, low-skill graduates, inefficient skills, and low productivity (reflected and confirmed high unemployment). Why innovation fails: lack of integration of STEM and STEAM to develop soft and technical skills, creativity, and critical thinking. The 70:30 model underestimates essential components of innovation from SS. STEM alone are insufficient for innovation, but STEAM does it. Bloom's taxonomy, like creativity, is the highest component of this, but limited consideration in the HEIs and pedagogy versus andragogy has implications for innovation.

The development state theory and/or state led admission of the 70:30 policy failed for HRD. Ethiopia followed a developmental state from 2004/05 to 2018/19, although the current government has an ambiguous economic model and ideology. The developmental state approach limits university and student

autonomy and ideally focuses only on public university-industry partnerships, but it underestimates labour-market demand and the role of the private sector, especially university-private sector collaborations in HRD. The 70:30 policy was formulated and implemented in line with the developmental state for state-led industrial growth; however, it not only underestimated the private and labour market, but it has underperformed compared to the original plan. Implementing a developmental state requires professional HR and skilled HRD for industrial and manufacturing growth, but HEI graduates and policy outcomes have not met these needs. State-led 70:30 admission and planning without sufficient university capacity, resources, students' interests, industry demand, quality education, or weak university-industry linkages increase the risk of failure. State-led industrialisation cannot succeed without these factors. Cadres act as implementers of the developmental state in Ethiopia, which has serious implications for professionals. Consistent with the developmental state, learners were pushed into S&T fields without regard for their interests, ability, or self-selection in profession, and the placement policy is contrary to literature emphasising interest and talent. Moreover, the 70:30 policy has failed to produce skilled HRD for industry and manufacturing sectors, and to address job insecurity for S&T graduates, and lack of joint coordination in policy planning, curriculum designing and implementing it. Political commitment is critical for implementing the developmental state, but the current government’s ambiguous ideology and programme complicate the implementation of the 70:30 policy, which is neither neo-developmental nor neo-liberal. Therefore, this research raises new questions for future studies.

Therefore, the contribution of this thesis is to aid the government in developing relevant HEP in accordance with ideological principles for HRD. This research contributes to how HEP relates to ideology-development theories for HRD and their implications for economic development, especially given that Ethiopia's current government has an ambiguous ideology and policy stance. The government must establish a clear ideology, along with policies and joint strategic

plans, and effectively implement them while considering the country's economic situation to modernise the education system. This transformation is crucial for advancing S&T and the nation's industrial development. The government should prioritise expanding access to education to increase GER and achieve HCT, HDI, and STE for HRD in S&T, particularly given the population growth and demographic structure, which includes a significant proportion of young people. Specifically, STE is vital for HRD, admission, and placement of learners based on their abilities, interests, self-selection of professions, and talents. HR is the primary driver of economic development in today's dynamic economy, including digital transformation, technological progress, and industrial growth, all aligned with human capital in S&T. Investing in education access to boost GER has implications for HDI and HCT, which represent a key aspect of economic development.

There is also a conundrum regarding the theories of pedagogy and andragogy in Ethiopian curriculum HEIs, among the government and scholars. It is important to reconsider the pedagogy courses offered in HEIs, as andragogy should be more relevant and considered when developing curricula and teaching strategies for HE.

Globally, skill shortages (ICFGEO, 2017), automation risks for employees (Vally & Motala, 2014; Mankiw et al., 2018), as technology increasingly replaces and mitigates the amount of labour (ICFGEO, 2017), neo-liberal job insecurity and GFC (Potter et al., 2018), and the 70:30 policy's failure to address job insecurity for S&T graduates in line with the developmental state, pose significant issues. Global challenges like health (COVID-19 and HIV), climate change, and economic, political, and social crises further underscore the predicament. These factors indicate not only the future implications for rethink for HRD but also the failure of the policy and raise questions about ideology and theory for HRD.

Contribution to theory: Therefore, a new alignment in education theory can be one of the approaches. The theory of education should align with education policy

and curriculum, as well as their effects on HRD, employment development, economic growth, and development. *This thesis therefore introduces a new alignment of education framework/theory-the Demand-Driven Alignment of Higher Education-that links demand-driven education policy* (covering interests and talents, students' intrinsic motivation influencing academic performance, labour-market and industry demands, and national plans) to STEAM-focused curriculum innovation (including pedagogy to andragogy, educational resources and university capacity-building, university-industry linkage, university-labour-market linkages, school-university partnerships, and stakeholder coordination). From there, it extends to National HRD, employment development, inclusive education and innovation talent, career and skill development, and ultimately economic growth and development. This framework is especially relevant in developing countries. This alignment leads to graduates with innovation-oriented skills and entrepreneurship. This shift aims to reform admission and placement systems, strengthen linkages, and join coordination implementation. Key stakeholders' coordination-including universities, governments, and the public-private sectors-must engage in policy planning and STEAM curriculum design and its implementing through, coordination of on-the-job training, up skilling, apprenticeships, traineeships, internships, practicums, and externships, and feedback. Currently, no existing theories align in this manner. This thesis makes a unique, original contribution to knowledge by proposing a clear new alignment of higher education. It identifies gaps in existing literature, introduces an innovative approach, and offers a novel theoretical framework. Additionally, it extends current theories incrementally, challenges previous assumptions, and advances scholarly understanding in education policy for HRD in S&T and innovation, with important implications for development. This new alignment asserts that misalignment between stakeholder policies, curricula, and practices results in low returns, more so than quota-based admissions, resource shortages, or mismatched demands from learners, labour markets, and industry growth. The Demand–Driven Alignment will serve as a key driver of HRD in S&T, development employment, and overall development. It emphasises shifting from

quota and forced enrolment policies to alignment-based theories, policies, and curricula. This approach directly impacts education policy, HR planning, curriculum development, and coordination of stakeholders. *This new alignment of education framework/theory-the Demand-Driven Alignment of Higher Education-that links demand-driven education* policy promotes creating an ecosystem for inclusive socio-economic development, inclusive innovation, and education for sustainable development**.** Further details are provided in the sections below.

8.4.2 Contribution to Educational Philosophy

While Pragmatism as an educational philosophy formed the foundation of the country's education system during the EPRDF era, it has certain limitations in practice. Both pragmatism and progressivism are recommended approaches for Ethiopian education because problem-solving is one of the objectives of HE in Ethiopia. Learning by doing is also one of the teaching methods within the educational philosophies of pragmatism, naturalism, and progressivism. The current findings indicate that learners are inadequately aligning their fields of study with their self-selected professions, which should reflect their abilities and aptitudes. These findings contradict Plato's principle of specialisation based on the unique aptitude doctrine, which posits that each person is born with a natural talent suited for a specific craft or type of work and social role (Oxford University, 2017). Not only do the findings contradict self-selection of professions, but they also contradict existentialism's self-selection of HEIs. One of the goals of HE is to address individuals' learning needs and aspirations by fostering their intellectual abilities and aptitudes throughout their lives (Lange, 2013), which has not been realised in the current findings. Therefore, this thesis assists for both the principle of specialisation and the self-selection of HEIs according to existentialism**,** which are crucial for placing learners in roles that correspond with their unique talents, self-selected professions, interests, and abilities.

8.4.3 Contribution to Knowledge, Policy, and Its Implications

This study has contributed to a new policy for HRD that is a demand-driven education policy along the STEAM curriculum innovative, encompassing student demand-driven and skill prioritisation of employers/industry, demands labour market and industry, and government plans/prioritises HR planning.

This study introduces new knowledge for the policy. Individuals possess unique talents and interests within their fields of study, especially in policy development. People also have specific abilities/talents suited to certain types of work, which can impact policy creation. For instance, some learners are talented in mathematics and therefore have an interest and admission in it; others do not. Some learners may have a particular talent or passion for politics, though this is not universal. Others might excel in linguistics or music, while some lack these talents. Additionally, some learners have a strong aptitude and interest in technology, whereas others do not. If learners perform well and show interest in physics, they may pursue engineering at university; similarly, those interested in politics might focus on political development. Learners select their careers based on their ambitions and self-choice, aiming to improve their academic success and future work performance. Although these factors are not always considered in policy placement, they have significant implications for policy development, specialisation fields, and later professional choices and types of work.

This thesis presents the first national ex-post evaluation of the role of developmental state theory in Ethiopia's 70:30 HE admission policy for HRD and national development since its launch in 2008/09. Although the policy has been in place for over a decade, it has never been scientifically studied regarding its outcomes, impact on HRD, and implications for national development. This opens new research questions and a research agenda. The researcher identified two conflicting aspects within the 70:30 policy: on one hand, students typically choose a field of study before entering university, while on the other hand, government policies influence students' placements across various fields. Data from 2012/13

to 2017/18 shows that most students attended public universities (based on extrinsic motivation) without prior interest, being assigned to fields of study that do not align with their preferences, career goals, talents, or abilities. As a result, many students do not study what they originally wanted, which can lead to lower academic performance and possibly reduced contributions to economic growth. Conversely, students placed in their preferred fields, based on their talents and interests, tend to experience greater autonomy, enjoy their studies and work, and make positive contributions to HRD, including talent, career, and skill development based on intrinsic motivation, while also helping to reduce unemployment for sustainable development. Generally, placing students based on their interests fosters intrinsic motivation; in contrast, placement without regard to preferences may result in extrinsic motivation, affecting HRD outcomes. This contradicts the theory of HE in STE (Mankiw et al., 2013), thus reducing its relevance for HRD in S&T and innovation. These discrepancies also negatively influence students' academic performance and, consequently, the overall quality of graduates. All these issues have significant implications for policy development.

The domain of learning objectives, pedagogy versus andragogy, also has implications for policy and curriculum development. Some learners have the best auditory learning style; others may have the best visual learning style; and others may have the best kinaesthetic learning style (learning by doing), which has implications for curriculum development. HEIs usually give pedagogy courses and employ pedagogy as a teaching strategy rather than andragogy. The policy and curriculum should take andragogy into account within HEIs. The domains of cognitive learning (including critical thinking, problem-solving, analytical, and creative skills), affective learning (values and attitudes), and psychomotor learning (physical activities, abilities, and skills) need to be addressed. Even though creativity is the highest level of cognitive domain learning to be achieved by learners, which is an essential way for innovation in HEIs, they have not achieved it, and/or are unequipped. Bloom's taxonomy is paramount for

developing critical thinking skills. If learners possess psychomotor abilities (experimentation, experience, activity, and observation), this can enhance the physical fields of study. Particularly, HEIs should emphasise andragogy for fostering more critical thinking, systems thinking, strategic thinking, problem-solving skills, and creativity.

The government underestimates the value of social and human sciences. It believes that the contemporary world of work is more conducive to studying S&T instead. While S&T has become relentless, we should not underestimate the role of SSs; for example, health, education (including quality education), as well as democratic and social issues, represent the global challenges, such as health crises like COVID-19, management and leadership, governance, politics, democracy, and social unrest and crises. Although the relevance of S&T in education is growing, it is important to give SHS as well.

The study contributes to policy development by identifying and enhancing the self-selection in professions, aligning learners' talents, interests, and tendencies with their future fields of study in line with the pedagogical science in lower schools and andragogy in HEIs. This study has an original contribution to demand-driven development policies and/or programmes for HRD, which is a crucial implication for sustainable development in the country. If the government has a plan for HR, it must consider learners' interests, talents, and abilities, motivating them, accordingly, starting at the lower school for HRD by applying the principles of supply and demand, HR pertinent to each economic sector. This study also has implications for behavioural, and labour economics related to macroeconomics, unemployment, and employment. The engagement and requirement of stakeholders, employers, and the government in policy planning is crucial. Demand-driven fields of study, education policy, and programmes, starting from lower schools to HEIs, are essential for S&T, innovation, and HRD in general. Hence, this promotes creating inclusive innovation and education for sustainable development**.** To do so, learners must have a robust foundation in mathematics and sciences, and the integration of S&T/STEM and SS/SHS

subjects during lower schooling to advance in S&T and innovation in the HEIs. Not only technology-driven innovation, but also social innovation aspects of both ecosystem-driven innovation are paramount for socio-economic and political development.

Furthermore, the researcher believes that the psychomotor domain of learning, akin to vocational education, should be introduced at lower schools to establish a robust basis for technical skills, especially for S&T learners. The study highlights the significance of S&T in recent economic advancements. New technologies, such as machines and AI, have begun to displace the workforce, which has implications for future unemployment rates. This research is timely and the first to conduct an ex-post evaluation study to address policy indicators using evaluation criteria and their implications for HRD. Hence, this research raises new research questions for further investigation. Hence, new models and policies are necessary based on future research**.**

The Implications will commence at the lower school level to develop learners' tendencies and talents as the basis for future fields of study. They must identify their ambitions and inclinations early in their educational journey. Understanding their talents and abilities for their future fields of study, as well as providing learning platforms and environments to enrich and accelerate their talents, abilities, and interests, should be considered at the lower school to commence a demand-driven development policy and programme. HEIs must cultivate learners' talents and encourage self-selection for professional careers, including unique talents and abilities, to mitigate the unemployment of graduates. By doing so, they will achieve good performance and enhance their skills. As a result, they could advance S&T and innovation and engage in scientific research, thereby contributing to better economic development.

8.4.4 Contribution to Science, Technology and Innovation

There needs to be more clarity on the concept of S&T among disparate fields of study. The government, HEIs, and several scholars thought S&T was merely a

natural field of study, excluding the SS area. However, S&T exists in both natural and social fields of study to varying degrees. All fields of study are sciences, and they have technology to varying degrees. Science is a system that acquires knowledge through various scientific methods, whereas technology is the application of knowledge for efficient work. There is also a need for more clarity in the documents of the Ethiopian government, HE, and some scholars regarding social sciences and humanities; however, humanities is also one of the fields of study of science, which should be referred to as a social and humanities science.

There needs to be more clarity and conceptual understanding about innovation. The government and scholars also consider S&T to be merely important for innovation. However, the fact is that STEM alone is insufficient for innovation; thus, multidisciplinary and interdisciplinary approaches have more implications for innovation by integrating both S&T and SS, which have their own implications for innovation. More importantly, literature indicates that innovation is predominantly associated with STEM; however, AHSS is not excluded. Hence, STEAM provides more opportunities for creativity and innovation. HEIs should not only focus on S&T for technological innovation but also include SS for social innovation. Not only S&T, but also pedagogical and andragogical sciences have implications for critical thinking, creativity, systems thinking, and problem-solving, all of which are crucial for innovation. We need to consider not only the S&T/STEM technology economy but also creativity and critical thinking for social, governance, democratic, and political issues from SSs. Thus, STEAM represents the integration of STEM and AHSS in both education policy and curriculum. Hence, this contributes to creating inclusive innovation and education. Innovation can emerge from various fields of study, and it is relevant to all scientific disciplines. Overall, both S&T and SS contribute to innovation, including what STEM offers for technological innovation, and SHS emphasises more for social innovation, both of which are integral components of the ecosystem and its implications for inclusive socio-economic and sustainable development. Thus, STEAM encompasses both technological and social innovation, with implications for the country's socio-economic development. STEAM education can foster

digital literacy and skills for HRD in the contemporary and future economy, especially within the digital economy and digital society.

8.4.5 Contribution to Literature

This thesis contributes to the literature and references by presenting a unique policy case from Ethiopia's 70:30 education policy, which has not been experimented with, is sporadic, and has not been implemented elsewhere or in other countries, along with its effects on HRD and its implications for national development. Therefore, the thesis offers a new international benchmark, especially for African countries. It also provides new insights into the developmental state, focusing on the state-led adoption and implementation of the 70:30 policy and its impact on HRD, particularly in S&T, for industrial and national development in Ethiopia, a developing country in Africa. In line with HCT, the findings confirm that low-skilled workers decrease productivity and economic returns. The contribution to African HEP in S&T/STEM versus STEAM and its implications for innovation and industrial and economic development.

8.4.6 Contribution to Methodological Approach

The contribution of this study has elevated and executed a new innovative approach and methodology that incorporates pedagogical and andragogical principles. The thesis was carried out by integrating contemporary theoretical methods, applying practical techniques, and integrating new conceptual frameworks with advanced policy analysis techniques. It presents a novel evaluation and in-depth policy analysis that considers theoretical frameworks, which have not been previously studied.

New Innovative policy approaches and analyses using advanced quantitative and qualitative methods were employed to obtain comprehensive findings. A unique exploratory approach was adopted, incorporating embedded visual graphics and statistical analysis of quantitative data visualisation analysis with SPSS and Stata. Additionally, a visual graphic network visualisation and qualitative

descriptive approach were employed through data visualisation analysis with ATLAS.ti. Advanced analytical techniques, such as an ITSD, triple DID, RDD, multiple and logistic regressions, and ARIMA, along with data visualisation analysis, were applied for quantitative analysis. For qualitative analysis, ATLAS.ti was used to facilitate advanced categorisation, a network visualisation of coding and sub-coding occurrences, and quotation, including hyper-network quotations alongside data visualisation analysis.

From a pedagogical and andragogical perspective, this thesis is unique in its consideration for both visual and reading learners. The visual network and data visualisation analysis are connected to textual descriptions that serve both types of learners. Furthermore, pedagogical and andragogical approaches have been examined, including discussions and debates on STEM versus STEAM, S&T versus SS, and STEM versus AHSS, along with ideology and policy and their implications for policy and economic development, incorporating additional scenarios.

8.5 Recommendations for Policy and Practice

Recommendations for policy and practices are proposed based on the findings. Recommendations have been forwarded to various stakeholders, encompassing the government, HEIs, private sector employers, industries, and the university-industry interface, among others, as forwarded in the following sections.

8.5.1 Policy Recommendations to the Government Practice

Revising the policy to make a relevant policy and a resilient economy

The government and policymakers must review periodically, evaluate, revise, and reform the policy, including programmes, to make a relevant educational policy and a resilient economy. The policy needs revision, considering the labour market and the employability of the graduates. The government should be committed to meeting international education standards to produce internationally competent

graduate learners for the labour market. The government must be pragmatic with this policy.

Evidence-based policymaking and M&E

The policy has no policy process, M&E, and evidence-based policymaking. These are essential for tracking the policy's impact and effectiveness on HRD. Furthermore, the policy lacks a policy process and research evidence, which the government needs to address urgently and meticulously.

Formulating demand-driven higher education policy and programme model

Demand-driven education policy model is relevant to inclusive education and innovation. The demand-driven education policy will have implications for career, talent, and skill development, mitigation of unemployment, and HRD. To do so, the policy placement should consider abilities, self-selection of professions, talent, and interests so that learners can have intrinsic motivation to study hard for better HRD. The involvement of the stakeholders, skill prioritisation, and HR plan of employers, government, industry, and/or labour-market demand should also be considered in the demand-driven development policy and programme for HR planning and development.

Elevating HR planning through market-aligned placement

One of the study's findings is the macro-70:30 policy and its micro policy effects; fields of study affect variations in the employability of graduates. Another finding, which has crucial implications for policymakers/decisionmakers and stakeholders, is that learners placed according to their prioritised choices and good performance at NLA with appropriate assessment were relatively likely to have better employability opportunities. The unemployment crisis is one of the challenges facing Ethiopia today. A demand-driven development policy and programme for HR planning and development can be one approach. Demand-driven HR policy and planning are paramount for the country's different economic

sectors. It should be a new model-HRD approach that balances the local needs and realities with the quality and relevance of programmes in Ethiopian universities that directly respond to graduate employability. The policy should consider behavioural labour economics as unemployment is one of the components of macroeconomics. The employability of respective graduates should be measured as a criterion for HEP and university performance.

Formulating demand-driven STEAM curricula by integrating S&T and SHS

The STEAM curriculum should be designed from school to university. STEAM policy is more effective in skills required for 21st-century industry. At present, STEM graduates have deficiencies. STEM alone is insufficient for innovation, but STEAM is complete for innovation and the ecosystem. The STEAM policy needs to be formulated based on the effect and impact of the 70:30 policy in lower schools and HEIs. The STEAM policy must be developed for twenty-first-century skills (digital and literacy skills), a knowledge-based economy, and the digital and gig economy. Demand-driven education policy along the STEAM curriculum is relevant to inclusive education and innovation. Not only is STEM innovation for tech economic development, but other AHSS fields of study are essential for social innovation, which have implications for the ecosystem. Not only STEM tech economy, technology-derived innovation, and technology-derived entrepreneurship, but also needs to be embedded along with business management and social innovation. Social innovation from some fields of study should also be considered when solving social, management, economic, equality, democratic, and political issues. Interdisciplinary and integrated knowledge of experts is required for development. Thus, STEAM education policy has to integrate the innovations of both S&T and SS with the potential to produce analytical, hybrid workers and critical thinkers, strategic thinkers, gig/remote workers and adaptability in digital economy, communicative and creative, entrepreneurship, soft skill and innovative graduates, as well as to foster learners' awareness of social, technological, political, management, economic, and

democratic issues. The HEIs shall provide scientifically and technologically innovative HR.

Regional autonomy in educational policy formulation

Each region ought to possess the freedom to develop and update education policies tailored to its unique context, considering its distinctive resources and socio-economic conditions, including the resilience of conflict-affected regions. Since 2015, Ethiopia has faced multiple conflicts and complex wars, which require a special education programme or policy. Given disparities in resources such as agriculture, land, industry, mining, minerals, natural assets, and population across regions, it is crucial to implement tailored education that utilises these resources effectively, aligned with STEAM policy and stage of industrial development.

Standardising Policy across public and private sectors

National government policy and the standard curriculum innovation need to involve cooperation with the private sector at all levels of education, and this collaboration should be actively empowered to boost the GER and education system of the country, along with M&E and quality assurance institutions.

Reforming micro policies for balanced HR supply

HR planning is a difficult part of the policy. Thus, continuous reviewing and reforming the micro policies are needed to supply HR for each socio-economic sector and manage the labour market. There needs to be a better match between HR supply and demand. The micro policy needs to be studied to address the national priorities, the needs of industries and employers, the present and emerging role of each micro policy, and professional requirements based on HR

demand and supply projection, without compromising the interests and talent of the learners by motivating them starting at lower schools.

Aligning educational philosophy with national strategy

The government must have an appropriate ideology, including educational philosophy and strategic planning and implementation in line with education policy and programme, as the current government has an ambiguous ideology, programme, and education policy and plan.

Green HCD and Agricultural transformation:

HCD plays a crucial role in S&T for cutting-edge technology and the economy. Building a green HRD is paramount for being environmentally friendly. Constructing a skilled labour force to make the agricultural transformation and agriculture-led industrialisation successful. A skilled workforce can adopt new methods and technologies to transform from agrarian to industrial development because more than 80% of the people of Ethiopia depend on agricultural economic activity.

Increasing the enrolment of postgraduates in S&T policy: Since postgraduate degrees, especially Doctorate degrees, is scarce in Ethiopia, the government must commit to increasing Master's and Doctorate enrolments in the HEIs. Explicitly, in the postgraduate field, the government should provide more chances in favour of S&T because the 70:30 implementation has yet to be appropriate.

Extending the duration of the study

The study term needs to be revised to provide more contemporary STEAM courses and opportunities for professionalism.

Enriching the resources

The HEIs need infrastructure and resources to implement the STEAM education policy, especially since S&T needs inputs (resources) for practical training. Moreover, it needs to strengthen the teacher training and capacity-building activities of the academic staff to achieve the qualification of the academic staff in line with the policy. The S&T policy needs to allocate the resources needed for effective implementation.

Minimising the gender disparity and gender-specific STEAM interventions: Gender composition in Ethiopia is almost identical, but the result of the study indicated gender inequity in enrolment, especially in S&T/STEM, which concurred (Chalchesa, 2012). Thus, the government and other stakeholders should strive to increase the enrolment of females in HEIs, especially gender-specific STEM versus STEAM interventions, which have implications for creating an educated society.

Relevance of HR demand-supply projection

The government should periodically review the policy and conduct periodic national surveys aiming to develop the supply and demand of HRs needed for disparate sectors of the economy. The law of supply and demand of HR needs to be applied. That would assist the government in making a feasible national plan for HE expansion and the appropriate placement of learners under macro and micro policies. The policy should be revised through periodic assessment studies of the market demand and learners' demand and supply projection of HRs for each sector of the country.

Differentiating University missions

Not all universities should have the same mission in all regions and universities. All universities have the same missions in Ethiopia. However, universities should have disparate missions and programmes considering their regional and local resources like agriculture, tourism, population, mining and mineral industries, and others on the other hand.

Engaging stakeholders in policy process

Professional HR must implement and engage in the government policy process, planning, and education programmes instead of merely being a cadre. Strategic planning and implementation for coordination and collaborative working need to engage in the policy process and implementation.

Minimum wage and employment policy

The government should have a minimum wage and employment policy, as many industries employ workers without established minimum wage standards, and some of them are underpaid.

Providing career guidance, assessment, counselling:

- Providing career guidance and academic pathways services primarily at schools and universities to match learners' preferences, government priorities, capabilities, labour-market demand, and their academic or strategic career goals for better HRD and successful graduate outcomes. Some learners may not yet recognise their talents, while others need motivation, empowerment of diversity, and capacity development. Recruiting relevant learners depends on establishing academic and career pathways and guidance within academic services; some learners may identify their talents, whereas others need information and guidance at school and university. This also aligns timely policies with market demand and industry growth to match labour and industry expansion, as well as supply and demand for HR.
- Career development involves setting career goals, managing, and advancing professional growth and career trajectories through strategic planning, skill development, and professional development.

- Career assessment utilises various tools and methodologies, such as surveys, interviews, psychometric tests, and exam results, to identify students' suitable talents and interests for their career paths and development opportunities.
- Career counselling involves assessing students' interests, skills, and values, and providing guidance using personality assessments and labour-market information to support graduate students' opportunities.

Appropriate assessment strategies learning styles, pedagogy, andragogy, and the talents and interests of learners at school and university

To ensure effective assessment strategies in schools and universities, it is essential to consider more than just the NLA and entrance exams. The learning and assessments should consider various learning styles-including kinaesthetic, auditory, visual, and reading preferences-as well as pedagogical and andragogic factors. Additionally, the assessments should address different domains of learning: cognitive, psychomotor, and affective. Recognising the above factors and learners' talents, ambitions, preferences, and interests is important, as these play a crucial role in policy and curriculum innovation for HRD.

Conducting alumni study, monitoring, and evaluation at national level

Conducting periodic national alumni surveys and/or evaluation and M&E are vital to re-formulating, re-designing new strategies and evaluating the policy.

Developing and formulating policy based on the policy process

The policy process requires a feasibility study, problem identification, agenda setting, formulation, adoption, implementation, evaluation, policy change, and/or amendment. Particularly, the policy must have a policy process considering research evidence and evaluating its ex-ante and ex-post and/or impact. Policy should be based on external, reliable, and replicable research findings and policy

analysis, and policymakers must consider these findings when making decisions.

Rethinking HRD for the future digital and gig economy

Nowadays, HR is active, whereas other resources play a passive role in the cutting-edge technology and economy; hence, the government and HEIs must be considered the HRD for the digital and gig economy through creating a digital society and gig and/or remote and hybrid workers. STEAM education can create a digital society, a digital business, and a literacy society. Advanced digital technology, digital literacy, and skills are paramount for the digital and gig economy. STEAM education policy and curriculum need to be formulated and developed to do that.

Comparative study of education for development and adopting policy

If the government desires to adopt a policy from another country, it shall study the similarities of the countries in terms of economic, educational, ideological, social, cultural, political, and philosophical conditions, and other factors. A minimum comparative study is required if an adoption policy is needed.

Providing and advancing physical, digital infrastructures and resources for STEAM education for inclusive and quality education and lifelong learning

This includes ensuring a reliable electricity supply, providing state-of-the-art networking equipment, digital resources and infrastructures, quality internet, and investing in trendy computing devices to provide inclusive and quality education, and education for all and lifelong learning, including remote, population age, rural, gender and conflict-affected regions and areas. Providing digital education and learning through digital technology, both within the university and outside the gates to do so. Additionally, expanding high-speed internet access, leveraging cloud-based solutions for scalable digital resources, and developing advanced educational software are crucial. By prioritising these enhancements, the

government can ensure access to quality STEAM education and foster lifelong learning opportunities for all individuals, regardless of geographic location or socio-economic status.

Ensuring relevant and quality education

Education should be relevant and of excellent quality. The government must provide and ensure the relevance and quality of education to have HCD.

Rethinking national education policy and curriculum innovation for hybrid work environments and technology-driven employment

Developing education policies and curriculum innovation considering a hybrid work model is an essential and forward-thinking approach to the current and future work environment. Embracing remote work and gig workers is an effective long-term strategy for enhancing employee job performance compared to traditional office-based work. The future of remote work is anticipated to be shaped by advancements in AI and automation, digital literacy and skills, integration of human domain and AI, an expanding gig economy and work, and the widespread adoption of hybrid work models. Hence, technology-driven skills are paramount for the employability of the graduates. To do that, our education policy and curriculum should consider structures for remote and in-office work environments in the future, like STEAM education.

Guaranteeing quality and educational rights

The policy's relevance to increasing GER for learners includes the right to quality education and access to educational resources to boost GER. Since Ethiopia's GER in HE is among the lowest globally, the government must recognise that education is a fundamental human right. Both the government and stakeholders should acknowledge the importance of education in line with the MDG (2015) education agenda for all and the SDG (2030) for quality education. Education should be regarded as a basic human right.

8.5.2 Recommendations to HEIs Practice

Theoretical training vis-a-vis practical training

The policy of the HEI should focus on integrating theoretical vis-a-vis applicable study, like those offered in industries and businesses, public-private sectors in the form of apprenticeship. It needs university-industry/labour-market demand, and public-private sector linkage to provide practical skills development programmes and innovation, such as vocational education, on-the-job training, apprenticeship, traineeships, internships, practicum, and externships.

Developing STEAM curricula innovation in each micro policy of HEIs

HEIs should design STEAM education and revise their curricula for all programmes of study, and link education and training with the contemporary real world of work. STEAM interdisciplinary and multidisciplinary curriculum innovation needs to be designed at the national, regional, and institutional levels, considering their situation. STEM graduates have deficient skills. An innovative approach to STEAM needs to provide more opportunities for critical thinking, communication, logical reasoning, problem-solving, soft and technical skills, creativity, S&T, and innovation. To do so, the HEP should develop the STEAM curricula. STEAM can promote graduate learners to have 21st-century skills and a 21st-century knowledge-based economy, digital economy, advanced and digital technology, and digital literacy and/or skills.

STEAM education for digital infrastructure inclusive education:

Investing in robust physical and digital infrastructure is essential to overcoming barriers to digital inclusion in education, particularly for individuals facing gender, disability, and geographical challenges in rural and remote areas. Such infrastructure underpins the delivery of comprehensive STEAM education by facilitating access to critical resources and fostering digital literacy and skills, which are fundamental to STEAM education. By addressing these infrastructural

needs, the universities can ensure equal educational opportunities, thereby promoting inclusivity and lifelong learning for all.

Rethinking ethical courses and STEAM education for the work environment: STEAM education has the potential to enable graduates to work in online work, gig work, hybrid, and digital, and remote work environments. Thus, ethical courses are paramount for the emerging work environment. New ethical courses, along with STEAM education, can help develop a work culture, work discipline, trust, and integrity, as well as build integrity in an emerging remote and digital working environment.

Modernizing Education for Global Employability

When considering an employable graduate, education should be relevant, of excellent quality and up to date with the latest innovations. Re-skilling, digital skills, technology up-skilling, new skill development, and up-skilling of graduate learners need to be considered in the HEI-industry linkage for the contemporary and future work environment of the digital and gig economy. They must possess innovative technologies and skills to remain competitive in the international labour-market and technology-driven employment. This can help mitigate technological unemployment.

Demand-driven policy, HR planning, and programmes in HEIs

HEIs take the primary responsibility, particularly in ensuring the relevance and quality of their programmes, thus producing graduates with the requisite knowledge, skills, and attitudes. HEIs' policy should be supported, and feedback be collected by involving the stakeholders and beneficiaries of the policy, including learners, practitioners, implementers, graduates, teachers, employers, manufacturers, and industries. To elevate an HR plan for its programme, the government should begin at the elementary school level by identifying learners' needs, ambitions, and inclinations to increase the demand and supply of HR

policy. It should then motivate them to align with its strategic HR plan and create a learning environment accordingly.

Conducting graduate tracer studies

Graduate tracer studies need to be periodic to receive feedback on the effects of the policy on graduates' programmes. There is a need for a Graduate Data Management Information System in each HEI to monitor and evaluate the policy effects and progress.

Ensuring the employability of the graduates

One of the main objectives of HEIs should be to enhance and guarantee the employability of their graduates. This includes providing them with the relevant and necessary skills, considering contemporary needs and implications for future working environments, to thrive and compete in the local and international job markets for the real world of work.

Driving Digital transformation in HEIs:

- IT, IoT, and digitalisation enable learners to reach anywhere at any time, wherever, and whichever course/programme, to increase the enrolment rate with cost-effectiveness and efficiency. ICT provides a more efficient and sustainable enrolment in HEIs.
- Digital education and learning, including e-learning programmes/courses, online education, AI, digital technology, virtual reality, and the IoT, are helpful for lifelong learning, innovative learning technologies, and enhancing quality education and access to education. Hence, HEIs should provide digital education and learning elsewhere accordingly. Digital education and learning need to increase the GER and inclusive education, such as for females, remote and rural areas, and disabled learners,

to enrol in HE regardless of geographic locations, remote areas, and time.

- Digital education and learning not only provide access to education but also can ensure equal access to quality education from qualified and digital resources through digital technology within and beyond the university. Quality education is one of the main problems in Ethiopia, and it is one of the agendas of the SDGs (2030). Digital education and learning in HE offers opportunities for the best visual, auditory, and kinaesthetic learners to ensure quality education and lifelong learning cost-effectively and efficiently.
- Digital education and learning may positively impact graduates' employability through digital marketing, business, technology, and entrepreneurship development over time. This can also assist the graduates to create new jobs, green jobs, and digital skills.
- Teachers must initiate digital skills development programmes, ranging from fundamental digital literacy training to advanced training in digital technologies to do so.
- Since gender disparity in enrolment in HE is very high, digital inclusion education can overcome this issue through digital education and learning.
- Digital infrastructure, digital libraries and virtual digital laboratories can also allow learners to utilise them whenever and wherever.
- The government should commit to providing quality access to the internet and infrastructure like electricity, and access to the internet should consider facilitating digital education, technology, learning, virtual laboratories, and libraries.
- Digital education and learning consider lifelong learning through utilising computer-assisted learning, including computer-assisted individual and group learning with tablet and TV, along with the internet. This can assist in the MDG (2015) education agenda for

all and the SDG (2030) for quality education. Learners have the right to quality education.

- AI should be integrated into the HE sub-sector, necessitating a cohesive framework that incorporates AI and human collaboration in educational policy and guidance. AI maximises educational resources aligned with individual needs and learning styles to enhance the quality of education regardless of geographic location and time. This strategic integration will enhance the quality and accessibility of education within HEIs.
- The integration of the HR domain and AI and/or IT can be one approach for the future work environment. A collaborative model of AI and humans must be considered in strategic planning for HRD.
- Pedagogical, especially andragogical innovations need to integrate AI within curriculum design using AI for automated education, individual needs and learning styles, assessment, and feedback.
- Develop curricula and teaching strategies aligned with individuals' needs and learning styles using an andragogic approach in HEIs.
- Aligning curriculum innovation with emerging trends, industry, and AI technologies

Rethinking entrepreneurial education courses, including innovative technologies, digital entrepreneurship, and technology in the HEIs

To boost the entrepreneurship and self-employment of graduate learners, the HEIs must include entrepreneurial courses, including digital entrepreneurship and technology. Entrepreneurship Education should equip learners with new, digital, and advanced technological skills, green skills, and knowledge of innovative technologies. It is crucial to stay up to date with the latest advancements and prepare future digital entrepreneurs to use them effectively. This can mitigate technological unemployment.

Rethinking the cognitive, affective, and psychomotor to have creativity, critical thinking, physical, and problem-solving skills**:** The course and the curriculum need to be up to date for the learners to have creativity, critical and strategic thinking, physical skills, and problem-solving skills, considering the higher-order levels of domains of cognitive, psychomotor and affective learning. The higher-order domains of affective and psychomotor, especially cognitive learning objectives, are paramount in HEIs.

Shifting HEIs from pedagogy to andragogy

Ethiopian HEIs usually utilise a pedagogical approach and strategic teaching rather than andragogy. Hence, HEIs must recognise the need to shift from a pedagogical to an andragogical approach in their teaching process and curriculum development. Pedagogy is more relevant in primary and secondary school.

8.5.3 Recommendations for Private, Industrial Sectors and Employers

- The private employers and industry should participate in the HE policy in formulating and designing curricula. Employers must be involved in the curriculum, updating courses with their industry's priorities. A needs assessment of the industries, including competence, qualifications, and fields of study, will benefit all stakeholders. Furthermore, they must provide their feedback to the policymakers and decisionmakers, and HEIs as well.
- The private and industry sectors, as employers of graduates of the policy, should assist by providing short-term learners' internships, on-the-job training, graduate training, soft-skills training, and even funding as part of their social responsibility. The industry and public-private sectors, and employers, need to provide job training (specific job-related skills), short-term training courses, and training centre courses in line with their demand and requirements.

- The private and public sectors should provide re-skilling, digital skills training, technology up-skilling, new skill development and up-skilling for the new entrants and recruits to their companies and organisations considering the nature of their work, job design, and specifications.

8.5.4. Recommendation for University-Industry, Labour-Market and School Linkage

- **The university-industry linkage.** The university-industry linkage needs to be collaborative and coordinate working on apprenticeships, traineeships, internships, practicums, and externships for their graduate learners. University-industry must be robust with a collaborative effort on policy and curriculum development, including obtaining feedback from industry/employers' universities must consider the feedback on their programmes.
- Universities and industries should collaborate to share knowledge, work on policies, engage in HRD and R&D, and facilitate technology transfer, development, and advancement to strengthen their partnerships.
- **University-labour-market linkage**. The government and the policy ignored the university-market labour linkage. Therefore, the university-employers of market labour need to establish a labour-market linkage to secure employment opportunities for graduates to mitigate unemployment. The government, university, and policy ignored market labour demand. Hence, the university should have considered market labour demand, access to the database, and information about the market labour demand.
- **School-university linkage**. The school-university linkage needs in terms of education policy, curriculum, relevance and quality education, and STEM versus STEAM programmes.

8.5.5 Recommendation to Key Stakeholders

- All the stakeholders need to participate in the policy formulation and curriculum design of HEIs. The Other stakeholders in education, under normal circumstances, take responsibility for the quality of education and the employability of the graduates.
- The stakeholders should provide financial support, training for entrepreneurship, and up-skilling development for graduates who have a feasible proposal.

8.6 Future Research

Future research needs to prepare for future developments of the policy. This research opens new research questions and models for future research work**.**

- Future research is needed for each macro and micro policy by each economic sector to address relevant HRs in terms of national and sector-wise supply and demand forecasting models. National and regional clusters of HR performance and regional comparative analysis need further study.
- This research has raised questions in need of further study on S&T versus SSs, STEAM versus STEM, and STEM versus AHSS and its implications for HRD, innovation, technology, social, cultural, democratic, political, and economic development, which need further study.
- Low enrolment of females in HEI, in general, and in STEM in particular, which needs a gender-specific STEAM intervention study.
- Future studies need to target the impact of the macro and micro policies on supplying HRs by HEIs for each socio-economic/economic sector. The policy's impact on the HR market

in disparate industries and the graduates' employability need further study.

- Lack of skilled labour, automation risks, technology replacing and reducing labour, and high unemployment at an alarming rate are the challenges facing today's Ethiopia. Semi-skilled and low-skilled graduates and the inept will face an elevated risk of youth unemployment due to employers' preference for technology, AI and machines in HR. New research questions, models, approaches, and ideologies are required**.**
- Future studies need to be on the effect and impact of the policy on economic sectors and socio-economic and employability of the graduates in terms of long-term, direct and indirect, the intended and unintended impacts of the policy.
- The problem that requires further investigation is the brain drain of graduates, particularly postgraduate graduates.
- Longitudinal study on policy relevance and quality education of primary→ secondary university STEM versus STEAM readnes→effect on HRD and impact on economic development
- The role of the government in HE development in line with appropriate ideology, policy, programme, and strategic planning and implementation needs future study.

8.7 Conclusion

The thesis demonstrates that Ethiopia's 70:30 S&T policy failed to achieve its industrial goals. This is attributable to severe execution gaps, rapid university expansion without proper resources, and low student readiness. Furthermore, weak university-industry linkages, rigid field assignments, and a lack of monitoring have driven high graduate underemployment. In addition, neglecting social sciences has hindered holistic innovation. This study introduces a Demand-Driven Alignment model.

In line with the developmental state framework, 70% of learners studying S&T were intended to enhance education and employment opportunities aligned with the country's industrialization and manufacturing initiatives through HRD; however, these plans have not yet been realized. The developmental state's 70:30 policy failed to supply skilled human resources for the industrial and manufacturing sectors—a finding consistent with previous literature that in showed (e.g., Oqubay, 2016; Woldegiorgis, 2015; Yigezu, 2013)—and failed to address job insecurity for S&T graduates. The issue lies not only with the developmental state model in Ethiopia, but also with poor implementation, chronic resource deficits, limited university capacity, and inadequate S&T systems and institutions, as well as a mismatch between students' interests and their assigned fields of study. These findings align with prior studies (e.g., Nega, 2009; Asgedom, 2009; Shebeshi et al., 2009; Leka, 2009; Woldetensae, 2009; Kahsay, 2012; Geda, 2014). Additional issues include a lack of investment in quality education, underdeveloped university-industry and labour-market linkages, political instability, and weak industrial demand. While the policy emphasis on S&T is, in principle, appropriate and timely, the quality of education has been severely compromised by rapid expansion without adequate inputs or institutional capacity—a challenge underscored by early evaluations of the policy (e.g., Nega, 2009; Asgedom, 2009; Shebeshi et al., 2009; Leka, 2009; Woldetensae, 2009).

Structural bottlenecks in the policy process follow a clear sequence: policy irrelevance leads to misalignment with learner and market demands, which, combined with resource deficits, results in poor educational execution and low-quality graduates. This ultimately restricts industrial growth and increases the risks of graduate underemployment and economic stagnation.

Although the policy’s goal and its intended outcomes aimed to promote industrial development through S&T human resources, the implementation has significantly affected results, as corroborated by several studies (e.g., Shebeshi et al., 2009; Semela, 2011; Kahsay, 2012; Geda, 2014; Stoker, 2017). Key

impacts include the inability of growing industries to absorb graduates and low employability skills among graduates, which undermines national human capital. The policy lacks a formal process and evidence-based policymaking, particularly regarding M&E. Specifically, it has no ex-ante or ex-post evaluation studies or analyses related to HR planning, demand, and supply forecasting. Graduates, especially those in STEM fields, often lack crucial technical and soft skills needed for 21st-century industry, underscoring arguments for integrating S&T/STEM with SS/AHSS to form a unified STEAM curriculum for inclusive education and innovation. Both learners and graduates display a frail foundation in mathematics and science in school, and in general, S&T/STEM in the HEIs. Unmotivated students are admitted to S&T, which has negative implications for their academic performance (Leka, 2009; Shebeshi et al., 2009; Kahsay, 2012). Furthermore, national higher education entrance examination results indicate that over 50% of public university entrants fail to achieve the 50% passing standard. This reflects inadequate foundational preparation in S&T subjects and low performance on national assessments, confirming earlier findings (e.g., Leka, 2009; Shebeshi et al., 2009; Kahsay, 2012; Geda, 2014; Belay et al., 2016). Female students display lower average entrance exam scores than male students upon admission to HEIs, which aligns with Chalchesa's (2012) findings.

There is not only a mismatch between student preferences and labour-market demands, and a mismatch between HEIs' supply and the targets of government policy, but also a disparity between HEIs' HR supply and demand across various economic sectors, reflecting a structural disequilibrium in the law of supply and demand for human resources. Hence, both the policy and curricula require improvement. The curriculum should focus on andragogy in HEIs and pedagogy in schools. The 70:30 policy was not evaluated prior to implementation; as a result, curricula remain disconnected from market and industry needs. Addressing this requires workforce planning models that balance local socio-economic realities with educational quality to improve graduate employability—a conclusion supported by Olkaba (2019). Significant concerns remain regarding

E&T capacity, program relevance, and graduate employability (e.g., Shebeshi et al., 2009; Kahsay, 2012; Geda, 2014). The quality and relevance of programmes are among the challenges of agricultural education, as noted by Belay (2008) and Abraha (2015). These findings align with Olkaba (2019), who demonstrated that Ethiopian higher education failed to align university missions with policy-driven, agriculture-led industrialization. Consequently, curricula have failed to prepare graduates for rural development challenges or labour-market realities (Belay, 2008). Macro and micro policies lack the alignment necessary to supply qualified human resources across different economic sectors. These findings echo Olkaba (2019), who observed that the rigid 70:30 allocation produced severe labour-market mismatches. There is a persistent gap between supply and demand in the labour market, resulting in low graduate employability (Semela, 2011; Olkaba, 2019). Furthermore, the rigid admission policy directly contradicts actual labour-market demands. Ethiopia continues to face a scarcity of skilled and experienced labour, which remains a major bottleneck for agricultural development (Belay, 2008). In general, the decline in educational quality across Ethiopian higher education is widely documented in recent literature (e.g., Nega, 2009; Woldetensae, 2009; Shebeshi et al., 2009; Asgedom, 2009; Leka, 2009; Semela, 2011; Ashcroft & Rayner, 2011; Kahsay, 2012; Abebe, 2014; Woldegiorgis, 2015; Belay et al., 2016; Molla & Cuthbert, 2016; MoE, 2017; Olkaba, 2019). The findings of this thesis reinforce the literature showing that poor instructional quality devalues national HRD contributions to S&T and innovation.

GER is a key indicator of development; however, Ethiopia maintains one of the lowest tertiary GERs globally. These findings align with multiple studies (e.g., Loukeris, 2005; Yizengaw, 2005; UNESCO, 2009; Yigezu, 2013; MoE, 2017; World Bank & UNESCO, 2025), underscoring ongoing socio-economic development challenges. Ethiopia is the second most populous country in Africa, with a young population, but its GER in HE remains very low. Progress reached only 10.4% in 2018 against a 22% target, indicating that national goals to achieve lower-middle-income status through expanded tertiary access remain unfulfilled.

Without a skilled workforce, achieving long-term economic transformation remains difficult. The 70:30 policy and HEIs have struggled to facilitate the structural shift from agriculture to industry, constrained by political instability, civil conflict, and institutional disruptions. While human capital is the primary driver of economic growth, especially S&T in a dynamic economy, the country's GER remains among the lowest, which has significant implications for HRD, HCT, HDI, innovation systems, and the knowledge economy. There is a clear link between human capital and economic growth. Although the policy has potential implications for S&T, the tech industry, technological development, and transfer, a lack of proper implementation and social innovation presents a challenge to achieving desired outcomes. STEM alone is insufficient for innovation. According to MOE strategic plans (MoE, 2017, 2019), the government aimed to adjust enrolment ratios to 55% S&T and 45% SS and business fields by 2030. However, this adjustment was planned without comprehensive baseline studies across educational levels, and macro-level policies still lack clear integration between STEM and non-STEM fields.

Today, natural resources and capital are passive, while HR—especially in S&T and innovation—serve as active primary engines for a modern economy and sustainable development. However, many graduates lack essential S&T skillsets. Rapid technological advances, such as AI and automation, have significant implications for future HR, including the risk of displacement, high unemployment, and the need to rethink HRD strategies. The lack of policy relevance, inadequate quality education, inefficient resource use, and ineffective policy implementation devalue national human resources and compound broader economic and political challenges. This situation causes a decline in the value of national HRD, resulting in inefficient HR that hampers economic growth. The study's findings highlight policy inefficiencies that perpetuate unemployment, underemployment, and low-skilled labour, adversely affecting the country's economic development.

This thesis proposes a new alignment approach known as Demand-Driven Alignment of HE, which includes demand-driven educational policies aligned with

an innovative STEAM curriculum, emphasising learner-driven fields of study, employer-driven skills priorities based on labour-market and industry demands, and government HR planning. This alignment requires establishing structural linkages across universities, lower-level schools, industry, the labour market, and national development plans. This approach supports inclusive education, innovation in HRD, and sustainable development. Socio-economic growth requires both technological and social innovation, which in turn demands interdisciplinary and multidisciplinary ecosystem approaches. The government has primarily focused on S&T/STEM without providing structural education at the lower school levels and has underestimated SS/AHSS, resulting in a lack of inclusive innovation, education, business, social development, democracy, and governance, despite these areas being part of the ecosystem. Consequently, integrating S&T, SS, and arts into a STEAM curriculum fosters inclusive innovation and education. The findings aim to guide policymakers at both macro and micro levels, considering specific fields of study, student preferences and talents, assessment performance, and employability skills—especially in the 21st-century industry—which are critical factors for effective graduate employment, career advancement, and skill and talent development

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Annexes

Annexture 1: Quantitative and qualitative data collection

1. Quantitative-Existing statistics data and/or report collection

The main purpose of this quantitative method is to determine the implication of the 70/30 policy for development in Ethiopia by collecting and analysing the existing statistical data and conducting a comprehensive analysis of the effects of the policy on HRD and its implicatins for development in Ethiopia. The 70/30 policy document/programmemes and report shall be collected and analysed in terms of students' enrolment growth, graduation completion, the performance of students and gender disaggregate. Moreover, the research studies carried out, employment opportunities of graduates, research, and community services of HEIs will be collected and analysed. These documents will be collected from MoE, NEAEA, ESAA, EMIS, and HEIs.

1. Title of the document----------
   ----
2. Type of the documents to be collected (including the policy and programmemes 70:30 documents, Tracer studies of HEIs, Alumni studies of MoE and ESC, and research carried out in the HEIs)._____
3. Year of production----------
4. Author/Institute ----------
5. Purpose of producing the document (depict briefly)----------
   ----

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6. Sources of evidence (depict briefly)----------

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7. Collecting the quantitative data (including the students' enrolment growth, graduate's completion rate, gender disaggregate, placement and enrolment for each discipline and students' choices of fields of study and grade 12 national exam (entrance exam) of students, quality of students and graduates).

2. Collecting the books, research carried out; tracer and alumni studies;

The main purpose of the qualitative method is to supplement the quantitative methods by reviewing and analysing the 70:30 policy document/programme. This document including the alumni and tracers studies can be collected from MoE and HEIs. Relevant research studies, GTP, ESDP, policy documents, and programmemes related to 70:30 shall be collected and analysed. Books and Journals will collect from different sources like library, electronic and website

Title of the document----------
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1. Type of the document (tick as appropriate): The alumni and tracers studies, a. Book b. Journal c. Research manuscript d. Policy document e. Planning document f. Evaluation report g. Performance report h. Proceedings i. MA thesis j. Doctorates thesis, k. Other (specify)----------
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   ---
2. Year of production----------
   -
3. Author/Institute ----------
   -
4. Purpose of producing the document (depict briefly)----------
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5. Sources of evidence (depict briefly)----------
   -

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6. Reviewing and analysing the major documents of 70:30 (write briefly by demonstrating the gaps of 70:30 policy and programmemewith the six micro policies)----------
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7. Major recommendations of the document (by demonstrating the gaps) ---
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8. Understanding what are the critical gaps of 70:30 policy----------
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9. Understand the relevance, outcome, and employability of graduates of 70:30 policy in Ethiopia:

Annexture 2: Key Informant Interview Guide

Background

As you may be aware of the fact that one of the main concerns of the Ethiopian Government is 70:30 higher education policy new reforms to accelerate national development. The macro policy of 70:30 have further micro policy and/or disciplines that are (1) 40% students are placed into E&T, (2) 20% students are placed into NCS, (3) 5% students are placed into MHS, *5%* students are placed *into ANRS,* (5) 20% students are placed into B&E, and (6) 10% students are placed into SHS in each year. Your response will be assistful to us in determining the implication of the 70/30 policy on development issues in Ethiopia. By considering you as one of the major stakeholders, we would request you to kindly respond to the following issues/questions, as widely as you can.

The purpose of the study is to analyse the policy of 70:30 and investigate its effect on HRD and its implications for development in Ethiopia.

General Information

1 Name of Institution represented_____
2 Sex _____
3 Education level _____
4 Profession/Field of Study_____
5 Position of the respondent in the organisation/institution_____

Interview Questions

1. How do you observe the relevance of 70:30 policy for HRD in Ethiopia?

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2. How do you provide details on the possible implications of the policy of 70:30 for development in Ethiopia?
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3. How do you observe the supply and demand of HRD in your sector/Professional discipline? Is it over or under and/or at equilibrium (balanced)? ----------
   Please provide details

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4. What do you think is the effect of the policy of 70:30 (in terms of success and failure of the policy)?

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5. How do you observe the quality, skills, professionalism, and employment of the graduates in your sector/profession?

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6. How do you explain the implementation of the policy of 70:30?

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.....Do you think that the new policy of 70:30 formulating process and its decision-making was based on evidence and/or research and participation of key stakeholders? (in terms of the feasibility study, assessment on its implementation, stakeholders and professional involvements in the policy, etc.)

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8. What major gaps of 70:30 are witnessed and observed in your sector?

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9. What would you suggest to the Ethiopian Government and/or MoE to improve the 70:30 policy? (specific to Governmental bodies at Federal)

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10. What recommendations would you have for the 70:30 policy and its implication for development? (specific to HEIs)

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(Thank you very much)

Table 26: Sample taken of Key Informant Interviews (KIIs)

Stakeholders	Participants	# Interviewees
FMoA	Minister level &/or relevant professional & human resources	
FMoH	Minister level &/or relevant professional & human resources	
FMoS&T	Minister level & /or human resource unit	
FMIT	Ministry level &/or human resources unit	
1st Generation (Mekelle & Jima University), 2nd (Axum, Debrebirhan & MedaWolabo University) & 3rd (Debretabor & Addis Ababa S&T University)	College of E&T	
	College of NCS	
	College of MHS	
	College of ANRSs	
	College of B&E	
	College of SHS	
Industrial sector	University-Industry linkage directorates	

Stakeholders	Participants	# Interviewees
	Industrial Development Corporation	
Policy Study Institute	Ethiopian Development Research Institute (EDRI)	
	Policy study Institute(PSI)	
	Educational Research Institute	
	Agricultural Research Institute	
	Central Statistical Agency	
Professional Associations	Association of Public Health	
	Association of Engineering	
	Association of Economics	
	Association of Agriculture	
	Mathematics association	
	Anthropology & sociology association	
	Humanity and language	
	Statistical Association	
	Educational Research Association	
Total		

Annexture 3: SPSS output

Table 27: Nationally Set Annual Intake Target for macro and micro policies with fields of study

	Band/Core Discipline	% share of the field of study	Total % share of the Discipline	Total share of 70% and 30%
1	Engineering and Technology	100%		
	· Civil Engineering			
	· Construction technology and Management			
	· Drafting and Surveying technology	40%		
	· Computer Science			
	· Information technology			
	· Informatics and Information sciences			
	· Electronics & communication engineering		40%	
	· Electrical engineering	25%		
	· Chemical and material engineering			
	· Mechanical engineering and machine			
	· Industrial engineering and technology	15%		
	· Water technology and management			
	· Water resources engineering			70%
	· Ground water and hydraulics engineering	10%		
	· Architecture and urban planning	7%		
	· Textile and leather technology	3%		
2	Natural and computational sciences	100%		
	· Biology and chemistry	40%		
	· Mathematics and computational sciences (Stati	30%		
	· Physics			
	· Earth science and geology	20%		
	· Environmental sciences		20%	
	· Health and physical education	5%		
	· Meteorology	3%		
	· Archeology			
	· Paleontology			
	· Biodiversity	2%		
3	Medicine and Health Sciences	100%		
	· Medicine	40%	5%	
	· Public Health, Nursing and Lab technology	30%		
	· Pharmacy	30%		
4	Agricultural and Natural Sciences	100%		
	· Vt. Medicine; range management, and postural	30%		
	· Irrigation agronomy and engineering; horticultu	25%		
	· Plant and Animal Science; and food sciences an	20%	5%	
	· Rural development, cooperatives & marketing;	12%		
	· Forest and natural resources development, pro	8%		
	· Dry-land agriculture; Fisheries, water bodies an	5%		
5	Business Economics	100%		30%
	· Economics; business management and administ	35%		
	· Accounting; banking and finance	30%	20%	
	· Marketing management; (eco) tourism and hot	25%		
	· Procurement and sales management; secretaria	10%		
6	Social Sciences and Humanities	100%		
	· LAW; English language; geography and environ	35%		
	· Ethiopian Languages; History and Civics; Journal	35%		
	· Music, fine arts and design; theatrical arts	9%	10%	
	· Linguistics; PSIR and ethics, gender and develo	9%		
	· Pedagogical sciences; educational planning and	7%		
	· Heritage conservation; library and information	5%		
	Annual converted Intake Grand Totals	100%	100%	

Table 28: Government Academic Staff by Qualification, Sex, Citizenship and micro policy in 2014/15

Year	Qualification	Sex	E&T(%)	NCS(%)	MPH(%)	ANRS (%)	B&E(%)	SHS(%)	S&T(%)	SS(%)
		Male	90.0	83.7	83.5	80.7	84.6	82.8	87.5	83.5
	Bachlor	Female	10.0	16.3	16.5	19.3	15.4	17.2	12.5	16.5
		Male	94.0	93.8	86.4	89.5	91.5	89.9	91.1	90.4
	Masters	Female	6.0	6.2	13.6	10.5	8.5	10.1	8.9	9.6
		Male	95.5	94.6	88.7	94.2	92.9	92.1	93.7	92.3
	PhD	female	4.5	5.4	11.3	5.8	7.1	7.9	6.3	7.7
		male	100.0	0.0	0.0	100.0	100.0	0.0	100.0	100.0
2014/15	Others	femalle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Male	87.4	75.1	80.0	73.3	75.5	79.5	83.9	78.1
	Bachlor	Female	12.6	24.9	20.0	26.7	24.5	20.5	16.1	21.9
		Male	91.2	93.1	84.2	88.7	88.7	89.7	89.2	89.3
	Masters	Female	8.8	6.9	15.8	11.3	11.3	10.3	10.8	10.7
		Male	95.5	93.8	89.5	89.0	91.7	91.8	92.4	91.8
	PhD	female	4.5	6.2	10.5	11.0	8.3	8.2	7.6	8.2
		male	0.0	100.0	90.1	100.0	94.1	87.5	90.4	92.9
	Speciality & up-speciality	female	0.0	0.0	9.9	0.0	5.9	12.5	9.6	7.1
		male	90.0	100.0	87.0	71.4	87.0	0.0	83.3	87.0
	Others	female	10.0	0.0	13.0	28.6	13.0	0.0	16.7	13.0
2015/16		Male	85.0	73.0	78.4	68.6	77.0	76.7	81.3	76.8
	Bachlor	Female	15.0	27.0	21.6	31.4	23.0	23.3	18.7	23.2
		Male	90.4	91.7	84.1	87.6	87.9	88.3	88.4	88.2
	Masters	Female	9.6	8.3	15.9	12.4	12.1	11.7	11.6	11.8
		Male	93.2	93.6	89.5	91.6	92.7	90.0	92.4	90.9
	PhD	female	6.8	6.4	10.5	8.4	7.3	10.0	7.6	9.1
		male	96.3	100.0	89.0	100.0	0.0	100.0	90.4	100.0
	Speciality & up-speciality	female	3.7	0.0	11.0	0.0	0.0	0.0	9.6	0.0
		male	72.7	100.0	77.3	81.8	94.7	68.2	78.4	73.1
2016/17	Others	female	27.3	0.0	22.7	18.2	5.3	31.8	21.6	26.9

Sources: MoE, EMIS, ESAA, 2016/17

Table 29: Demographic Characteristics of the interviewees

Gender			Qualification			Fields of Study			Position		
	No.	**%**		**No**	**%**		**NO.**	**%**		**No.**	**%**
Male	29	76.3	PhD	11	30.0	E&T	8	21.0	Dean	4	10.5
Female	9	23.7	Masters	23	605	NCS	5	13.1	HR	10	26.3
			Bachelor	4	10.5	MHS	5	13.1	dep't head	4	10.5
						ANRS	4	10.5	Director	4	10.5
						B&E	6	15.8	Consultant	3	7.9
						SHS	7	18.4	Researcher	4	7.9
						No Answer	3	7.9	Lecturer	5	13.1
									others	4	10.5
Total	**38**	**100**		**38**	**100**		**38**	**100**		**38**	**100**

Table 30: Axum University tracer study on micro policies undergraduate graduates of 2017 effect employment and/or unemployment

Micro Policies/Programmes	Unemployed	Employed
MHS	21.1%	78.9%
ANRS	44.4%	55.6%
B&E	50.0%	50.0%
E&T	49.5%	50.5%
NCS	37.7%	62.3%
SHS	48.8%	51.2%
Total	**41.9%**	**58.1%**

Source, Axum University, 2017

Table 31: Students' results of NEAEA based on gender and bands/micro policies.

The National admitted to Government University by gender, bands and greater than 350 and less than 350

Entry Year (E.C)	Gender Admitted to Government				Band																																					
	Male		Female		Band 1(Engineering and Technology)						Band 2(Natural and Compu tional						Band 3(Medicine and Health						Band 4(Agricultural and Natural						Band 5(Business and Economics)						Band 6(Social Sciences and								
	≥ 350	< 350	≥ 350	< 350	≥ 350			< 350			≥ 350			< 350			≥ 350			< 350			≥ 350			< 350			≥ 350			< 350			≥ 350			< 350					
					M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T			
2005	29882	30496	12864	21220	13723	4331	18054	12988	7361	20349	1784	486	2270	8235	6530	14765	4860	1712	6572	7	7	14	4332	1430	5762	821	538	1359	4116	1361	5477	4380	2768	7148	1067	3544	4611	4065	4016	8081		
2006	43367	20759	17245	21744	22798	8424	31222	6377	4399	10776	2084	997	3081	3613	7520	11133	5597	2514	8111	0	0	0	4609	2642	7251	1409	1444	2853	5916	1856	7772	4396	2949	7345	2363	813	3176	4964	5432	10396		
2007	39275	31018	15562	28899	18767	7881	26648	9320	10382	19702	6594	944	7538	5079	2752	7831	4548	3287	7835	0	0	0	2442	1109	3551	3233	3556	6789	5599	1798	7397	3246	7479	10725	1325	543	1868	10140	4730	14870		
2008	59407	9884	30951	20122	32127	13887	46014	0	2	2	2413	1607	4020	2483	9451	11934	5612	3548	9160	0	0	0	5534	4839	10373	1155	992	2147	11950	6069	18019	414	346	760	1771	1001	2772	5832	9331	15163		
2009	0	0	0	0			0	0	0	0			0			0			0			0		0	0	0	0			0	0	0	0			0			0			
2010	0	0	0	0			0			0			0			0			0			0		0			0			0			0			0			0			
Total	171931	92157	76623	91985	87415	34523	121938	28685	22144	50829	12875	4034	16909	19410	26253	45663	20617	11061	31678	7	7	14	16917	10020	26937	6618	6530	13148	27581	11084	38665	12436	13542	25978	6526	5901	12427	25001	23509	48510		

Source: NEAEA, 2017 and Author's compution

Table 32: Diagnostic test for collinearity and autocorrelation

Variables	Collinearity diagnostic test					Autocorrelation diagnostic test	
	Beta	T	Sig.	Tolerance	VIF	Durbin-Watson d-test	Sig.
E&T	.035	.191	.852	.039	25.767	2.467	.000
NCS	.220	2.783	.018	.126	7.963		
MHS	.378	.993	.135	.253	8.135		
ANRS	.321	3.335	.007	.072	13.887		
B&E	.051	.463	.652	.110	9.098		
SHS	.289	4.994	.000	.123	8.135		

Source:MoE, 2003/04-2016/17, & Author's computation using SPSS version 24

Table 33: Models of time series of the macro and micro policies undergraduate effect on enrolment and graduate

Macro policies Variables	Model Type		Remark
S&T undergraduate enrolment	ARIMA (0,1,0)	Random walk	Non-Stationary
SS undergraduate enrolment	Holt(AR) or ARIMA(0,0,0)	Exponential smoothing	Stationary
E&T undergraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
NCS undergraduate enrolment	Holt or AR (0,0,0)	Exponential smoothing	Stationary
MHS undergraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
ANDERS undergraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
B&E undergraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
SHS undergraduate enrolment	Holt or ARIMA (0,0,0)	Exponential smoothing	Stationary
S&T postgraduate enrolment	Brown(MA) or ARIMA (0,0,1)	Exponential smoothing	Stationary
SS postgraduate enrolment	Brown(MA) or ARIMA (0, 0,1)	Exponential smoothing	Stationary
E&T postgraduate enrolment	Brown or ARIMA(0,0,1)	Exponential smoothing	Stationary
NCS postgraduate enrolment	Brown or ARIMA(0,0,1)	Exponential smoothing	Stationary
MHS postgraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
ANRS postgraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
B&E postgraduate enrolment	Brown or ARIMA(0,0,1)	Exponential smoothing	Stationary
SHS postgraduate enrolment	ARIMA(0,1,0)	Random walk	Non-Stationary
S&T undergraduate graduate	Brown or ARIMA)(0,0,1)	Exponential smoothing	Stationary

SS undergraduate graduate	Holt or MRIMA(0,0,0)	Exponential smoothing	Stationary
E&T undergraduate graduate	Brown or ARIMA(0,0,1)	Exponential smoothing	Stationary
NCS undergraduate graduate	Holt or ARIMA(0,0,0)	Exponential smoothing	Stationary
MHS undergraduate graduate	Holt or ARIMA(0,0,0)	Exponential smoothing	Stationary
ANRS undergraduate graduate	Holt or ARIMA(0,0,0)	Exponential smoothing	Stationary
B&E undergraduate graduate	Holt or ARIMA(0,0,0)	Exponential smoothing	Stationary
SHS undergraduate graduate	Holt or ARIMA(0,0,0)	Exponential smoothing	Stationary
S&T postgraduate graduate	*Holt* or ARIMA (0,0,0)	Exponential smoothing	Stationary
SS postgraduate graduate	*Brown or ARIMA(0,0,1)*	Exponential smoothing	Stationary
E&T postgraduate graduate	*ARIMA (0,1,0)*	Random walk	*Nonstationary*
NCS postgraduate graduate	*Holt or* ARIMA(0,0,0)	Exponential smoothing	*Stationary*
MHS postgraduate graduate	*Holt or* ARIMA(0,0,0)	Exponential smoothing	*Stationary*
ANRS postgraduate graduate	*ARIMA (0,1,0)*	Random walk	*Nonstationary*
B&E postgraduate graduate	*Brown or ARIMA(0,0,1)*	Exponential smoothing	*Stationary*
SHS postgraduate graduate	*Brown or ARIMA(0,0,1)*	Exponential smoothing	*Stationary*

Sources data: MoE, 2003/04-2016/17, & Author's computation using SPSS version 24

Table 34: parameter of macro and micro policies effect on enrolment and graduate.

Variable	***Parameters***	***Estimate***	***SE***	***T***	***Sig***
SS undergraduate enrolment.	*Alphas(Level)*	*.001*	*.292*	*.003*	*.997*
	Gamma(Trend)	*.000*	*105.639*	*4.334E-6*	*1.000*
S&T undergraduate enrolment	Constant	29243.154	10167.637	2.876	.014
	Difference	1			
NCS undergraduate enrolment	Alpha (Level)	.098	.177	.557	.588
	Gamma (Trend)	9.389E-6	.255	3.686E-5	1.000
SHS undergraduate enrolment	Alpha (Level)	.098	.121	.813	.432
	Gamma (Trend)	2.943E-5	.144	.000	1.000
E&Tundergraduate enrolment	Constant	15128.846	6049.087	2.501	.028
	Difference	1			
MHSundergraduate enrolment	Constant	4248.769	1685.153	2.521	.027
	Difference	1			
ANRS undergraduate enrolment	Constant	2963.692	1424.149	2.081	.060
	Difference	1			
B&E undergraduate enrolment	Constant	8679.538	4470.173	1.942	.076
	Difference	1			

S&T postgraduate effect	Alpha (Level & Trend)	1.000	.168	5.964	.000
SS postgraduate effect	Alpha (Level & Trend)	.982	.140	7.033	.000
E&Tpostgraduate enrolment	Alpha (Level & Trend)	.580	.159	3.660	.003
NCS postgraduate enrolment	Alpha (Level & Trend)	1.000	.141	7.096	.000
B&E postgraduate enrolment	Alpha (Level & Trend)	.953	.139	6.861	.000
ANRS postgraduate enrolment	Constant	396.077	185.574	2.134	.072
	Difference	1			
MPH postgraduate enrolment	Constant	531.846	147.512	3.605	.004
	Difference	1			
SHS postgraduate enrolment	Constant	1584.308	767.492	2.064	.062
	Difference	1			
S&T undergraduate graduate	Alpha(Level & Trend)	.499	.121	4.132	.001
SS undergraduate graduate	Alpha(Level)	.001	.287	.003	.997
	Gamma(Trend)	.000	137.909	1.951E-6	1.000
E&T undergraduate graduate	Alpha (Level & Trend)	.575	.126	4.552	.001
NCS undergraduate graduate	Alpha (Level)	.098	.127	.773	.455
	Gamma (Trend)	1.317E-6	.154	8.565E-6	1.000
MPH undergraduate graduate	Alpha (Level)	.128	.122	1.057	.311
	Gamma (Trend)	5.889E-6	.073	8.026E-5	1.000
ANRS undergraduate graduate	Alpha (Level)	.120	.101	1.189	.258
	Gamma (Trend)	3.332E-8	.070	4.792E-7	1.000
B&E undergraduate graduate	Alpha (Level)	.100	.099	1.001	.337
	Gamma (Trend)	2.268E-5	.114	.000	1.000
SHS undergraduate graduate	Alpha (Level)	.100	.101	.990	.342
	Gamma (Trend)	5.235E-6	.120	4.358E-5	1.000
Variables	Parameters	Estimate	SE	T	Sig.
S&T postgraduate graduate	Alpha(Level)	.181	.306	.592	.565
	Gamma(Trend)	5.688E-7	.070	8.152E-6	1.000
SS postgraduate graduate	Alpha(level and Trend)	1.000	.225	4.439	.001
NCS postgraduate graduate	Alpha (Level)	.179	.285	.627	.542
	Gamma (Trend)	1.598E-7	.070	2.270-E6	1.000
MHS postgraduate graduate	Alpha (Level)	.100	.110	.907	.382
	Gamma (Trend)	4.663E-5	.137	.000	1.000

	B&E postgraduate graduate	Alpha (Level)	.604	.170	3.559	.003
	SHS postgraduate graduate	Alpha (Level & Trend)	1.000	.220	4.537	.001
	E&T postgraduate graduate	Constant	178.923	124.343	1.439	.176
		Difference	1			
	ANRS postgraduate graduate	Constant	108.846	58.350	1.865	.087
		Difference	1			

Sources data: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation using SPSS version

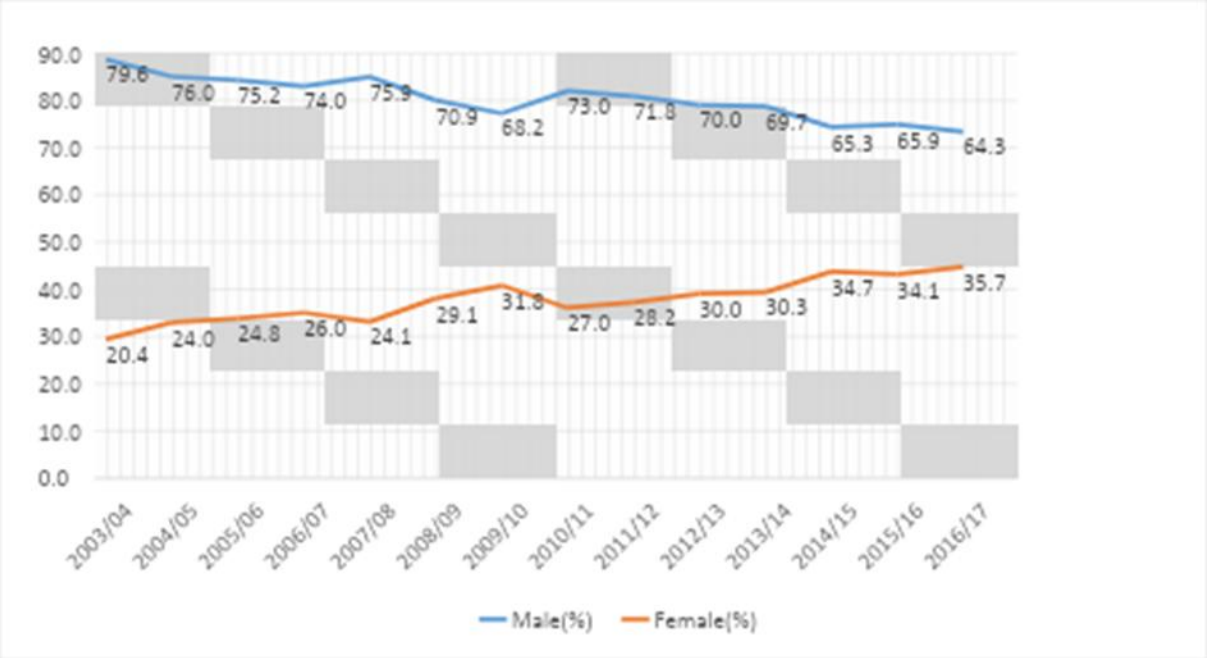


Figure 30 percentage of Postgraduate enrolment both public & private University by gender

Source data: MoE, ESAA and/or EMIS, 2003/04-2016/17 and Author's computation

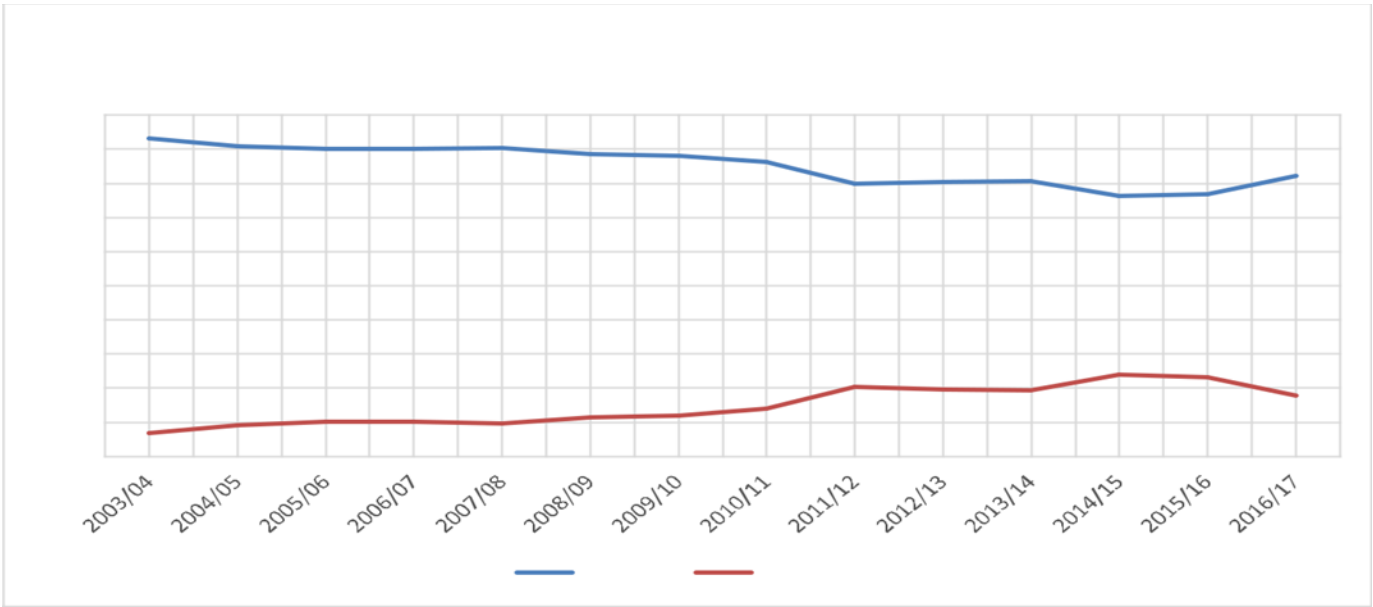


Figure 31 percentage of undergraduate enrolment both public & private University by gender

Source data: MoE, ESAA and/or EMIS, 2003/04-2016/17 and Author's computation

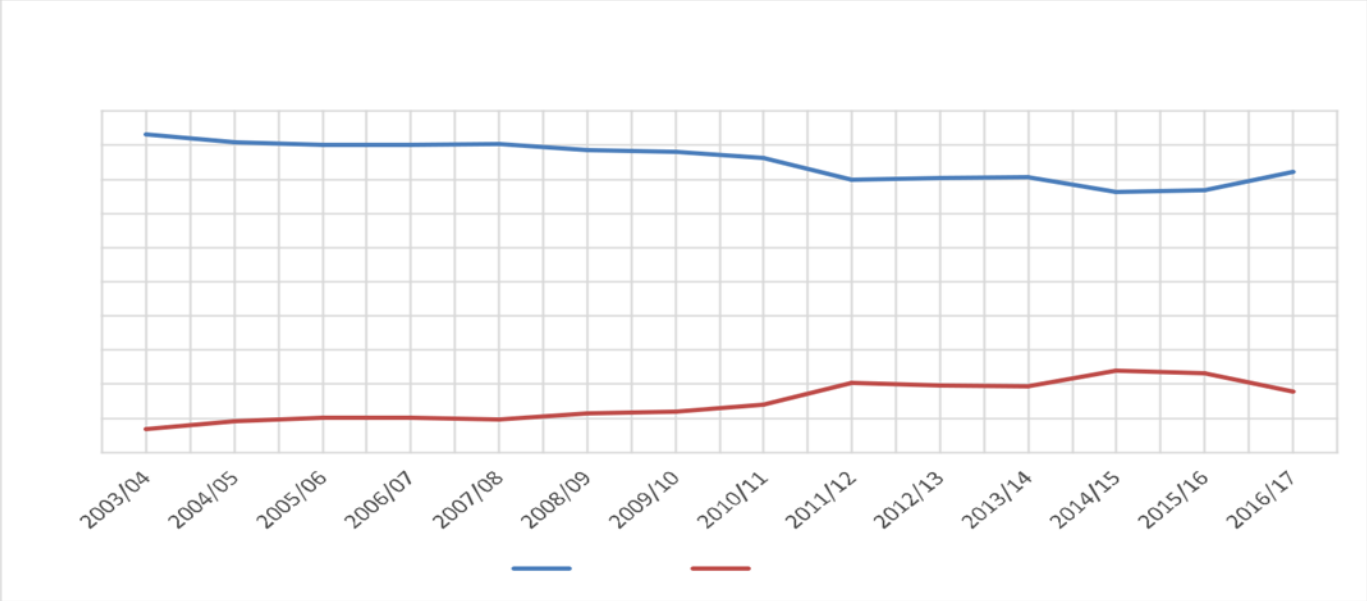


Figure 32 long-term trends percentage of postgraduate enrolment in Government and Non- Government universities by gender

Source data: MoE, ESAA and/or EMIS, 2003/04-2016/17 and Author's computation

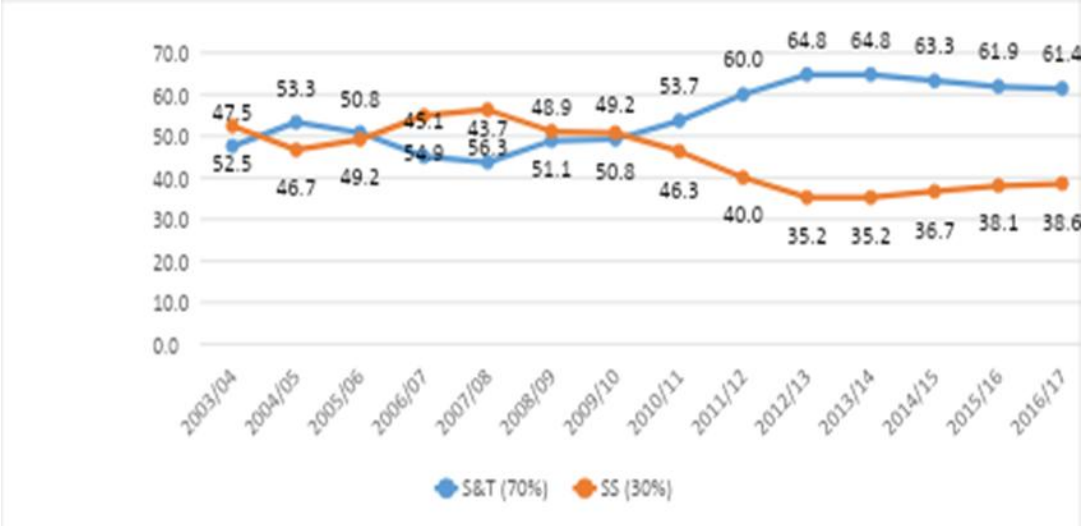


Figure 33: Percentage of Undergraduate Enrolment in Government-University by S&T and SS
Source: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation

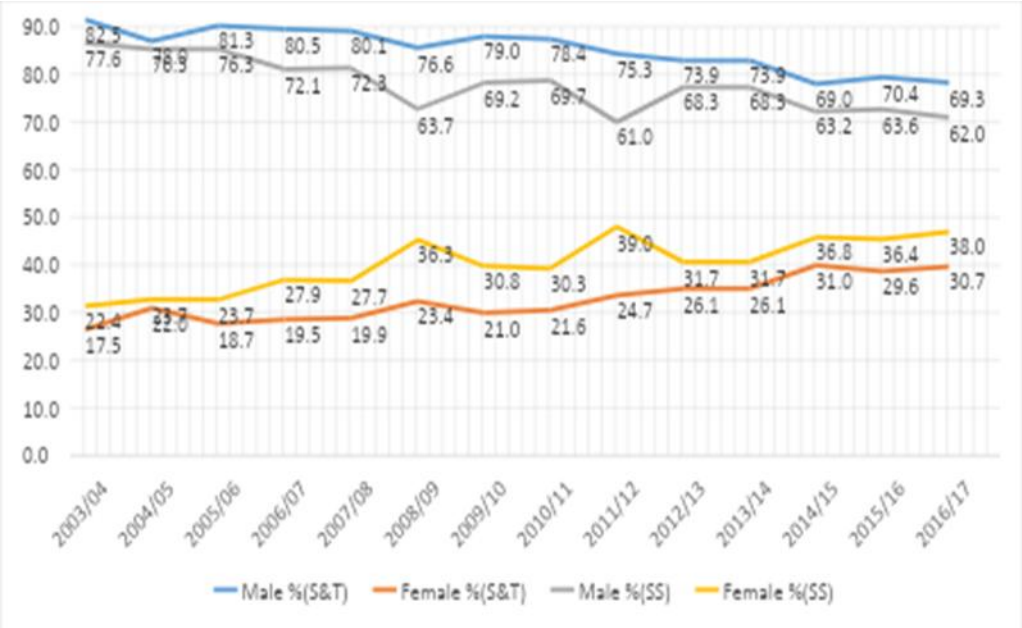
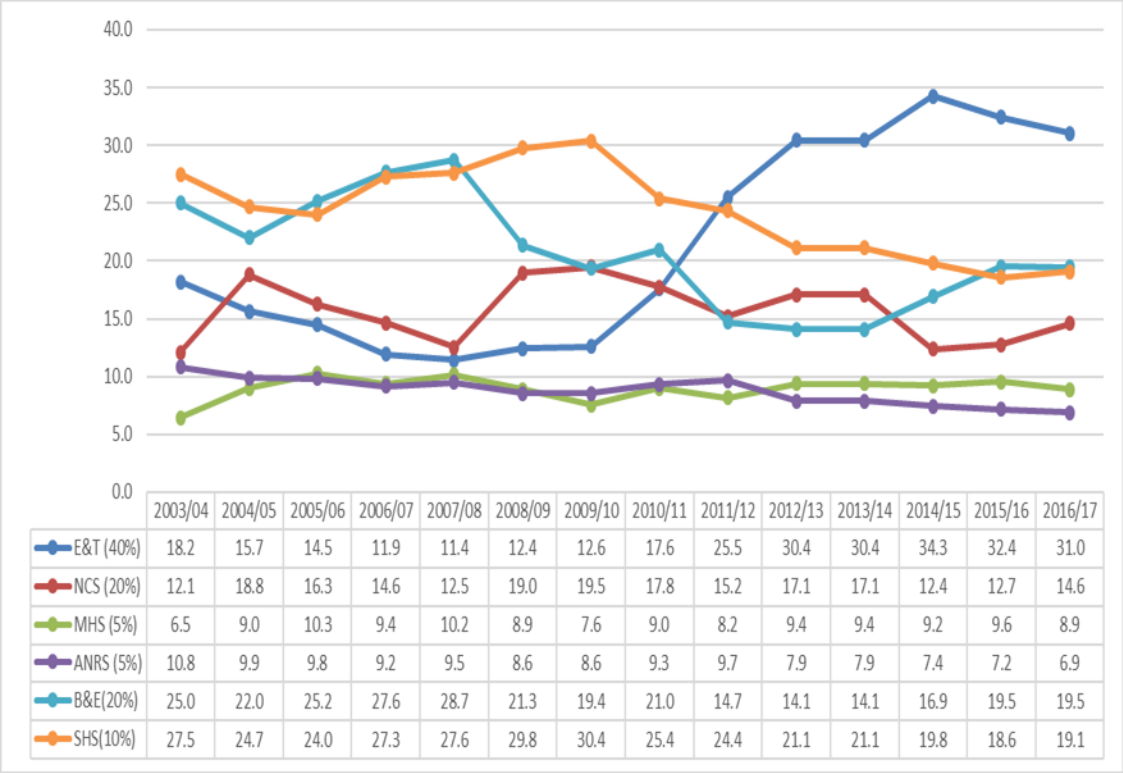


Figure 34: percentage of undergraduate enrolment in Government-University by Gender in S&T and SS
Source: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation



	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
E&T (40%)	18.2	15.7	14.5	11.9	11.4	12.4	12.6	17.6	25.5	30.4	30.4	34.3	32.4	31.0
NCS (20%)	12.1	18.8	16.3	14.6	12.5	19.0	19.5	17.8	15.2	17.1	17.1	12.4	12.7	14.6
MHS (5%)	6.5	9.0	10.3	9.4	10.2	8.9	7.6	9.0	8.2	9.4	9.4	9.2	9.6	8.9
ANRS (5%)	10.8	9.9	9.8	9.2	9.5	8.6	8.6	9.3	9.7	7.9	7.9	7.4	7.2	6.9
B&E(20%)	25.0	22.0	25.2	27.6	28.7	21.3	19.4	21.0	14.7	14.1	14.1	16.9	19.5	19.5
SHS(10%)	27.5	24.7	24.0	27.3	27.6	29.8	30.4	25.4	24.4	21.1	21.1	19.8	18.6	19.1

Figure 35: Percentage of Undergraduate Enrolment in Government-University by micro policies

Source: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation

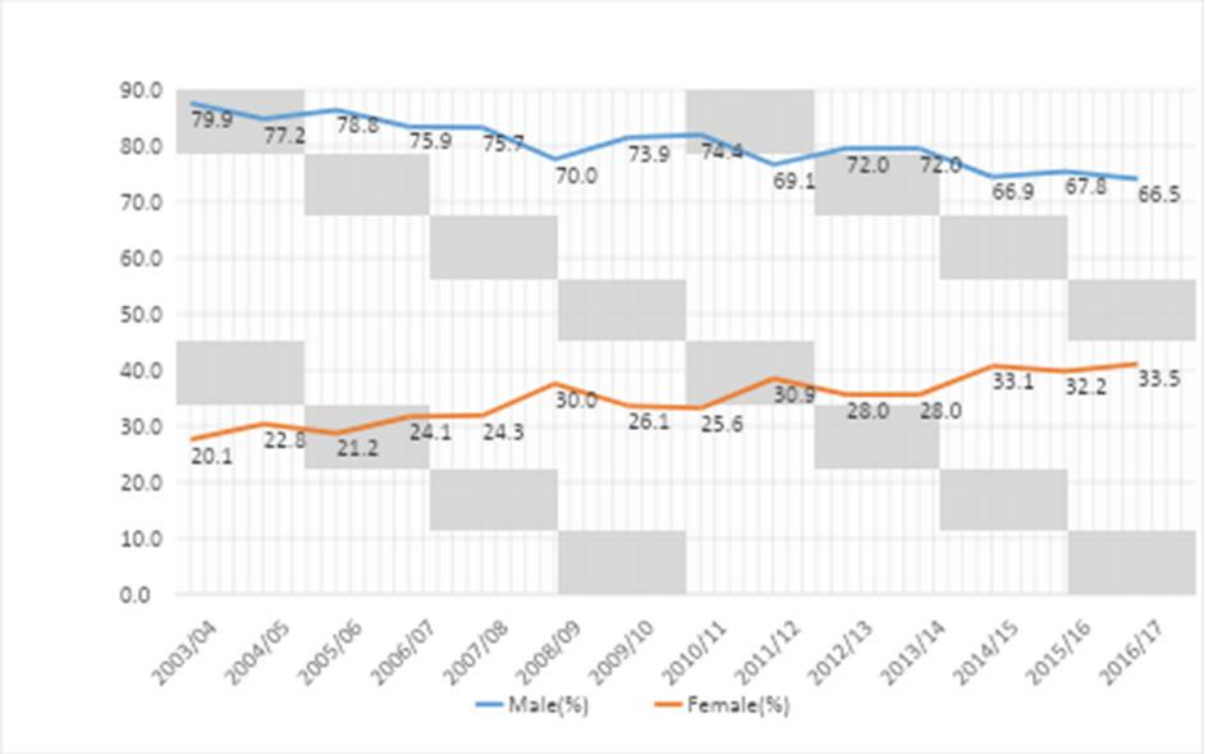


Figure 36: percentage of undergraduate enrolment in Government-University by gender

Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation

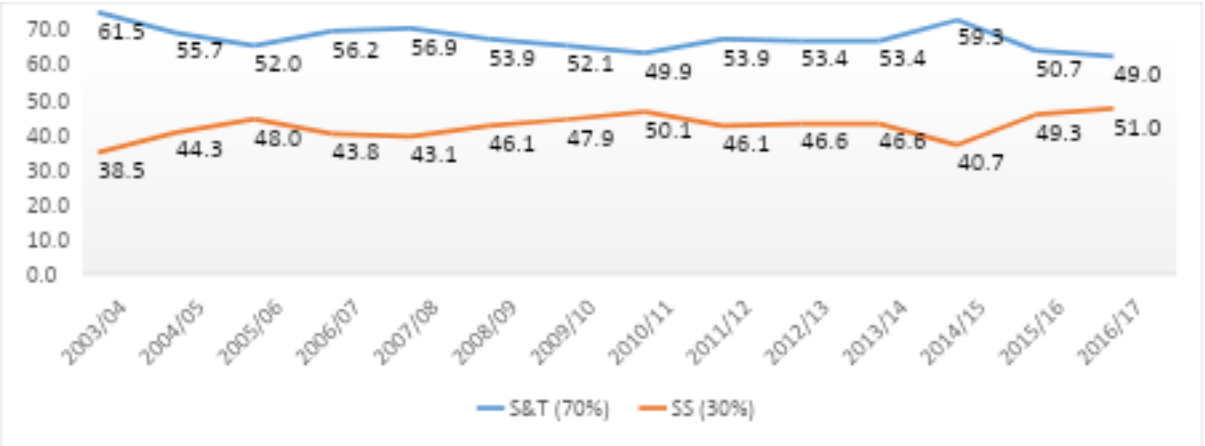
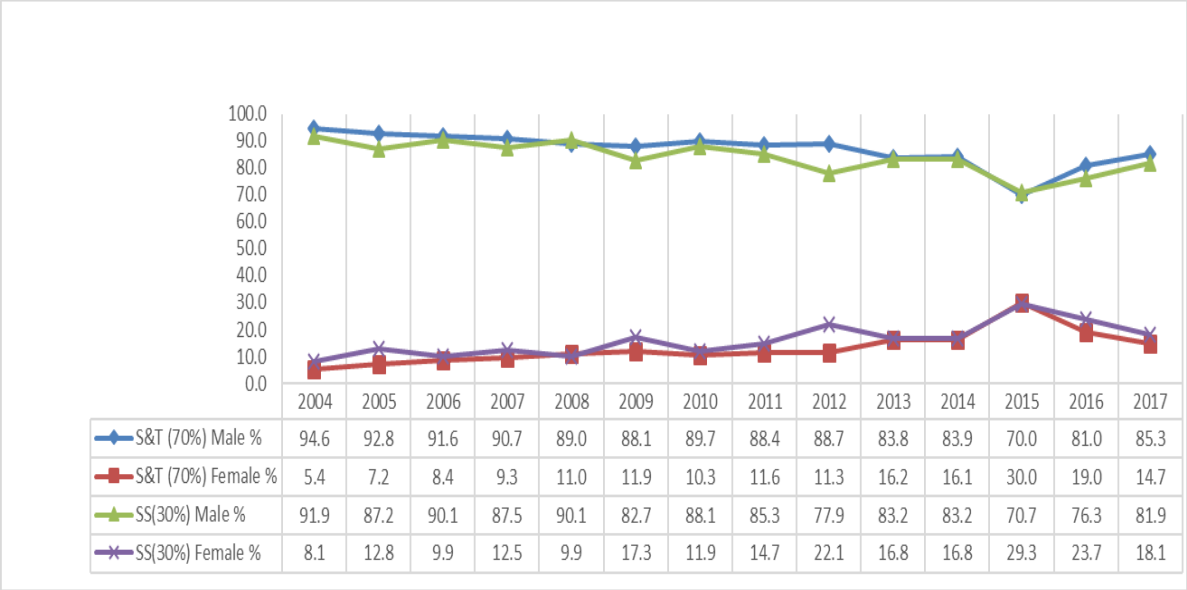


Figure 37: Share of Postgraduates Enrolment in Government-University by S&T & SS

Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
S&T (70%) Male %	94.6	92.8	91.6	90.7	89.0	88.1	89.7	88.4	88.7	83.8	83.9	70.0	81.0	85.3
S&T (70%) Female %	5.4	7.2	8.4	9.3	11.0	11.9	10.3	11.6	11.3	16.2	16.1	30.0	19.0	14.7
SS(30%) Male %	91.9	87.2	90.1	87.5	90.1	82.7	88.1	85.3	77.9	83.2	83.2	70.7	76.3	81.9
SS(30%) Female %	8.1	12.8	9.9	12.5	9.9	17.3	11.9	14.7	22.1	16.8	16.8	29.3	23.7	18.1

Figure 38: Share of Postgraduates Enrolment in Government-University by S&T & SS in terms of gender

Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation

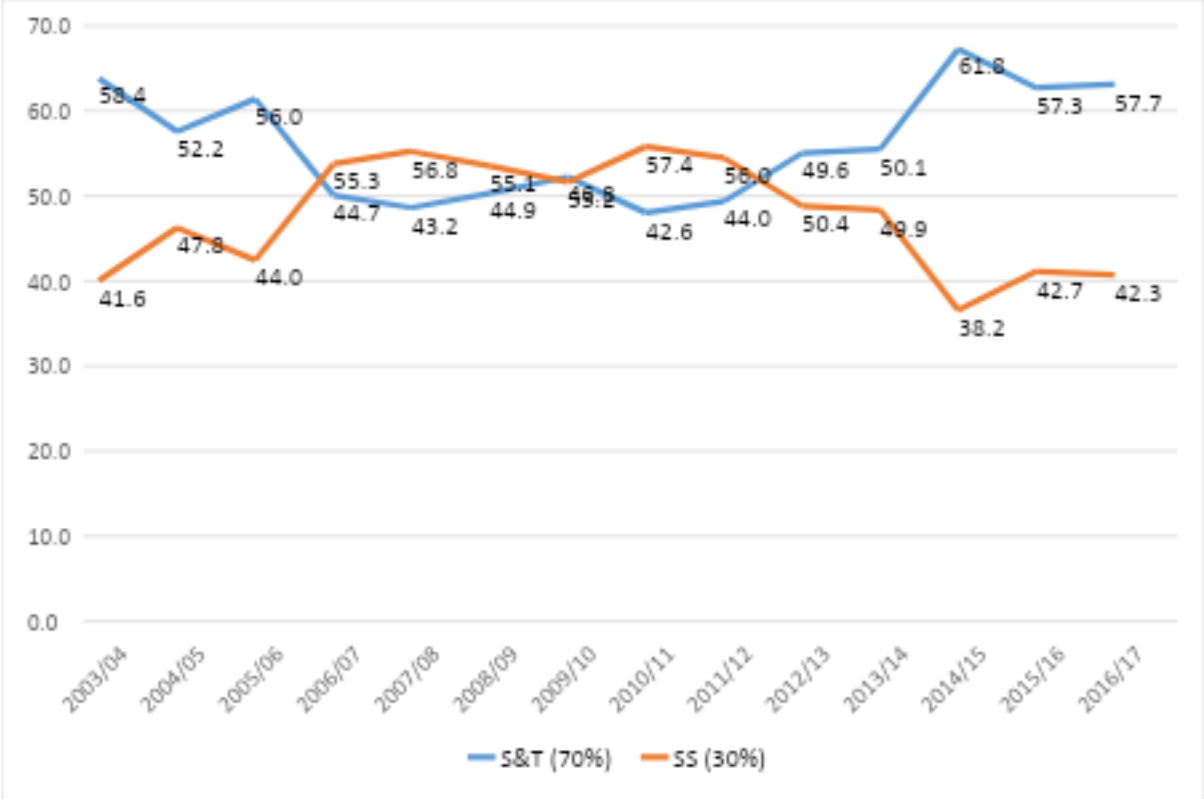
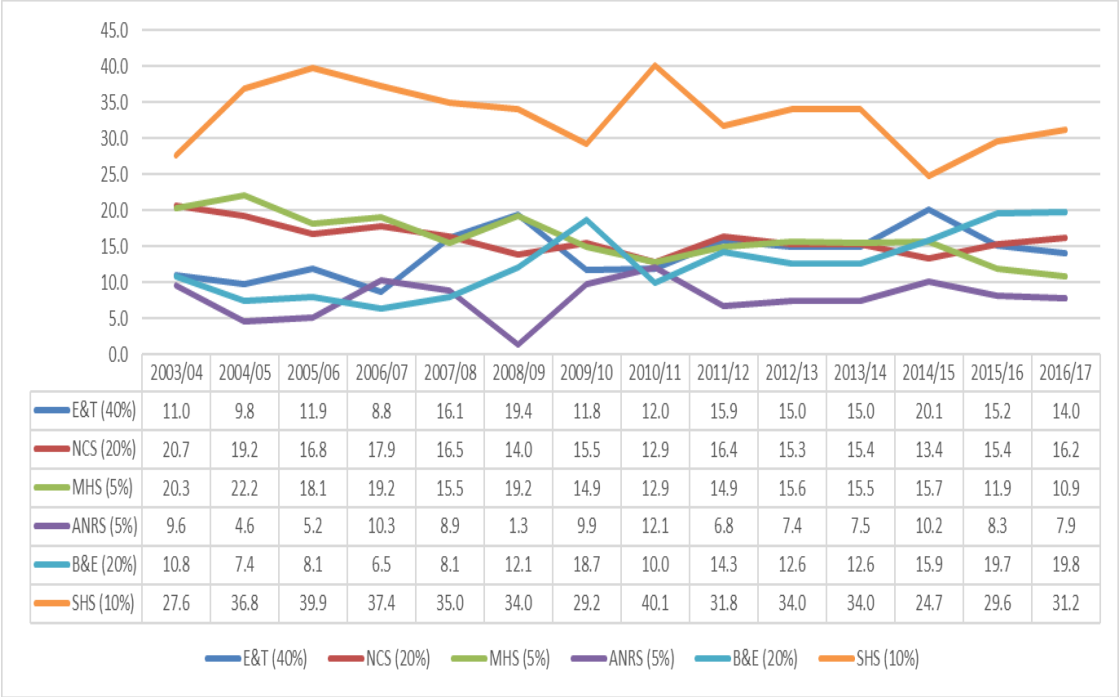
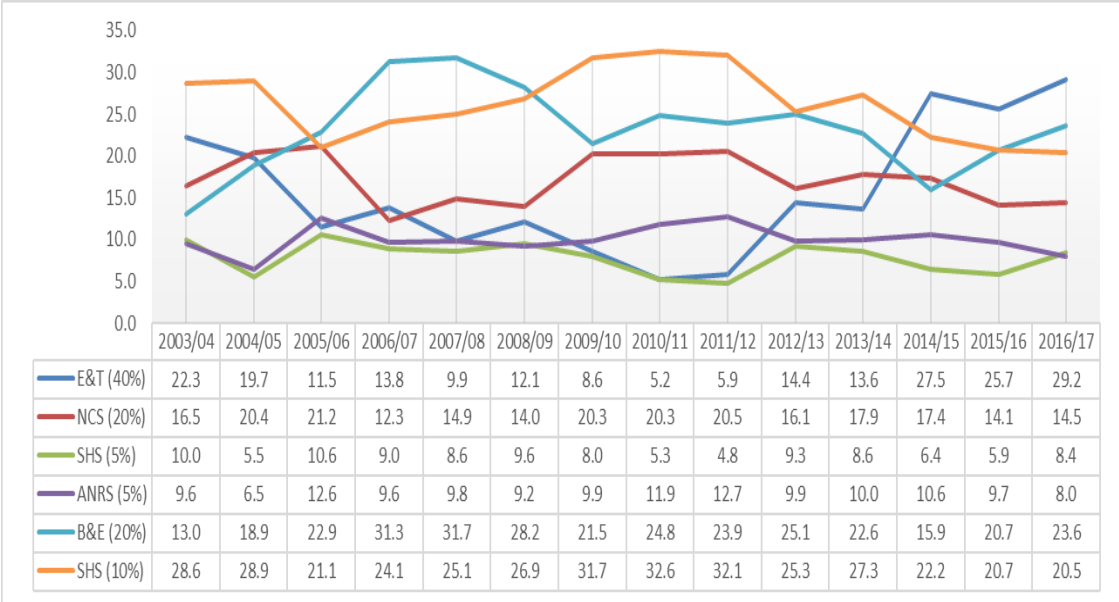


Figure 39: percentage of undergraduate graduates' programmemes in Government-University by S&T & SS
Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation



	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
E&T (40%)	11.0	9.8	11.9	8.8	16.1	19.4	11.8	12.0	15.9	15.0	15.0	20.1	15.2	14.0
NCS (20%)	20.7	19.2	16.8	17.9	16.5	14.0	15.5	12.9	16.4	15.3	15.4	13.4	15.4	16.2
MHS (5%)	20.3	22.2	18.1	19.2	15.5	19.2	14.9	12.9	14.9	15.6	15.5	15.7	11.9	10.9
ANRS (5%)	9.6	4.6	5.2	10.3	8.9	1.3	9.9	12.1	6.8	7.4	7.5	10.2	8.3	7.9
B&E (20%)	10.8	7.4	8.1	6.5	8.1	12.1	18.7	10.0	14.3	12.6	12.6	15.9	19.7	19.8
SHS (10%)	27.6	36.8	39.9	37.4	35.0	34.0	29.2	40.1	31.8	34.0	34.0	24.7	29.6	31.2

Figure 40: percentage of postgraduate enrolment programmemes in Government-University by Micro policies
Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation



	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
E&T (40%)	22.3	19.7	11.5	13.8	9.9	12.1	8.6	5.2	5.9	14.4	13.6	27.5	25.7	29.2
NCS (20%)	16.5	20.4	21.2	12.3	14.9	14.0	20.3	20.3	20.5	16.1	17.9	17.4	14.1	14.5
SHS (5%)	10.0	5.5	10.6	9.0	8.6	9.6	8.0	5.3	4.8	9.3	8.6	6.4	5.9	8.4
ANRS (5%)	9.6	6.5	12.6	9.6	9.8	9.2	9.9	11.9	12.7	9.9	10.0	10.6	9.7	8.0
B&E (20%)	13.0	18.9	22.9	31.3	31.7	28.2	21.5	24.8	23.9	25.1	22.6	15.9	20.7	23.6
SHS (10%)	28.6	28.9	21.1	24.1	25.1	26.9	31.7	32.6	32.1	25.3	27.3	22.2	20.7	20.5

Figure 41 percentage of undergraduate graduate in Government-University by micro policies

Sources: MoE, ESAA, EMIS 2003/04-2016/17 and Author's computation

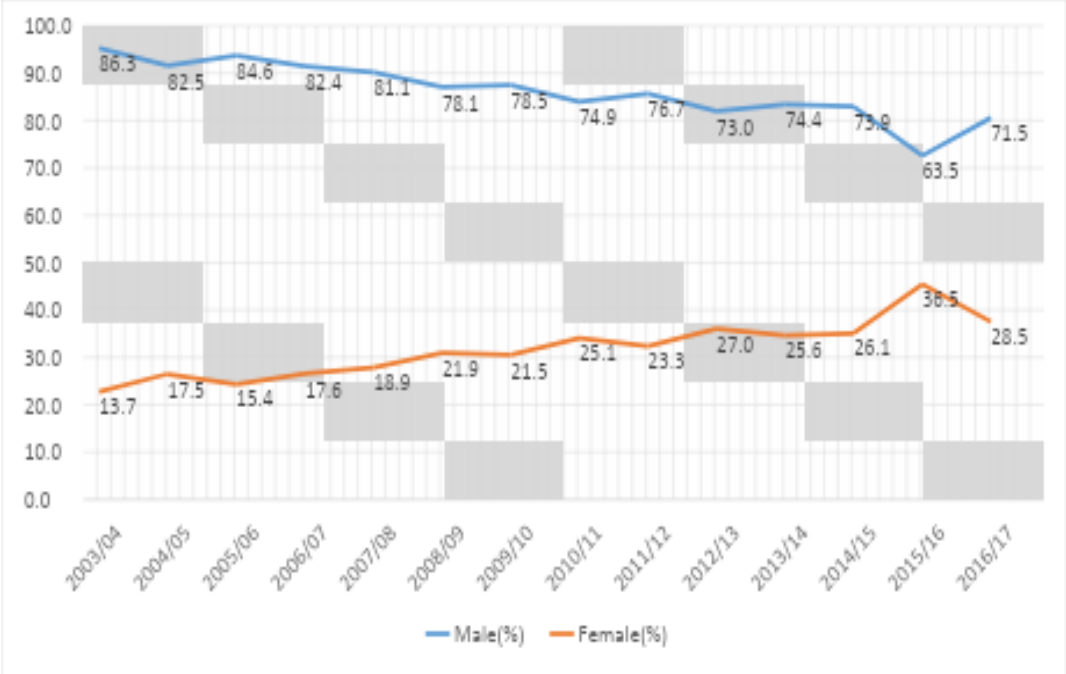


Figure 42 Percentage of Undergraduate Graduate in Government by gender
: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation.

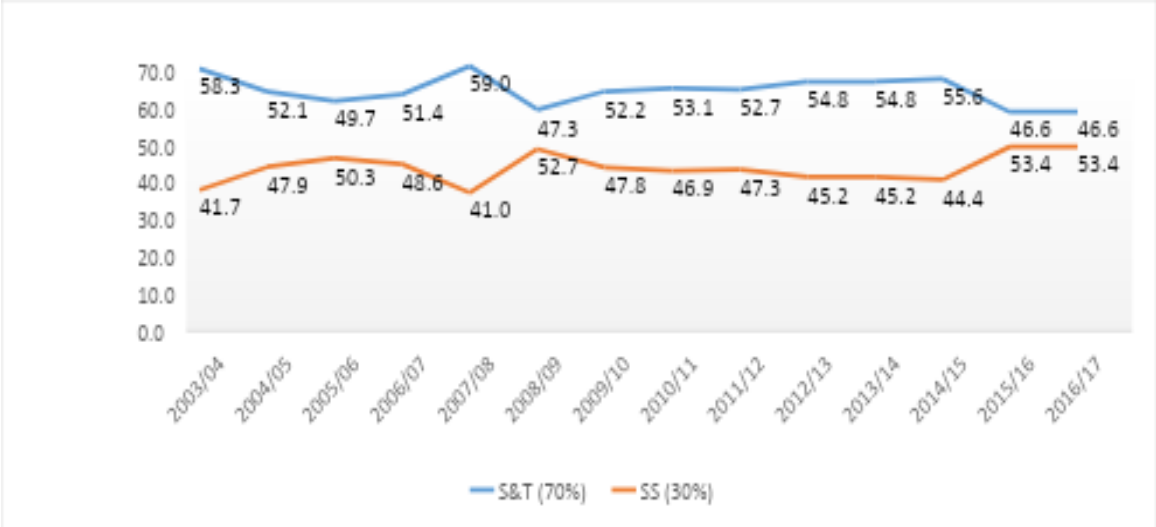


Figure 43 Percentage of Postgraduate Graduate in Government-University by S&T and SS

Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation

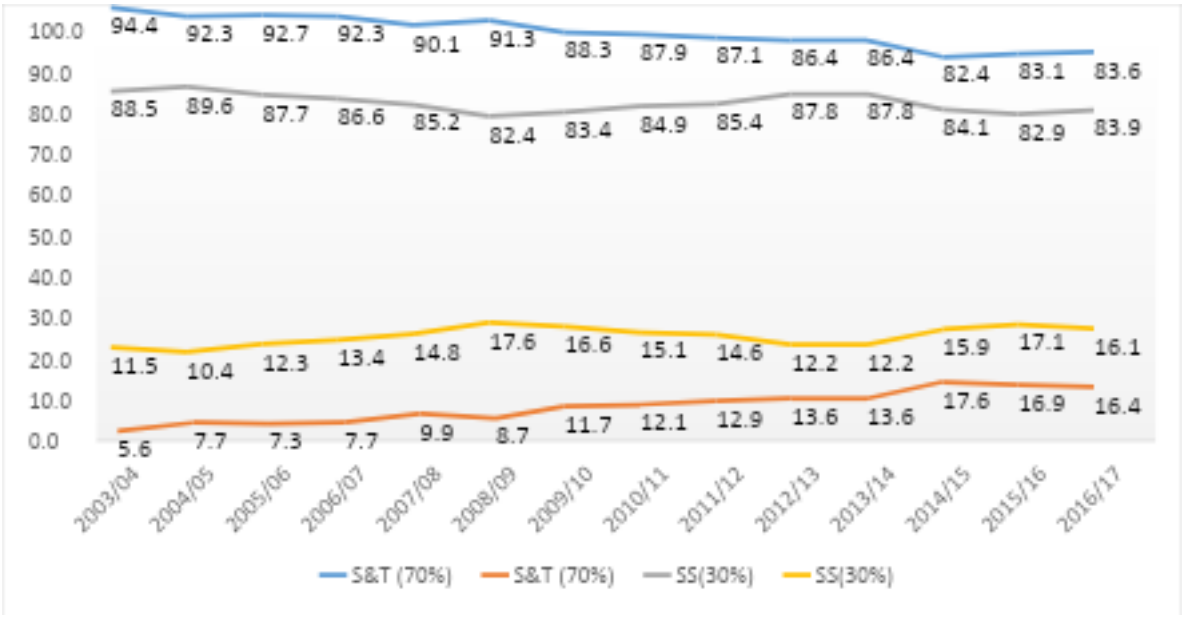
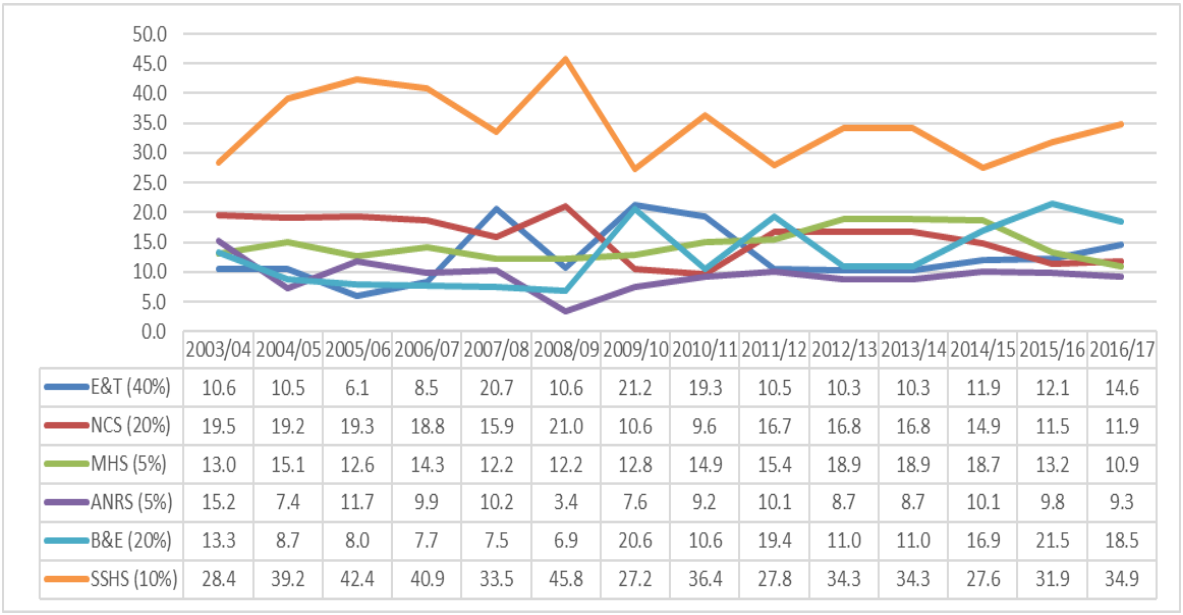


Figure 44: Percentage of Postgraduate graduates in Government-University by S&T and SS

Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation



	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
E&T (40%)	10.6	10.5	6.1	8.5	20.7	10.6	21.2	19.3	10.5	10.3	10.3	11.9	12.1	14.6
NCS (20%)	19.5	19.2	19.3	18.8	15.9	21.0	10.6	9.6	16.7	16.8	16.8	14.9	11.5	11.9
MHS (5%)	13.0	15.1	12.6	14.3	12.2	12.2	12.8	14.9	15.4	18.9	18.9	18.7	13.2	10.9
ANRS (5%)	15.2	7.4	11.7	9.9	10.2	3.4	7.6	9.2	10.1	8.7	8.7	10.1	9.8	9.3
B&E (20%)	13.3	8.7	8.0	7.7	7.5	6.9	20.6	10.6	19.4	11.0	11.0	16.9	21.5	18.5
SSHS (10%)	28.4	39.2	42.4	40.9	33.5	45.8	27.2	36.4	27.8	34.3	34.3	27.6	31.9	34.9

Figure 45 percentage of postgraduate graduates in Government-University by micro policies

Sources: MoE, ESAA and/or EMIS 2003/04-2016/17 and Author's computation

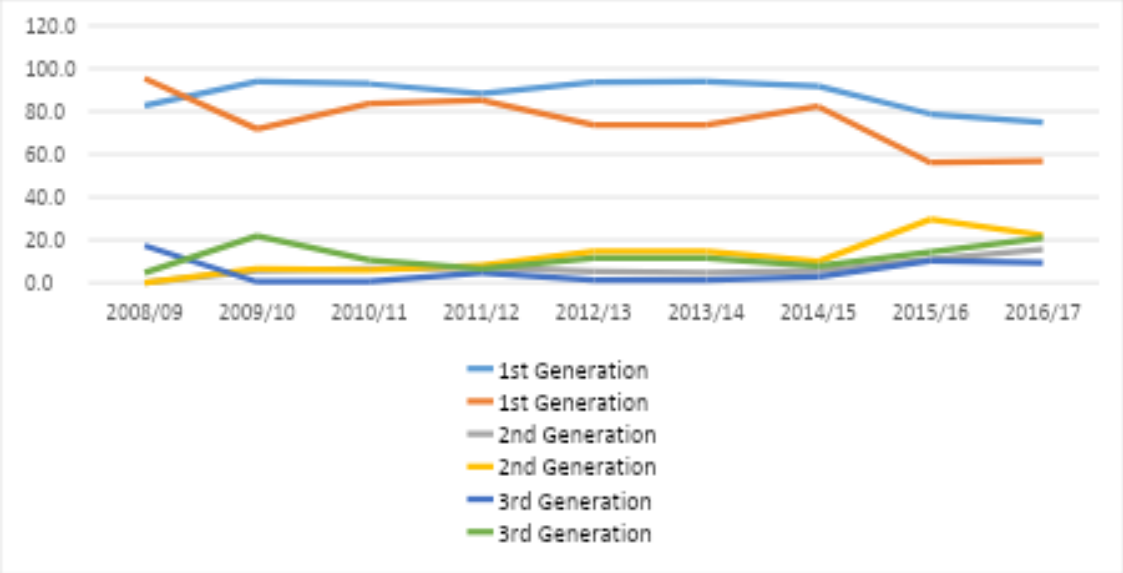


Figure 46 Percentage of Enrolment of Postgraduate Programmein Government-University by generation.

Sources: MoE; ESAA and EMIS, 2008/09-2016/17

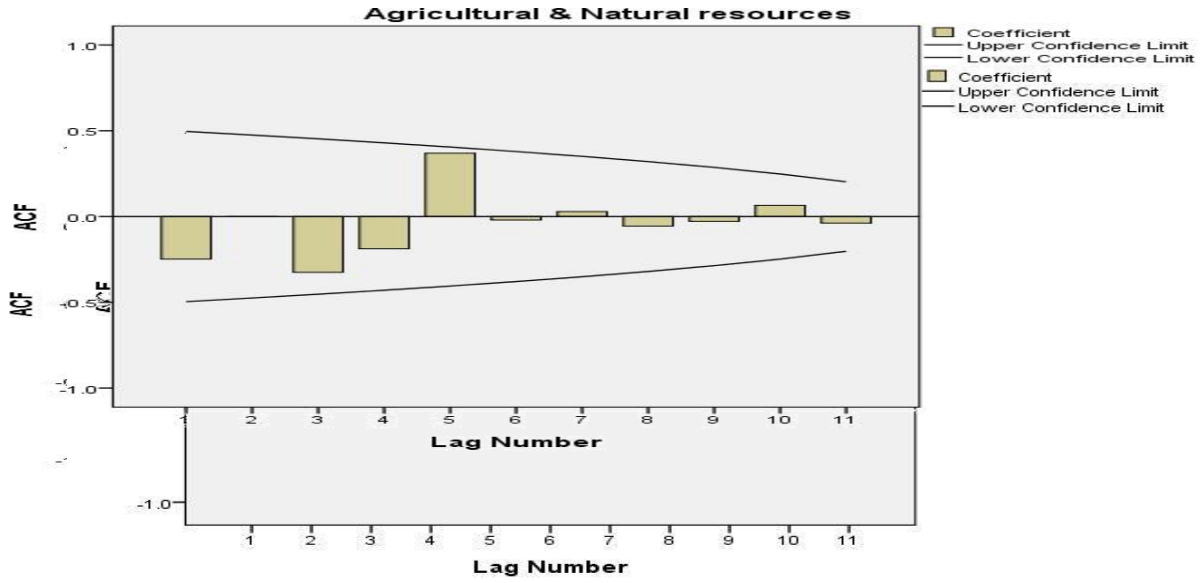


Figure 47 shows the ACF and lag number of E&T.

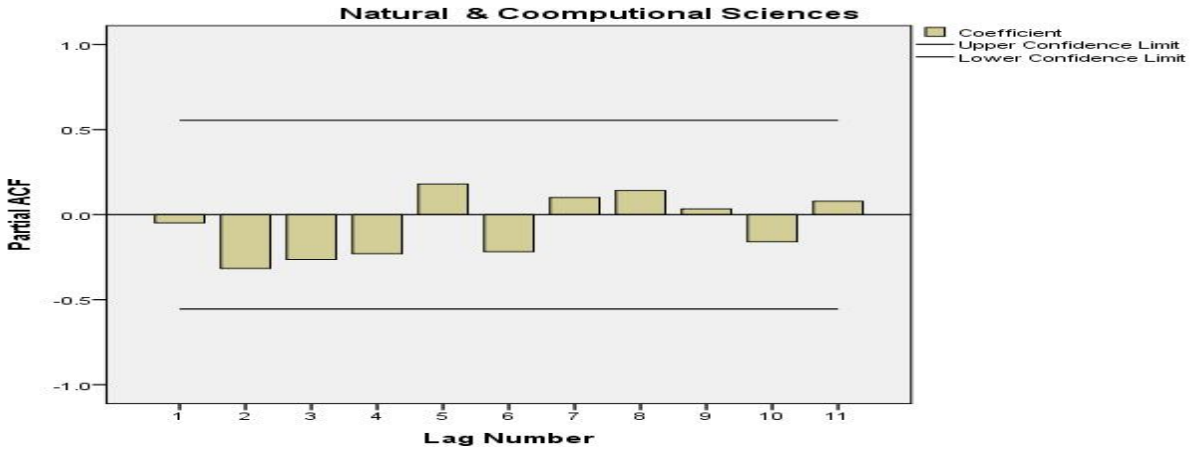


Figure 48 shows the Partial ACF and lag number of NCS

Figure 49 shows the ACF and lag number of MHS.

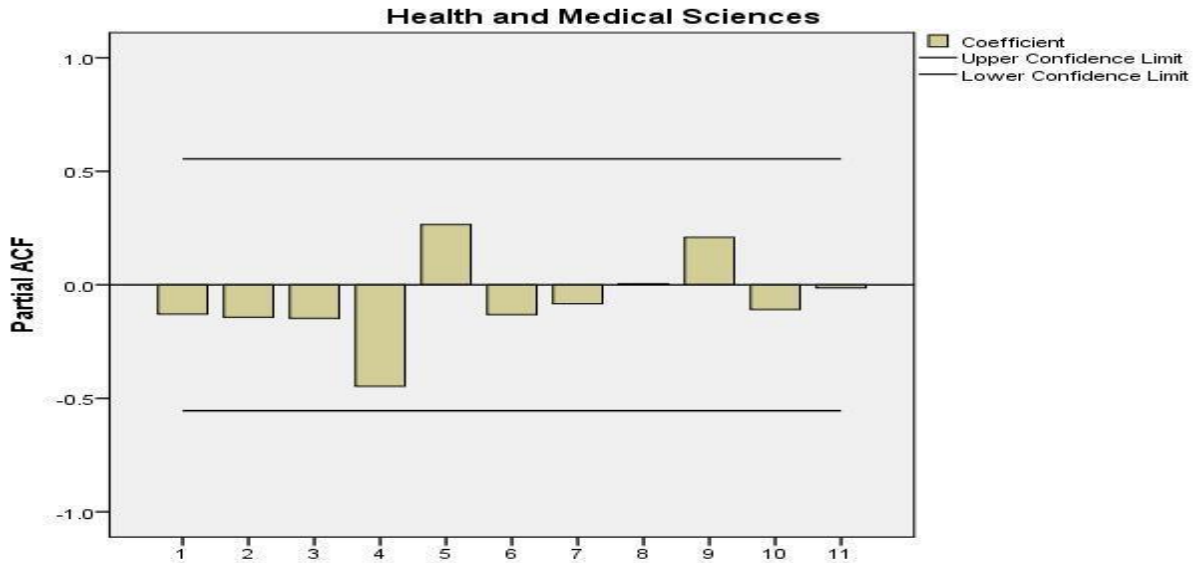


Figure 50 shows the ACF and lag number of B&E.

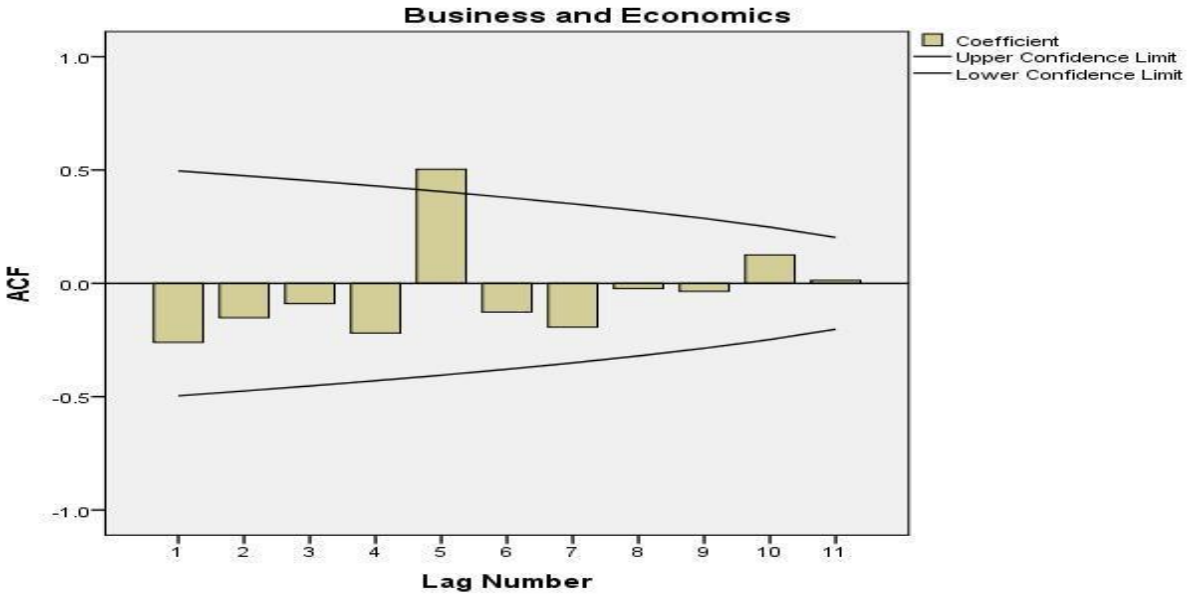


Figure 51 shows the ACF and lag number of ANRS

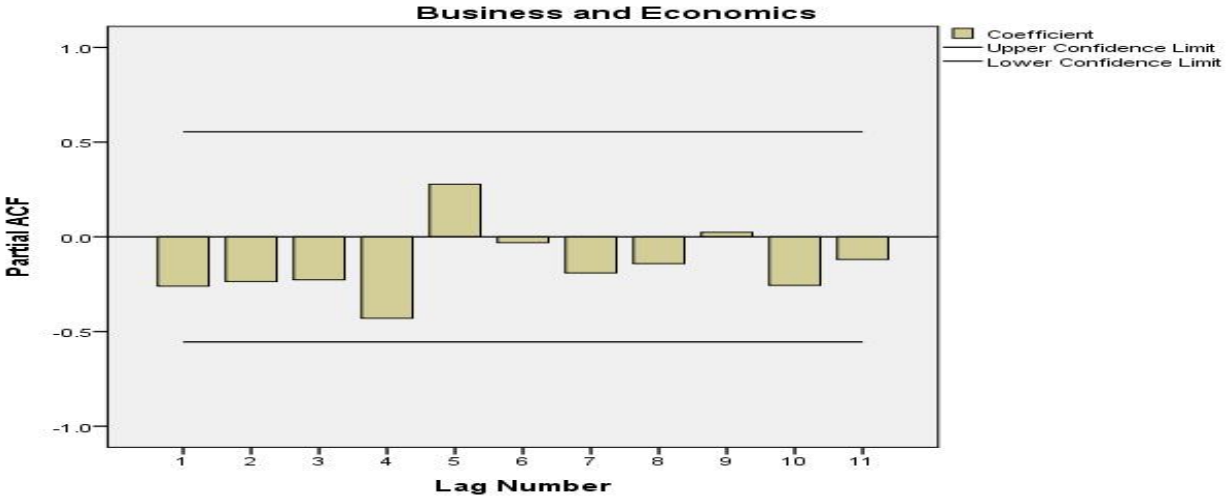


Figure 52 shows the ACF and lag number of B&E.

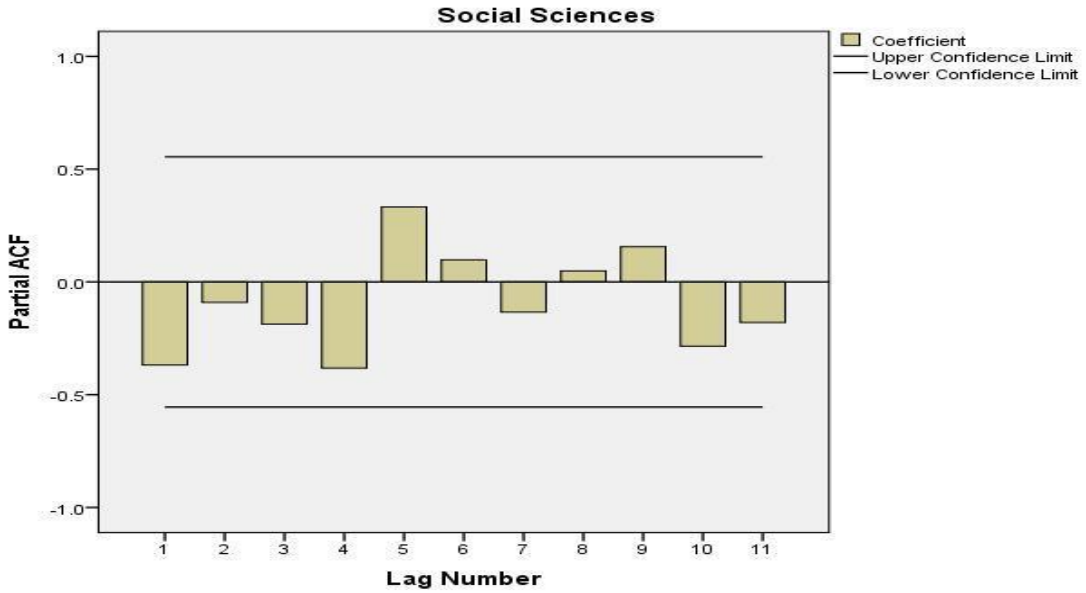


Figure 53 shows the Partial ACF and lag number of SS.

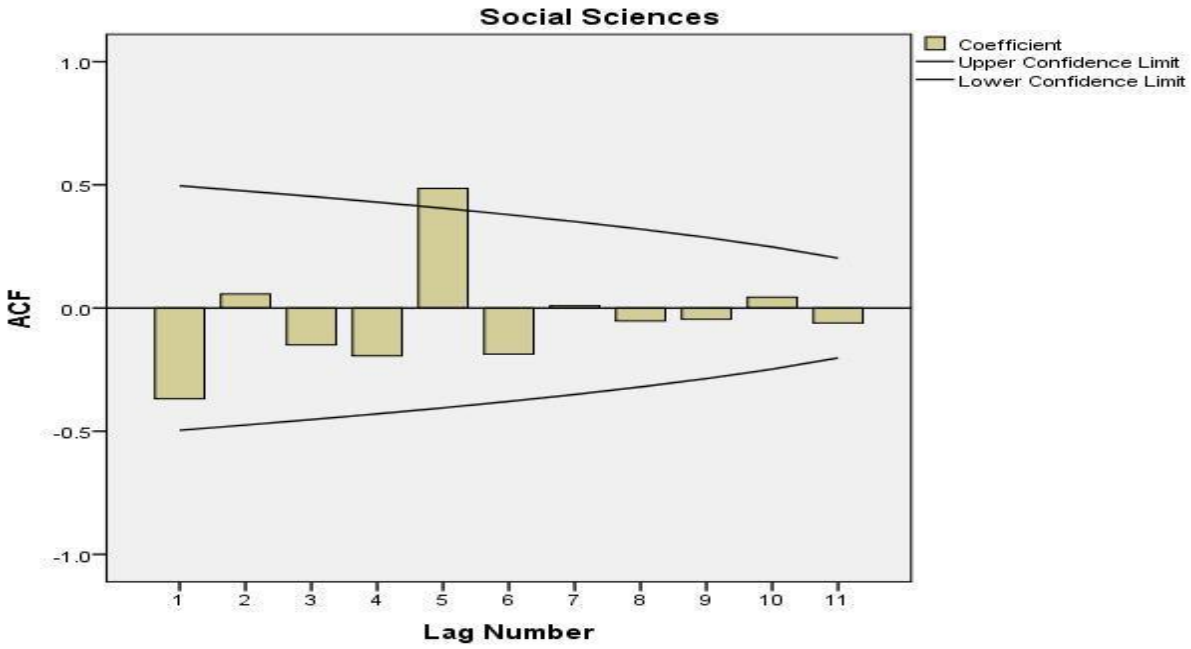


Figure 54 shows the ACF and lag number of SS.

Heteroscedasticity

S&T

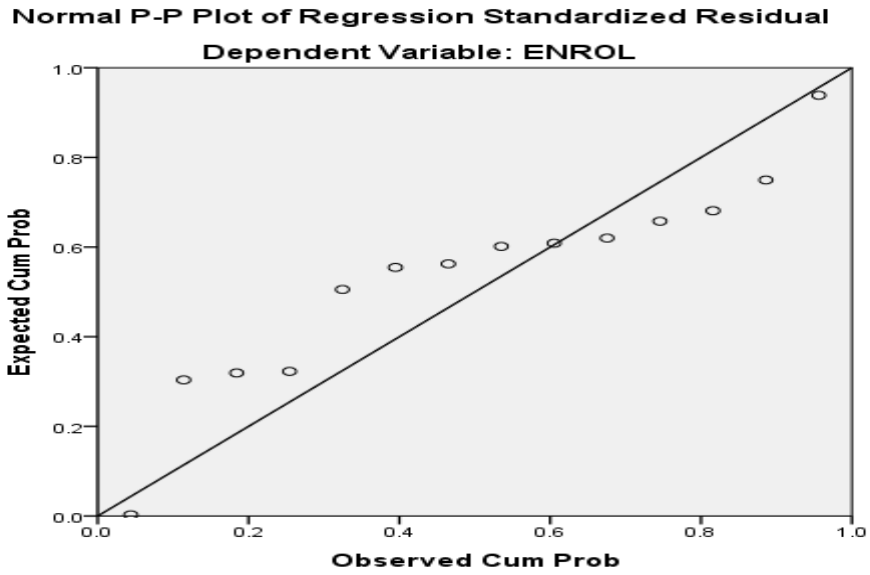


Figure 55 Figure shows Normal P-P Plot of S&T Regression Standardised Residual Dependent Variable (Enrolment).

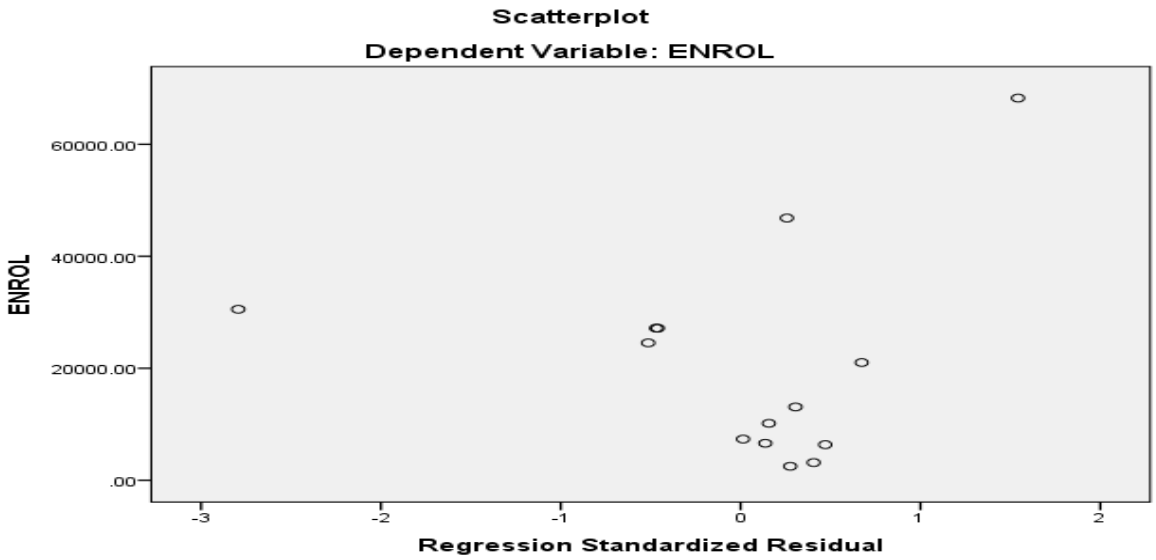


Figure 56 shows the Scatter Plot of S&T Dependent Variable (Enrolment).

SS

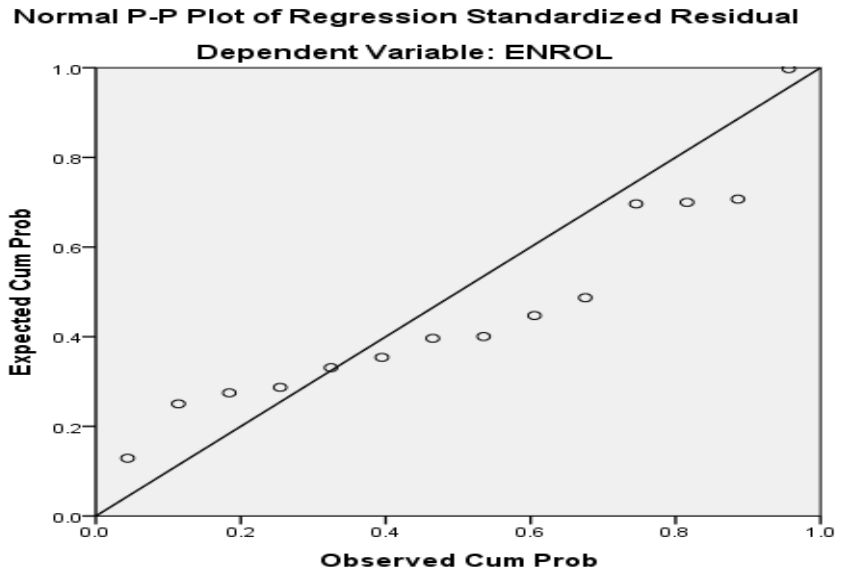


Figure 57 Figure shows Normal P-P Plot of SS Regression Standardised Residual Dependent Variable (Enrolment).

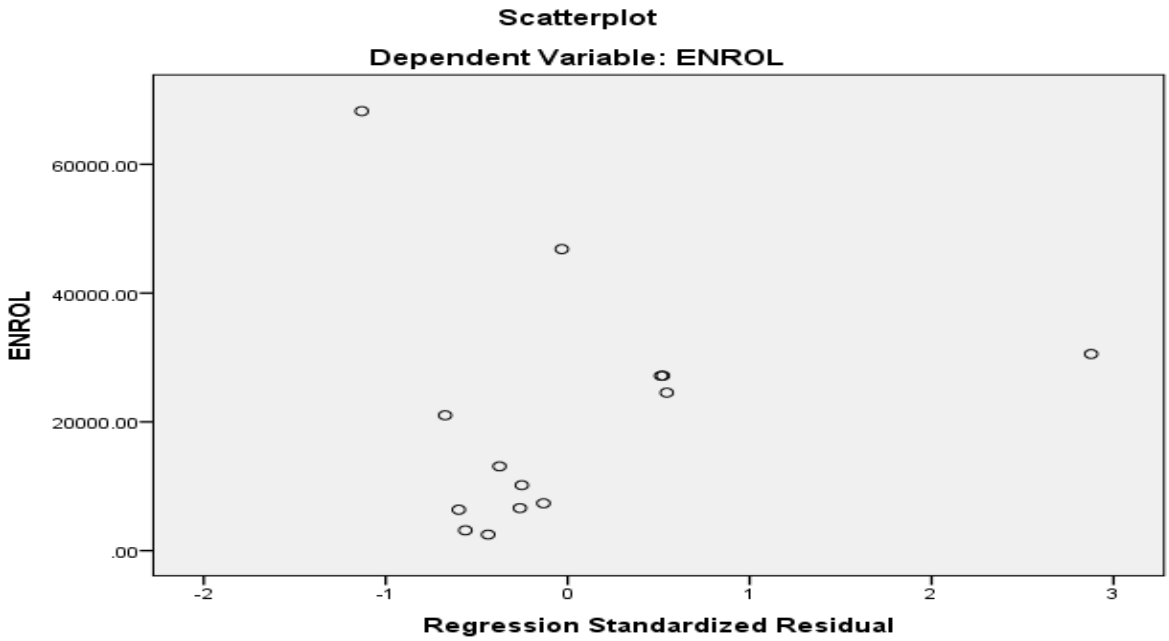


Figure 58 shows Scatter Plot of SS Dependent Variable (Enrolment).

E&T

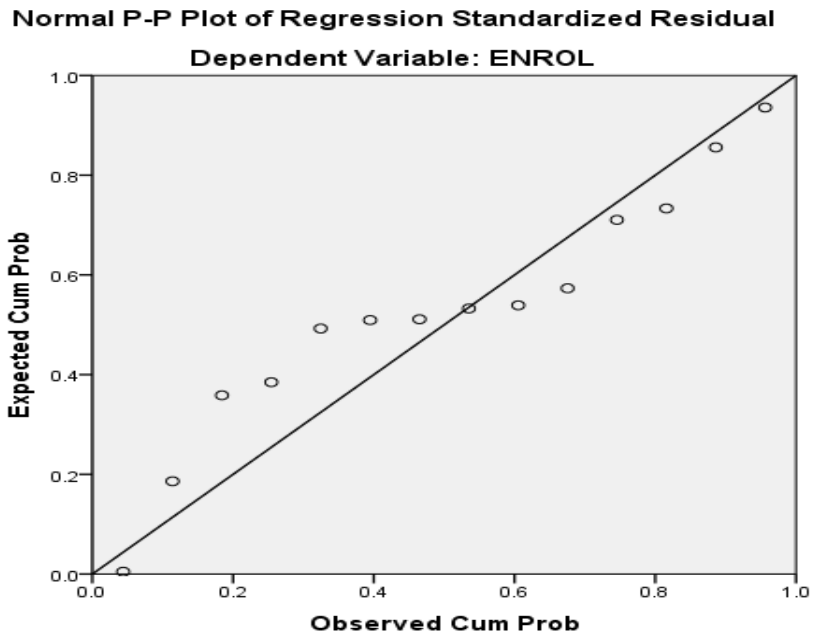


Figure 59 shows Normal P-P Plot of E&T Regression Standardised Residual Dependent Variable (Enrolment).

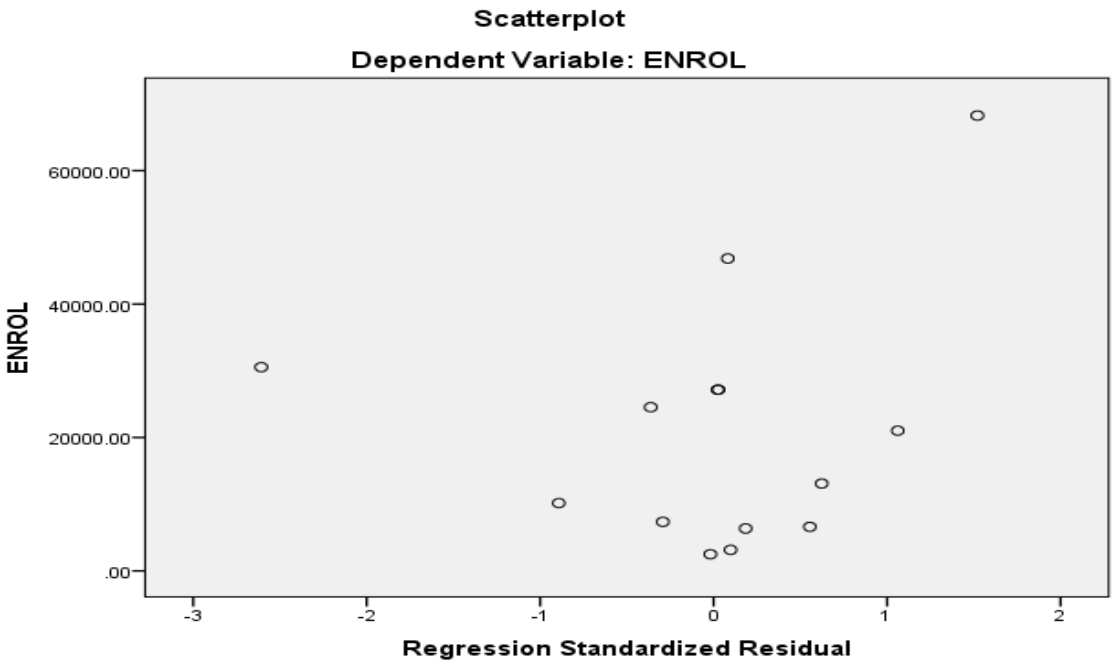


Figure 60 shows Scatter Plot Dependent Variable of E&T Dependent Variable (Enrolment).

NCS

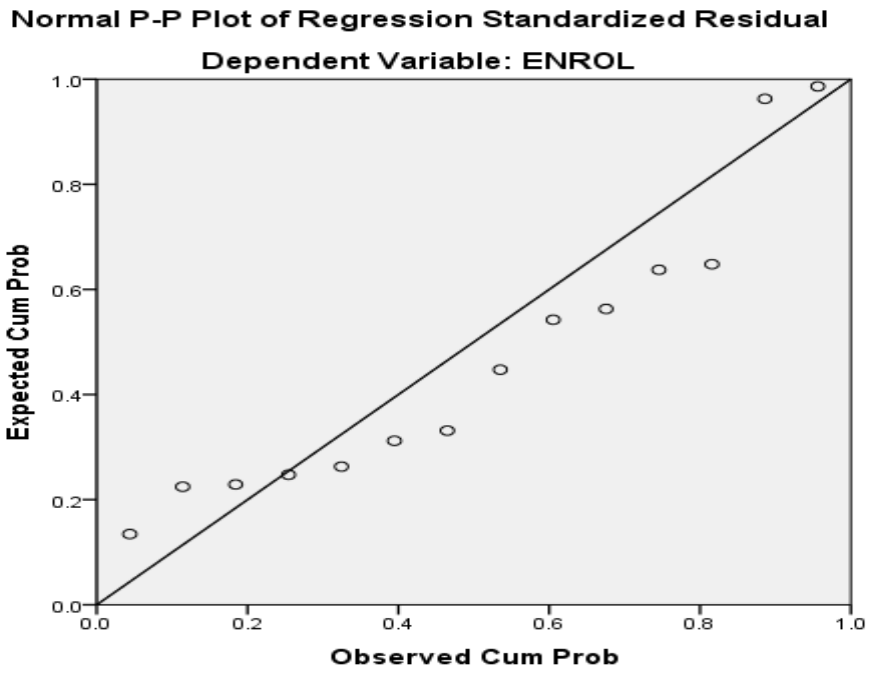


Figure 61 shows Normal P-P Plot of Regression Standardised Residual of NCP Dependent Variable (Enrolment).

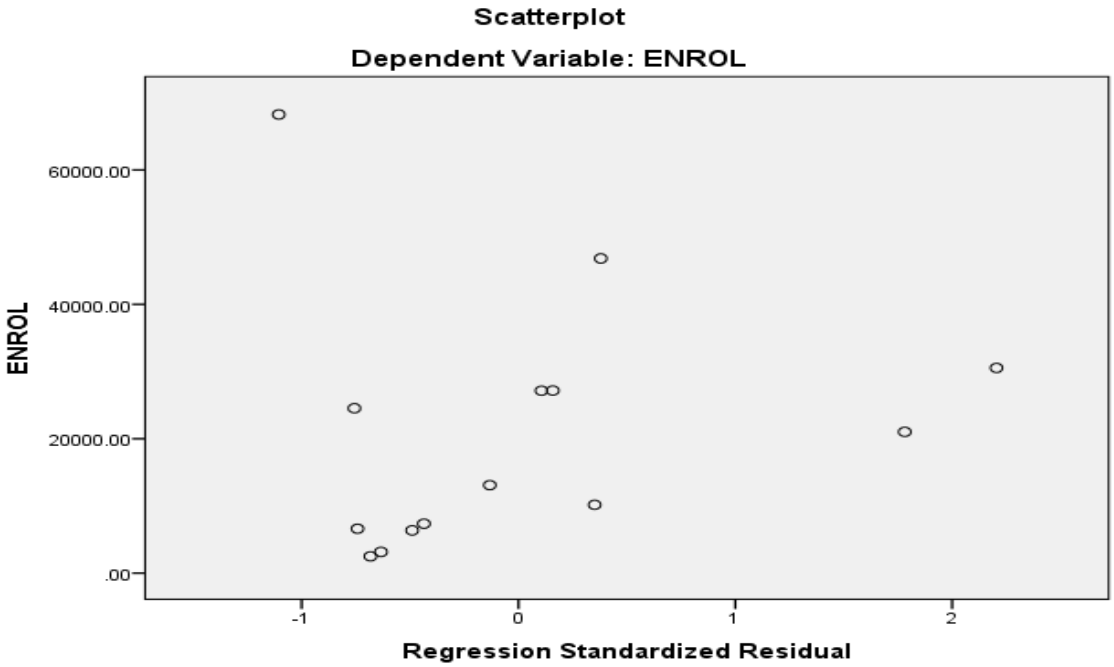


Figure 62 shows the Scatter Plot of NCS of Dependent Variable (Enrolment).

MHS

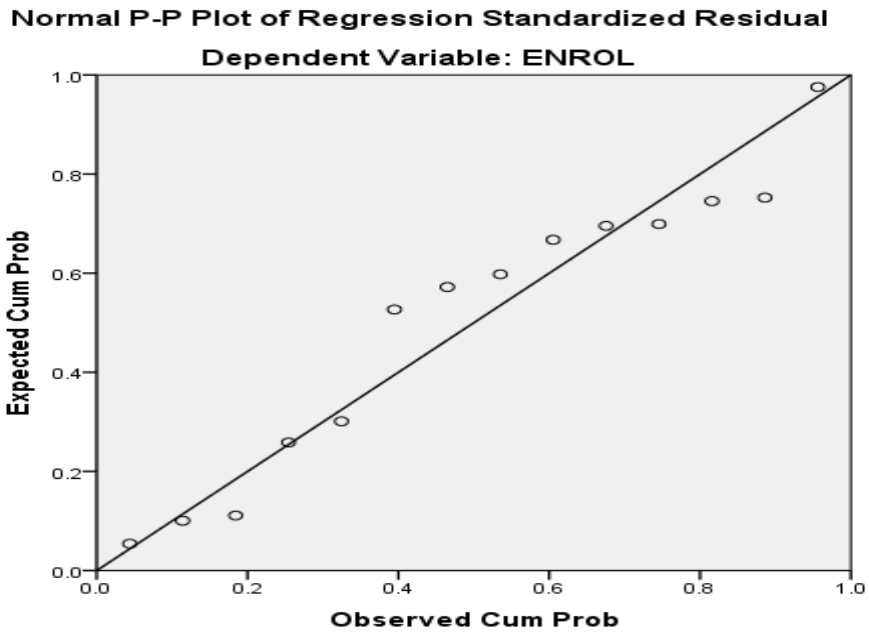


Figure 63 shows the Norma P-P Plot ANRS Regression Standardised Residual of Dependent Variable (Enrolment).

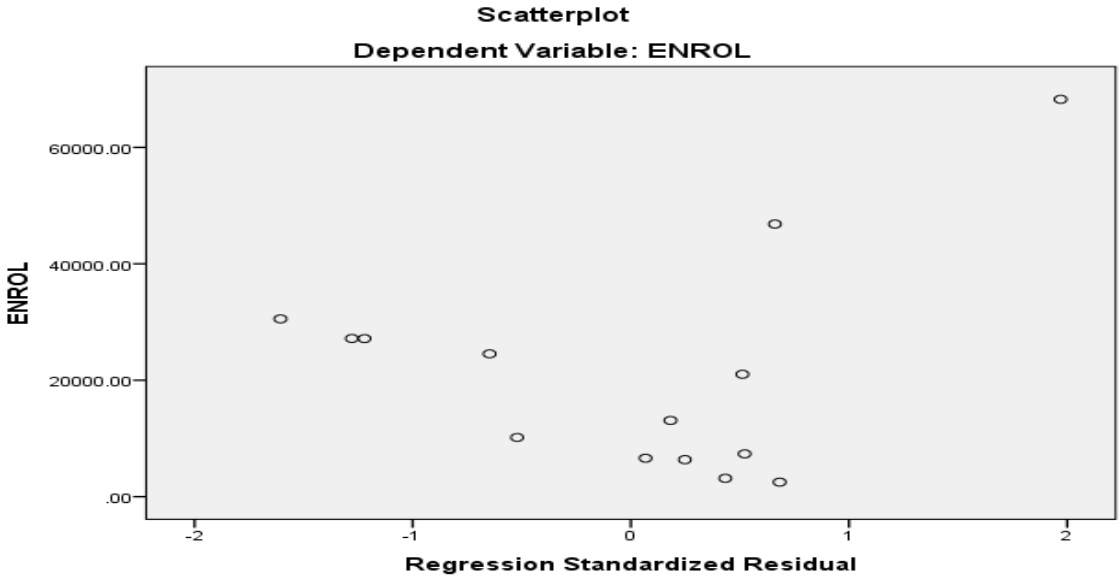


Figure 64 shows the Scatter plot of MHS of Dependent Variable (Enrolment).

ANRS

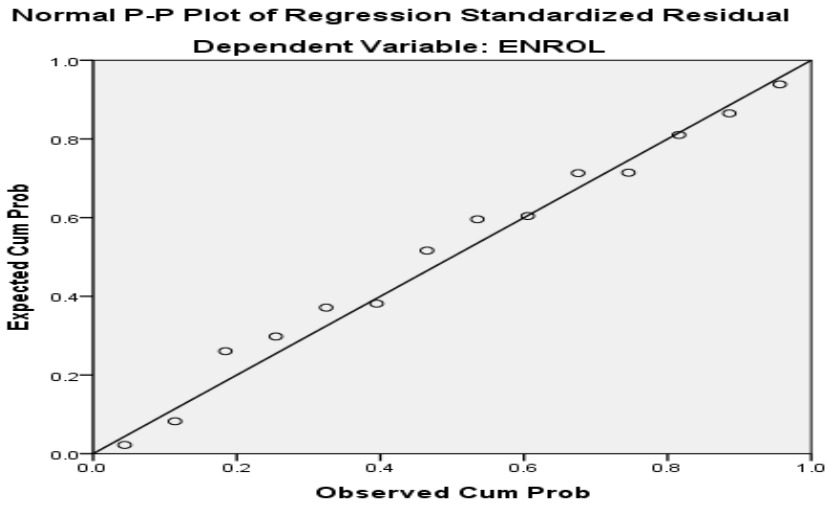


Figure 65 shows the Norma P-P Plot of Regression Standardised Residual of ANRS of Dependent Variable (Enrolment).

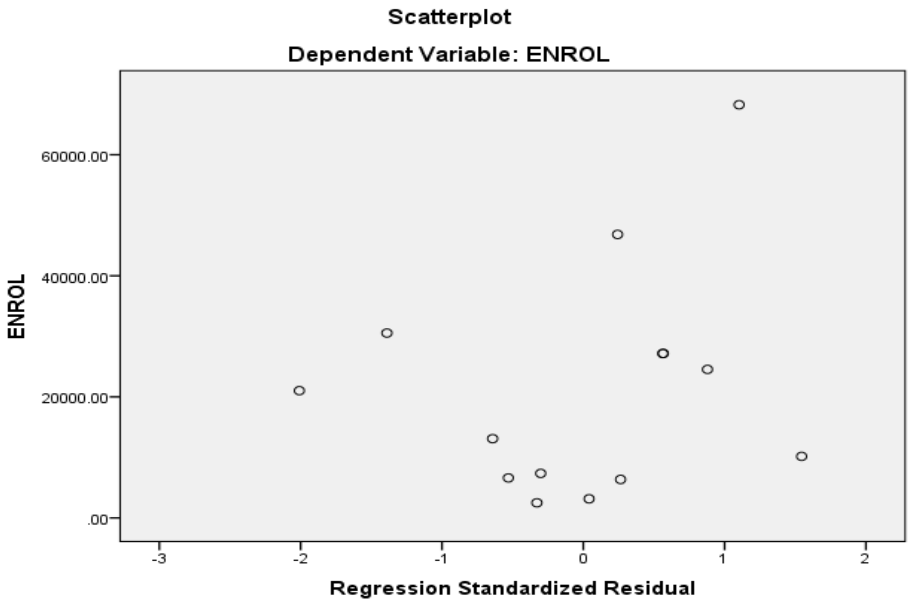


Figure 66 shows the Scatter plot of ANRS of Dependent Variable (Enrolment).

B&E

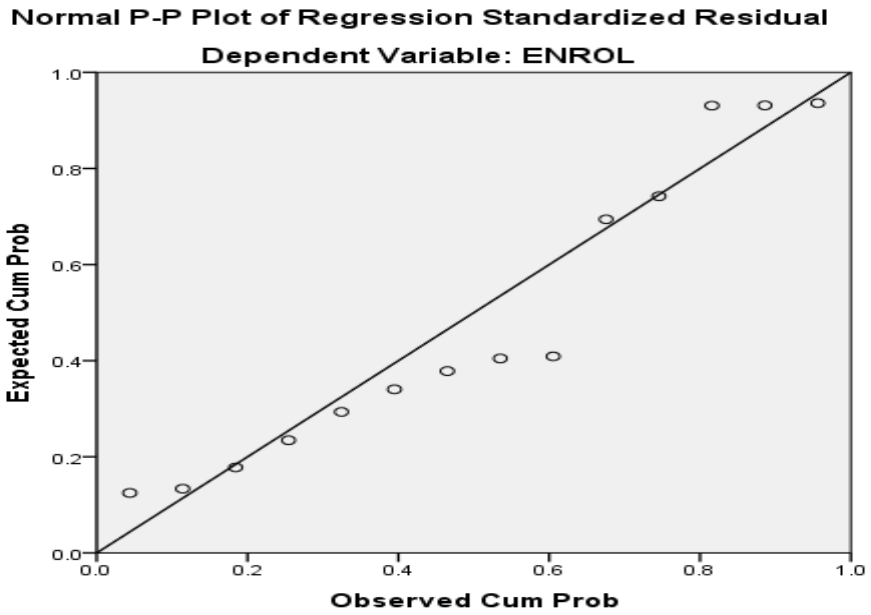


Figure 67 shows P-P Plot of B&E Regression Standardised Residual the Dependent Variable (Enrolment).

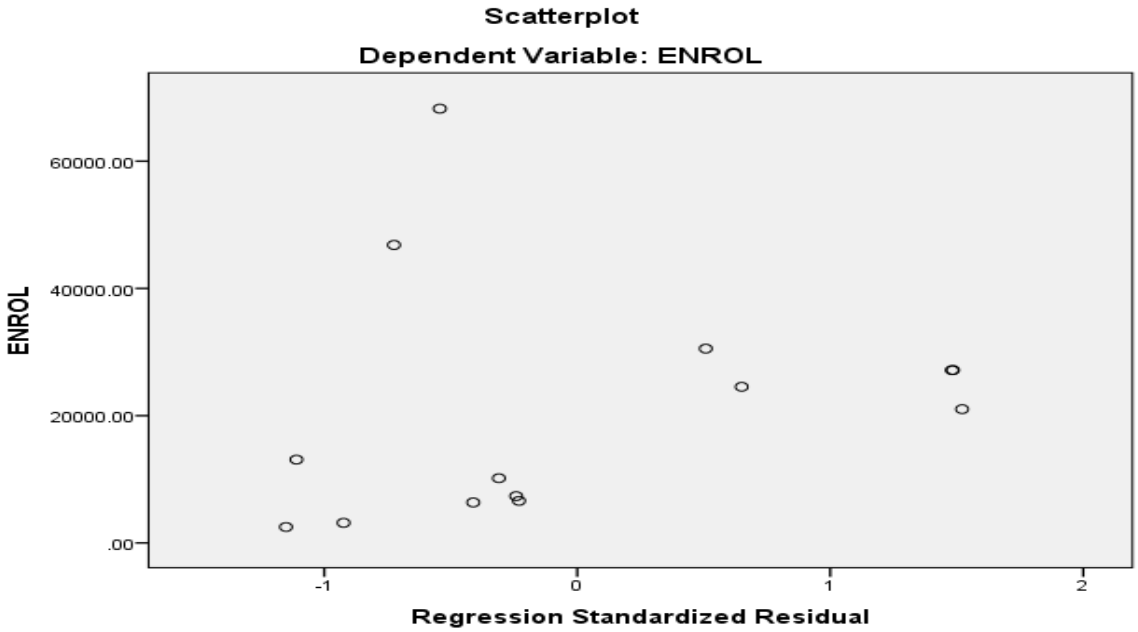


Figure 68 Scatter Plot of B&E of the Dependent Variable (Enrolment).

SHS

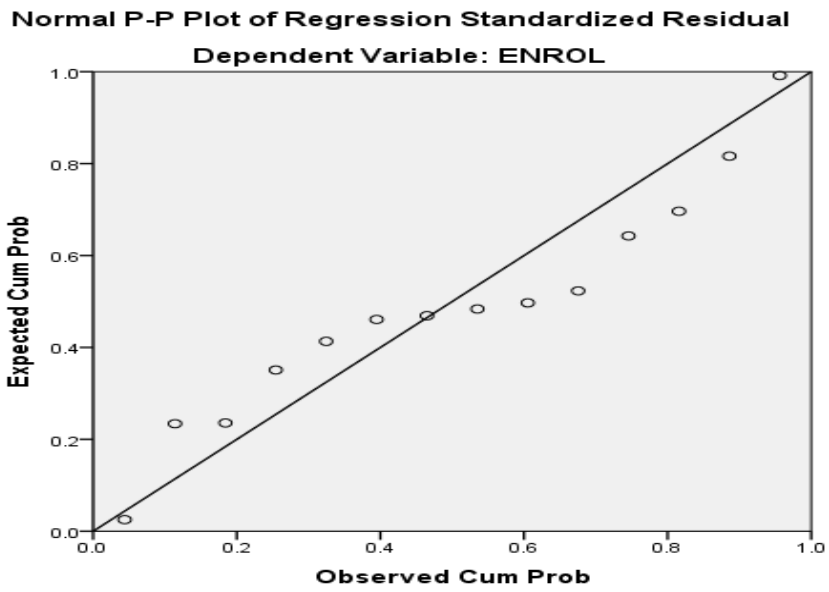


Figure 69 shows P-P Plot of SHS of Regression Standardised Residual the Dependent Variable (Enrolment).

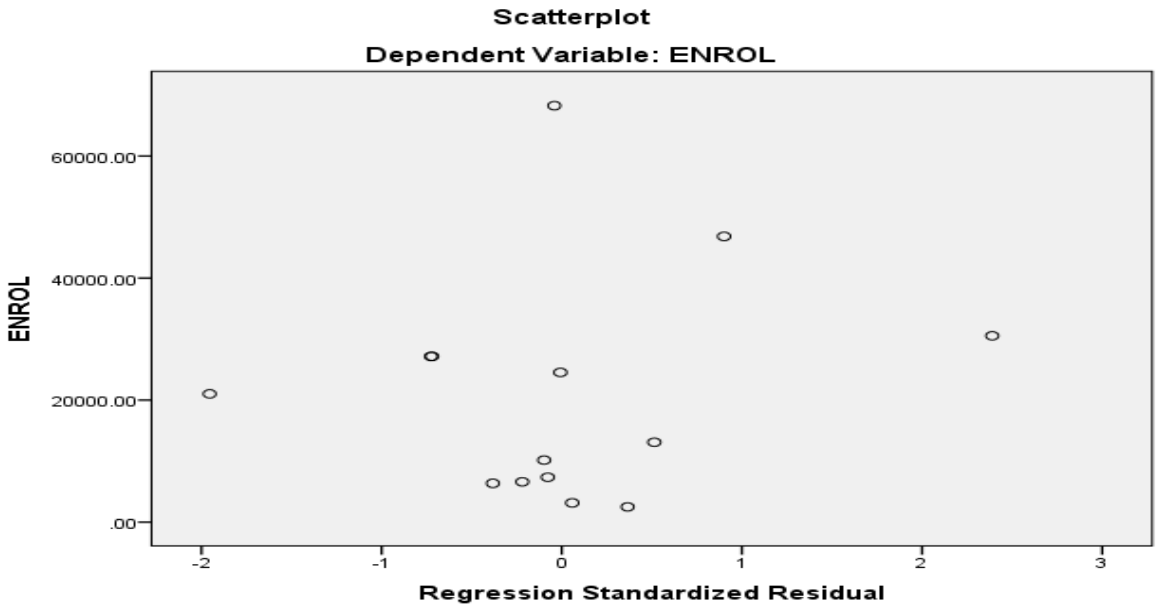


Figure 70 shows Scatter Plot of SHS of the Dependent Variable (Enrol

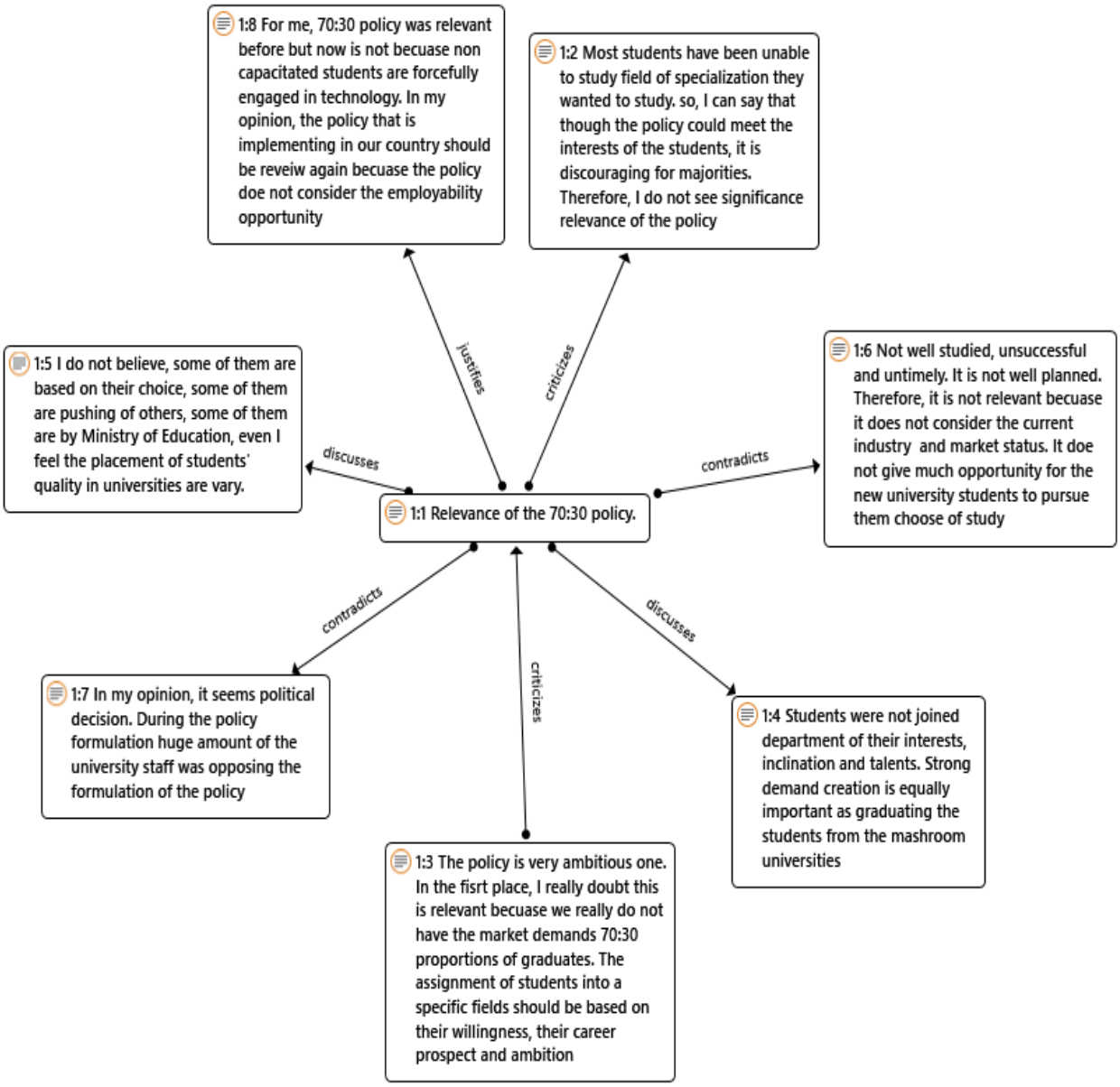


Figure 71 Hyperlinked quotation of the policy relevance

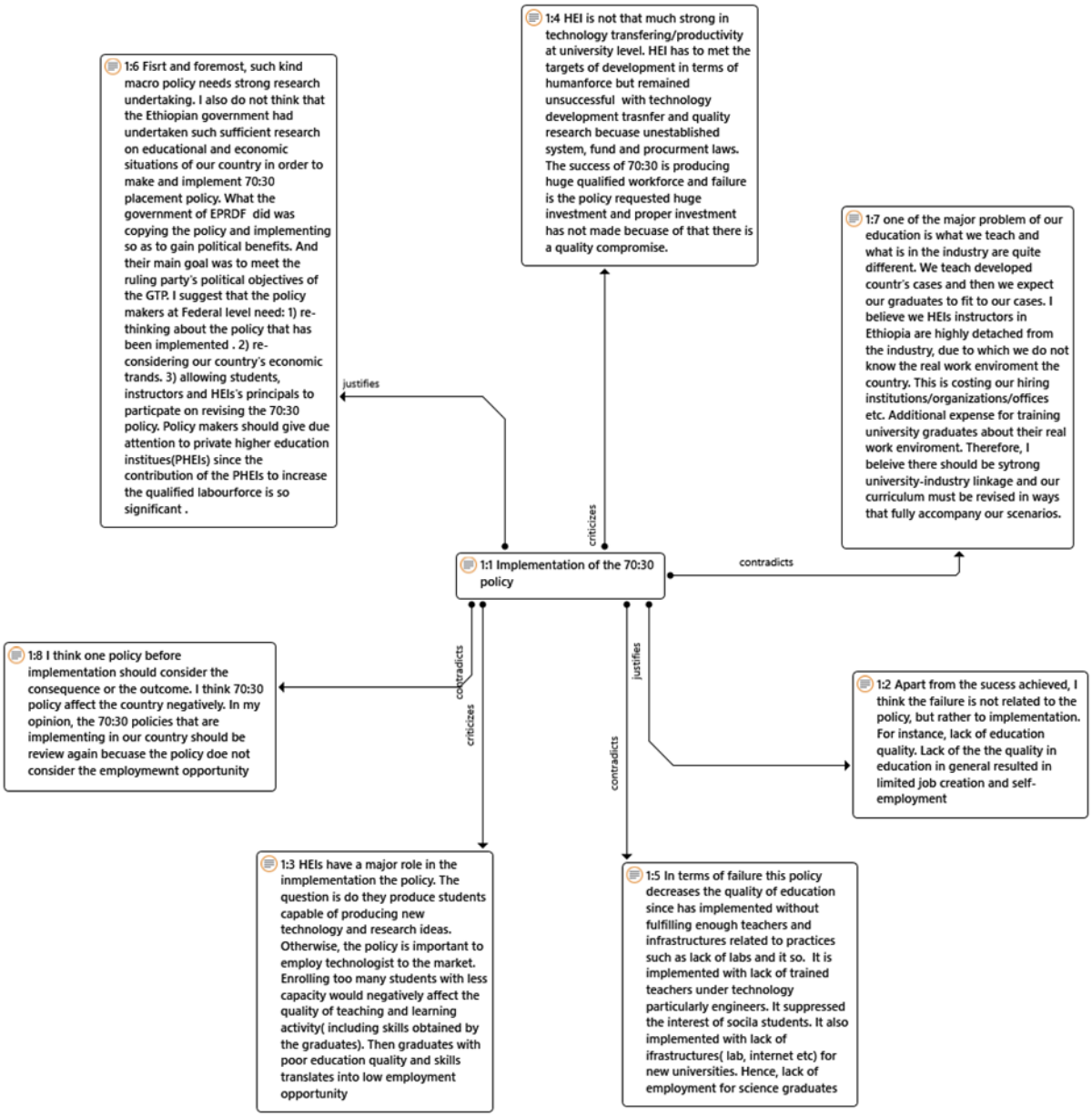


Figure 72 Hyperlinked quotation of Implementation of the policy

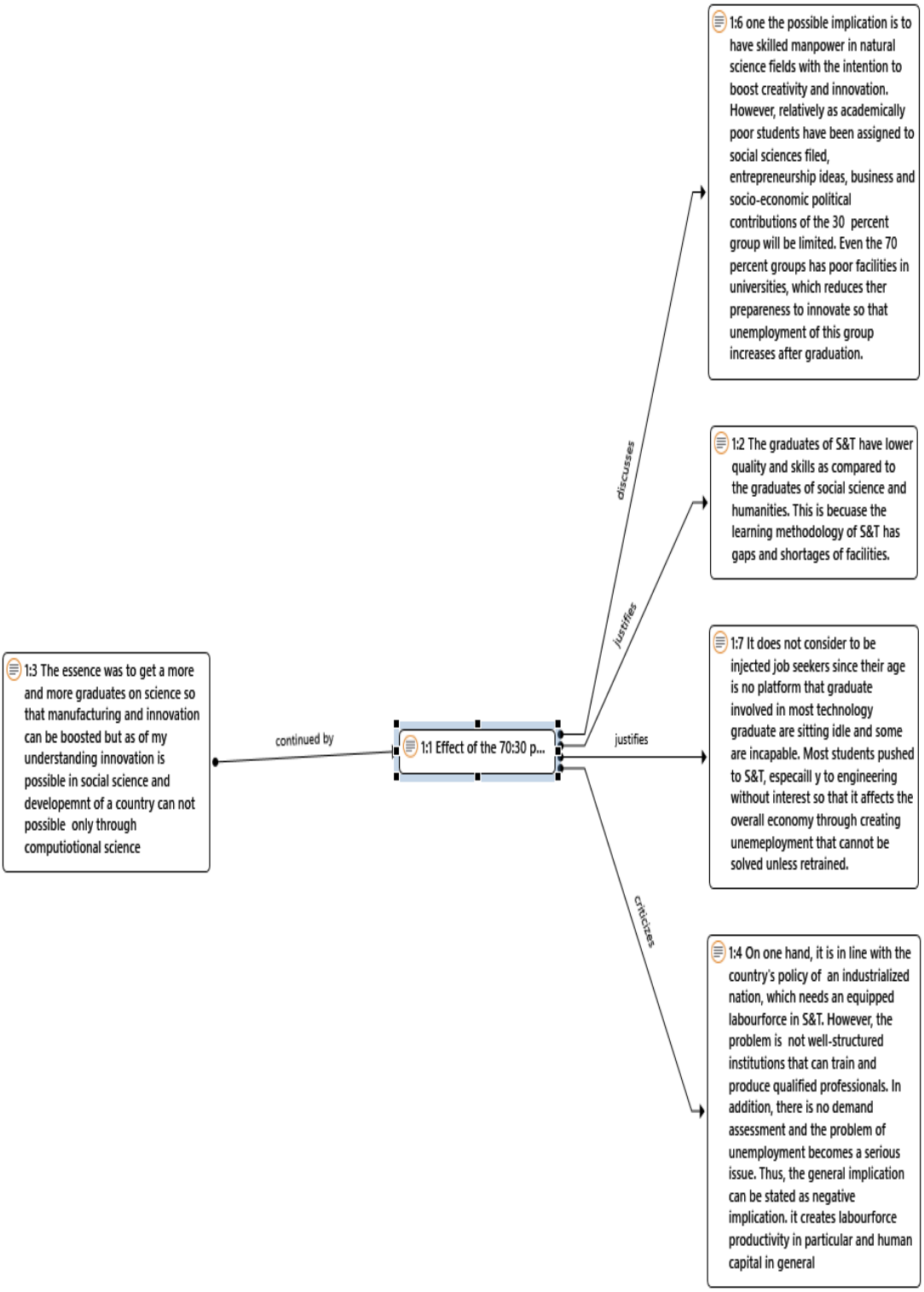


Figure 73 Hyperlinked quotation of effect of the 70:30 policy