

**CLASSIFICATION OF INFORMATION DELIVERY TECHNOLOGIES:
THE STATUS OF S.A. BUSINESS**

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by

ELMA MOORCROFT

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In loving memory of my sister *I/ze Land*.

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I certify that except as noted above the report is my own work and all references used are accurately reported.



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GLOSSARY

Artificial Intelligence (AI): AI is based on heuristics and attempts to apply human-thought-like processing to statistical problems (Lamb 1997).

Business-to-business commerce (B2B): The movement of information electronically between businesses over computer networks. (Wenninger,2000:62). It covers a wide range of electronic activities such as advertising, market research, auctions and trading commodities.

Business-to-customer (B2C): Also known as 'consumer-oriented E-commerce'. It covers a wide range of electronic activities that occur between businesses and customers. The major E-commerce applications for B2C are advertising, trade, transfer of payments, customer service, catalogue sales, shopping malls, and product and market research. (Turban & Aronson, 1998:324).

Clickstream: It is that record of every mouse click or keystroke of every visitor to a Web site (Winter, 2000:1).

Client Server: A relationship between machines in a communications network. The client is the requesting machine; the server is the supplying machine. (Spencer, 1994:89).

Competitor analysis: The analysis of data collected by a business regarding the behaviour of their current and potential competitors. This will typically include analysing competitive barriers and likely responses of the competition.

Customer analysis: The analysis of data collected by a business regarding their customer behaviour.

Data mart: A data mart is a subset of the enterprise-wide data warehouse. Typically it performs the role of a departmental, regional, or functional data warehouse. (Turban & Aronson, 1998: 125).

Decision Trees: A data mining technology which determines causal factors

ranked by their importance, and represents them in the form of a tree, made up of a root, branches and leaves. Decision trees are similar to organisation charts, with statistical information presented at each node (Lamb, 1997: 19).

Descriptive study: Descriptive study tries to discover answers to questions such as 'who?', 'what?', 'when?', 'where?' and sometimes 'how?' (Cooper & Shindler, 1998:11).

E-Intelligence: Enhanced Business Intelligence Systems that exploit the full potential of Internet as sales, marketing and support channel (White, 2000:1).

Exploratory data analysis: is a data analysis perspective and set of techniques. In exploratory data analysis, the data guide the choice of analysis, or a revision of the planned analysis, rather than the analysis presuming to overlay its structure on the data without the benefit of the analyst's scrutiny. (Cooper & Shindler, 1998: 426).

Extranet: The linking of one organisation's intranet to another, usually through the Internet using TCP/IP protocol (Greengard, 1997:31). See definition of intranet below.

Geographical Information System (GIS): A computer-based system for capturing, storing, checking, integrating, manipulating and displaying data using digitised maps. (Turban & Aronson, 1998:243).

Infomediaries: Businesses that capture, manage and maximise the value of consumer information. These companies register customers with the promise that they will receive only those product offerings that are consistent with their interests and needs (Nachtwey, 2000:4).

Internet: A network of organisational internal computer networks. The Internet connects many of these computer networks. Such a connection enables people to access data in other organisations, communicate and collaborate around the globe, quickly and inexpensively. (Turban & Aronson, 1998:303).

Intranet: Is a closed network based on the TCP/IP protocols: it is private, usually restricted to employees of a particular company (Moody, 1997:54).

Knowledge management: A mechanism that makes it easier for people to capture their insights, experiences and judgements so that they can record them and others can benefit (Marshak, 2000:1).

Machine Learning: Machine Learning can be considered a further evolution of AI, because it blends AI heuristics with advanced statistical analysis. Machine learning attempts to let computer programs 'learn' about the data they study so that programs make different decisions based on the qualities of the studied data, using statistics for fundamental concepts, and adding more advanced AI heuristics and algorithms to achieve their goals. (Lamb, 1997:2).

Mailbot: Software programs that scan the text of incoming e-mail and respond instantly and intelligently without human intervention (Goulde, 1991).

Mainframe: A large, expensive computer generally used for information processing in large businesses, colleges and organisations (Spencer, 1994:355).

Market/ Industry Analysis: The analysis of strategic data collected by a business regarding their target market. This will typically include the search for opportunities by analysing trends regarding their product, distribution channels, promotion methods and prices.

Mid-size business: Mid-size business in the USA economy is defined as those with annual sales of between \$20 million and \$500 million and at least 100 employees (Roberts, 1998). Freer (1999) and the Journal of Accountancy (1992) describes mid size companies as companies with annual sales between \$10 million and \$500 million.

Natural Language Processing (NLP): is an applied artificial intelligence technology. It refers to communicating with a computer in English or whatever

language one speaks (Turban & Aronson, 1998: 247).

Neural Nets: Offers the deepest data mining power. Neural nets attempt to build internal representation of patterns found in data, but these representations are not presented to the user. Software tools must be built to make the decisions visible to the user (Lamb, 1997:4).

Resources and Capabilities: The analysis of data collected by a business regarding its internal resources and capabilities with the objective of exploiting them, ensuring that they are fully employed and building its resource base for the future.

Rule induction: Refers to the detection of trends within data sets, or 'rules' about the data. The rules are then represented to users as an unordered list. (Lamb, 1997:4).

Statistics/ Time Series Analysis: see Time Series Analysis.

Strategic decision making: Management decision making regarding strategic issues.

Supply Chain: the sequence of suppliers and organisational buyers that spans all stages of processing from raw materials to final consumers. (Melnyk & Denzel, 1996: 613).

Supply chain management: The analysis of data collected by a business as material flows through the supply chain. The objective of this analysis is to improve efficiencies through the availability of information which provides businesses with the ability to focus on activities that create value for the customer and to eliminate wasteful activities. See also definition of supply chain.

Time Series Analysis/Forecasting: A complicated technology which is used to give statistically accurate forecasting. This is often confused with prediction or simple forecasting, but time series analysis/forecasting is much more complex

and mathematically based (Lamb, 1997:21).

Time/Place communication framework (DeSanctis and Gallupe (1985,1987)):

Classification framework classifying IT communication support technologies into four cells, namely same time/same place, same time different place, different time/ same place and different time different place. (Turban & Aronson, 1998).

Visualisation: presenting the results or intermediate steps of data mining in visual format such as charts and graphs so that users can see patterns (Lamb, 1997:21).

Web or World Wide Web (WWW): The Web is a set of standards for storing, retrieving and manipulating information. To do so, you need a special tool called a 'web browser' running on your computer. Web browsing is the preferred means of accessing Internet Sites (Turban & Aronson, 1998:345).

EXECUTIVE SUMMARY

Problem Formulation

Today's business environment is highly complex as a result of the astonishing technological advances that have taken place over the past century. Information Technology (IT) drives change but also contributes to the management of change. This accentuates the need for business to use IT appropriately. IT must be used not only to increase operational efficiencies but also as a strategic tool to enable business to gain a competitive advantage. There is currently a paucity of information and knowledge regarding IT trends and specific uses. This dissertation is aimed at providing business with insight into a practical tool, the Information Delivery Classification Matrix. This matrix provides a guideline for firms to measure the extent of their use of IT against that of other firms in their industry and to develop databases of trends, thereby enabling them to identify opportunities for both short-term and longer term competitive advantages.

Research Methodology

In this dissertation the current literature was reviewed and then an empirical study of current and future trends, as perceived by IT managers in a wide spectrum of industries, was undertaken.

Results and conclusions

There are clear indications that the biggest IT activity at the moment concentrates on ERP extension software (CRM, advance planning and supply chain management) and e-commerce. Other activities of importance include groupware and business intelligence (BI) implementations.

The implementation of BI was identified as a window of opportunity for South African business since a survey carried out in the United States of America

indicates that there is a tendency to under-invest in BI. BI is the technology that provides business with the tools necessary for survival by providing information in a format that facilitates anticipating, reasoning, learning and innovating in the complex business environment.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Richard, *et al.* (1999) describes the complex environment of business today as a turbulent environment which was created by technological, economic and social change. He then states that the only way to survive is to spend more and to invest more time and resources on anticipating, reasoning, learning and innovating. Another author who holds a similar view for surviving in the new economy is Lattig (1999d) who states that there is a window of opportunity for businesses which realise that if they could bring together all relevant data, analyse that data and then use that data to personalise products and services, they could exceed customer expectations and thereby gain a competitive advantage. All these survival strategies are made possible when information technology (IT) is used as a strategic tool in business. A business, however, must build capacity in its IT capabilities in order to get to the stage where IT can be used as a strategic tool. This dissertation is directed towards the study of a model proposed by Pellissier (2000) which focuses on providing management with a tool to build the right capacity in order to gain a competitive advantage and in effect to survive in the turbulent business environment of today.

1.2 THE INFORMATION DELIVERY CLASSIFICATION MATRIX

The model that Pellissier (2000) proposes is that the software landscape can be presented in four quadrants, each of which has a clear leader in terms of product superiority - Microsoft (office automation - quadrant 1), Oracle (transactional databases - quadrant 2), SAP (system applications - quadrant 3) and SAS (business intelligence - quadrant 4). She also

postulates that the first 3 quadrants are information delivery systems concerned mainly with improving operational efficiencies and that the 4th quadrant is concerned with strategy designed for rapid return on investment and sustainable competitive advantage. The Information Delivery Classification Matrix is a graphical presentation of the software landscape in Figure 1.

"Describe fundamental process in business terms!"

<u>SYSTEM APPLICATIONS</u> (OLTP, especially ERP) EXAMPLES: SAP, Peoplesoft, Baan, JD Edwards, SSA, Rubico	<u>BUSINESS INTELLIGENCE</u> (Information Warehousing and Mining) EXAMPLES: SAS, Hyperion, Cognos, Business Objects
<u>DATABASE APPLICATIONS</u> EXAMPLES: Oracle, Excel, Sybase, Informix, MS Access, Lotus Notes, Dbase, Software AG	<u>OFFICE AUTOMATION</u> EXAMPLES: E-Mail, Desktop Publishing, Word Processing, Facsimile Transmissions, Video Conferencing

Source: Pellissier (2000)

Figure 1: Proposed classification of information delivery systems in terms of cost and ease of implementation

This Information Delivery Classification Matrix can serve as a strategic tool for business to grasp the opportunity to gain a competitive advantage. This matrix makes it possible for organisations to measure the extent of their use of information delivery systems against other organisations in their industry, thereby enabling them to identify opportunities for both short-term and longer term competitive advantage.

The purpose of this dissertation is first to explain the concepts behind the Information Delivery Classification Matrix and then to support this with an empirical study done in 2000 on a wide variety of industries. The objectives of the research are to provide management with an indication of the following:

- The extent to which businesses in SA are using software in terms of the Information Delivery Classification Matrix (Pellissier, 2000);
- Where the tested businesses plan to move in terms of the matrix;
- The strategic features in business intelligence (BI) software which are most important to business;
- Whether top management perceive IT as a strategic tool; and lastly
- IT world trends manifested in S.A.

1.3 DEFINITIONS

Certain terms used in this paper could be interpreted in different ways and in order to provide a better understanding of this dissertation, a glossary of terms is provided. Words appearing in italics in the text are defined in the glossary. In addition there are some important concepts deemed to be of importance at this stage and these are explained below.

1.3.1 Information technology (IT)

IT is a very broad concept and there are many definitions of IT, but the one provided by Senn (1998:12) seems to be the most appropriate and all-encompassing for the purposes of this dissertation. He defines IT as:

.. a wide variety of items and abilities used in the creation, storage and dispersal of data and information as well as the creation of knowledge.

1.3.2 Information delivery systems

According to Pellissier (1999):

The SAS institute (1999) defines information delivery as the end-to-end process of converting raw data, which large organisations have in abundance, into the meaningful information required to support and enhance successful decision making.

It is important to note that in this dissertation the term 'information delivery systems' is often used interchangeably with the term 'software'.

1.3.3 Competitive advantage

Grant (1997:151) defines competitive advantage as follows:

When two firms compete (i.e. when they locate within the same market and are capable of supplying the same customers), one firm possesses a competitive advantage over the other when it earns a higher rate of profit or has the potential to earn a higher rate of profit.

1.4 FURTHER DEVELOPMENT OF THE INFORMATION DELIVERY CLASSIFICATION MATRIX

Based on new information regarding available software and the research findings in this document, an Extended Information Delivery Classification Matrix was developed for a paper presented by Professor R. Pellissier, assisted by myself at the 12th annual conference of the Southern Africa Institute for Business Management Scientists (SAIMS), entitled 'Africa's Century', in November 2000. Following is a graphical representation of the Extended Information Delivery Classification Matrix.

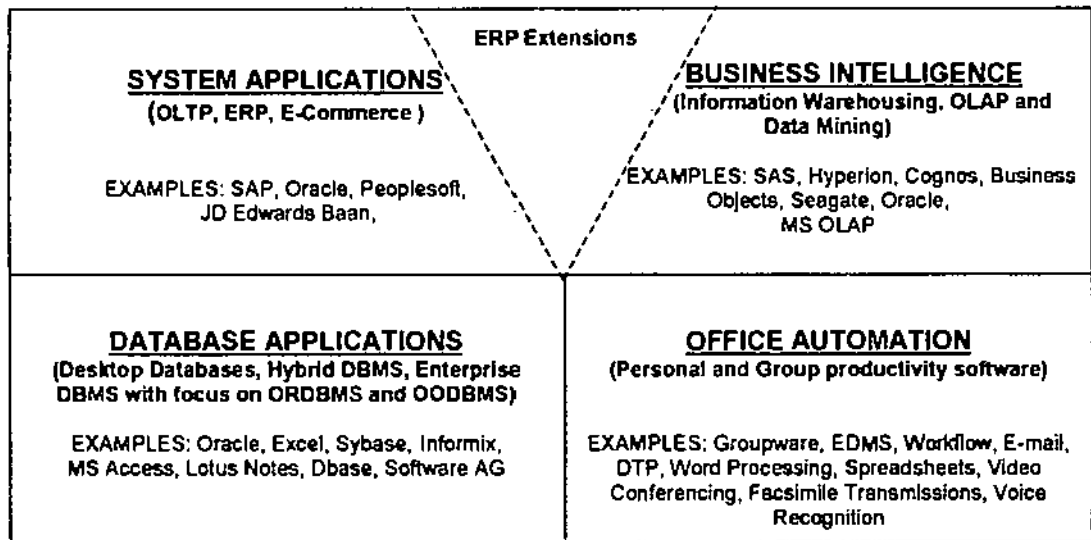


Figure 2: Proposed extended classification of information delivery systems in terms of cost and ease of implementation

1.5 APPLICATION OF THE INFORMATION DELIVERY CLASSIFICATION MATRIX IN STRATEGIC PLANNING

Grant (1997:74) says that:

.. by analysing the competition and demand, one can identify the potential for competitive advantage in a particular industry in terms of the factors that are important in determining a firm's ability to survive and prosper.

With reference to the above statement, the author proposes that the Information Delivery Classification Matrix has two important functions:

- It can be used to analyse the competition in terms of the capacity of their information delivery systems;
- It can be used to analyse the demand as this matrix also provides information on the technology that can be used to monitor customer behaviour.

1.5.1 Analyse the competition

This analysis encompasses two monitoring and analysis actions in terms of the Information Technology Classification Matrix. The one area for periodic review is that of the software industry and more specifically new product developments in the 4 quadrants. The second area is the benchmarking of the information delivery capabilities of rival organisations relative to one's own organisation. The advantage of applying the matrix in this way is that organisations will be able to develop the resource base of their organisation by designing strategies to exploit information technology strengths but also to invest in the preservation and upgrading of its information delivery systems.

1.5.2 Analyse the demand

In an article by Lattig (1999b: 32) he states that the Vice-President of data warehousing at Oracle Inc said ' If you don't know your customer and what they want, you won't stay in business', and the author cannot agree more. This statement emphasises the need to monitor and analyse customer behaviour. The supporting information regarding the Information Delivery Classification Matrix in this dissertation provides management with enough products and vendor names to direct the monitoring and analysis of technology that specialises in customer relationship management (CRM).

1.6 STRUCTURE OF THE DISSERTATION

This dissertation is organised into six chapters.

Chapter 1

In this chapter an introduction, a discussion of the Information Delivery Classification Matrix, definitions and the objectives of the research are provided.

Chapter 2

Chapter 2 provides an in-depth discussion of office automation (quadrant 1) and its components, and also includes information regarding the major vendor products.

Chapter 3

This chapter covers the topic of database applications with an overview of each type of database and the major vendor products.

Chapter 4

Chapter 4 deals with system applications which include, amongst others, on-line transaction processing (OLTP), enterprise resource planning systems (ERP), etc. There is also a discussion of the new trends in ERP, ERP vendors and their products.

Chapter 5

The fundamentals of business intelligence (BI) systems is the subject of Chapter 5. The discussion covers the components of BI, the attitude of business towards BI, new trends in BI and the major BI vendors and their products.

Chapter 6

This concluding chapter provides important information regarding the research methodology used, the analysis of the data and most importantly, the findings of the research.

CHAPTER 2

OFFICE AUTOMATION

2.1 INTRODUCTION

Office automation software is the most basic level of software usage by business and is classified as the 1st quadrant of the Information Delivery Classification Matrix of Pellissier (2000). Spencer (1994:406) describes office automation as the:

.. application of computers and communications technology to improve the productivity of clerical and managerial office workers. Involves the integration of all information functions in the office, including word processing, electronic mail, graphics, desktop publishing, and data processing. The backbone of office automation is a local area network , which serves as pathway between users and computers.

The emphasis of office automation was on personal productivity at the time of writing this definition. Organisations are now realising that substantial synergies can be derived from effective group work. This means that for the purpose of this dissertation, the above definition is expanded to include all software that enhances the efficiency of groups.

According to Pellissier (1999), office automation is one of the categories of software involved with data capturing, time saving and the achievement of day-to-day efficiencies.

Office automation software as discussed in this dissertation includes general accounting packages, word processing, spreadsheets, desktop publishing, electronic mail, electronic facsimile, video conferencing, speech recognition, office integration software, workflow systems,

electronic data management systems and groupware. The aforementioned software will be discussed individually after looking at the historical development of office automation software.

2.1.1 Historical development of office automation software

Industry Week (1984) reported that office automation software surged from fantasy to competitive necessity in 1984. Aspects like labour cost savings and smarter, better informed decisions, faster turn-around time, improved customer responsiveness and smoother staff relationships drove the move towards office automation. *Fortune* (1983) writes that the first generation of productivity tools were word processing and electronic spreadsheets which were introduced in the beginning of the 1980s. These packages were a patchwork of isolated programs. *Industry Week* (1984) says that the creation of second-generation productivity tools came about when software houses started to introduce integrated products which combined spreadsheet analysis, word processing, database management and graphics.

Forbes (1988) reports that this initial integration of office automation was extended to the integration of the corporate computer hierarchy, integration within departments and work groups, and integration of applications on the desktop. Goulde (1991) believes that the reason for this was that management realised that communications were critical to effective office automation in any corporate environment and that if information, once generated, could not be moved about efficiently, the promise of office automation would be an empty one. The office automation products in 1991 ranged from those that supported a limited set of functions such as word processing and scheduling, to those that covered a broad range of functions, including mail, conferencing, document management and decision support.

Goulde (1991) also confirms that office automation software was developed initially to support information-sharing capabilities, but the focus was on personal productivity, distribution and communications rather than on supporting group processes. The latter came later with specific applications such as work flow and document management which formed the building blocks for the subsequent development of groupware.

Forbes (1988) believes that as office automation took off, new demands were triggered such as the incorporation of knowledge systems into office automation products. This is particularly true of techniques like expert systems which mimic the decision-making capabilities of human experts and neural networks that are adaptive systems trainable without programming. One of the first commercial neural simulation applications that we saw was loan risk analysis for financial institutions, with the software doing the job as effectively as the best loan officers.

Forbes (1988) reported that the impact of office automation included faster growth of businesses. *Industry Week* (1984) added that office automation resulted in the elimination of some jobs and changes in focus, work habits, work styles and skills requirements. Every level in the organisation was affected, from professional to clerical workers.

2.2 TYPES OF OFFICE AUTOMATION PRODUCTS

As indicated above, office automation products are now discussed according to certain functions which they automated in the office and which are specifically focused on improving personal productivity, such as general accounting packages, word processing, spreadsheets,

desktop publishing, electronic mail, electronic facsimile transmissions, video conferencing and speech recognition.

The discussion then goes on to the next stage where all these functions were integrated into office integration software and then lastly we discuss the software that evolved from an increased focus on group productivity, namely workflow systems, electronic document management systems (EDMS) and groupware.

2.2.1 General accounting packages

2.2.1.1 Introduction

According to Turban and Aronson (1998), general accounting packages constitute software that facilitates transaction processing of the general ledger, cash book, accounts receivable and accounts payable. Transaction processing systems appeared in the mid-1950s and operated at first on mainframes, later on mini-computers and then on personal computers.

In this section the focus is on general accounting packages which are suitable for small to medium businesses and which are not targeted at business users with huge volumes of transactions and complex accounting tasks.

Early products of vendors such as IBM and JD Edwards could have been classified as just general accounting products but their products have evolved to become full-fledged enterprise resource planning (ERP) systems and one has to classify their current products as belonging to the 3rd quadrant of the Information Delivery Classification Matrix. The vendors that provide products classified as office automation products are mainly in the personal computer and or local area network

environment and they target specifically the requirements of small to medium-size business. Many of these vendors, however, are now offering more and more add-on modules such as automation of orders and inventory control. This is done either by themselves or by third parties. These packages, with all the add-on's, helped medium-size enterprises to automate some of their processes. Viewed as a whole, such a system exhibits some qualities similar to ERP systems which until now were too expensive for medium enterprises. This seems to be changing, however, as can be seen under the discussion of ERP systems. This means that the classification of general accounting packages depends on how business is using the products. However, the author believes that only very small businesses might survive while using only the basic general accounting packages, but that medium-size business will have no choice but to use an ERP system in order to survive in business. It is for this reason that only a few general accounting vendors are mentioned below, although this market consists of many vendors.

2.2.1.2 General accounting software vendors

Accpac, Brilliant and Impact are a few examples of general accounting packages in the personal computing and or local area network (LAN) environment.

2.2.2 Word processing

2.2.2.1 Introduction

According to Spencer (1994:618), a word processor is:

A computer program that provides for manipulation of text. Can be used for writing documents, inserting or changing words, paragraphs, or pages, and printing documents

2.2.2.2 Historical development of word processing

Industry Week (1984) comments that word processing was launched in the 1960s with IBM's magnetic tape typewriter and by the 1980s word processing was the mainstay of office automation. Word processing helped with clerical productivity but not with managerial productivity. It was the personal computer which in the end brought increased productivity to the desks of managers and white collar professionals. Word processing was the primary application on personal computers.

Janus (1986) pointed out that the occurrence of desktop publishing changed word processing forever as it raised the level of expectation of word processing users. The word processor users wanted publishing attributes like typographic capabilities, better integration of text and graphics and advanced formatting features. All this is provided for in today's word processing packages and even more in the graphics packages that form part of the integrated office suites available on the market.

O'Connor (1987) indicated that business started to use group authoring software in 1987 as an add-on to word processing, which facilitated groups working together on the same document. This must have been the start of groupware as we know it today and this is discussed later on.

It is the author's experience that word processing today is still not used by all people in the office. Because of the different generations of people in a business, word processing is still not used by the older members of staff but the author believes that there is an increase in the usage of word processors by managers in their early fifties and younger in general. These are mostly documents generated in a rough format which are then passed to the secretaries for formatting. This method of work as well as the number of users will definitely increase as the use of continuous speech recognition becomes more prevalent.

2.2.2.3 Word processing software vendors

Today word processing packages form part of integrated office software and the word processors most used are Microsoft Word (Part of MS Office), Corel Word Perfect (Part of Corel Office Suite) and Ami Pro (Part of Lotus Smart Suite).

2.2.3 Spreadsheets

2.2.3.1 Introduction

According to Spencer (1994:544), a spreadsheet is:

A program that uses a matrix consisting of rows and columns to perform calculations on numerical data.

2.2.3.2 Application of spreadsheets

Spreadsheets are widely used in most businesses. Turban and Aronson (1998) describes the applications of spreadsheets as being able to perform both simple and complex financial, statistical, mathematical and scientific calculations. There are also spreadsheet add-in's available for specific applications, for example Solver and @Risk for simulation studies. Apart from the applications mentioned above, spreadsheets are

also used as databases. Other features include integrated graphics, the programmability of command sequences into macros, 'what-if' analysis and goal seeking. Spreadsheets also provide fairly seamless integration to other databases, spreadsheets and word processors. In fact, spreadsheets have evolved into an important tool for analysis, planning and modelling.

2.2.3.3 Historical development of spreadsheets

Fortune (1983) referred to VisiCalc as the 'granddaddy' of spreadsheets. Lotus 1 - 2-3 was the most widely used spreadsheet in the DOS environment. This market changed in favour of Microsoft's Excel when users all over the world moved to the Microsoft Windows operating system and started to use Office suites which grouped together word processors, spreadsheets and graphic applications.

2.2.3.4 Spreadsheet software vendors

Turban and Aronson (1998) maintain that the most popular spreadsheets are Microsoft Excel and Lotus 1-2-3.

2.2.4 Desktop publishing (DTP)

2.2.4.1 Introduction

Seachrist (1992) describes DTP products as specifically designed software packages that mix text and graphics in one document with the ability to send the result to a laser printer. Today spreadsheets, databases, word processors, presentation graphic software and DTP packages and more can fit into this definition. This illustrates the fact that the uses of software that aids the publishing process are extremely

diverse. For the purpose of this classification the author concentrates on the professional DTP products.

2.2.4.2 Application/features of professional DTP software

The features of a professional DTP package include, amongst others, image editing, photo retouching, databases of high resolution photos, clipart images, fonts, rotating, skewing and flipping of text, etc. Probably the most important feature is that DTP packages can handle extremely long documents. The leading DTP package, QuarkExpress, can handle documents 2000 pages long, or 2 gigabytes (Quark, 2000)!

2.2.4.3 Historical development of DTP

Janus (1986) predicted that it would soon be difficult if not impossible to distinguish a DTP package with word processing capabilities from a word processing program with sophisticated formatting typographic capabilities and integrated graphics abilities. This prediction was realised to a great extent when integrated packages like Microsoft Office and Lotus Smart Suite appeared on the market because it is true that the word processing packages can fulfil most of the DTP requirements of business. More complex graphics and or presentation requirements are accommodated by graphics packages like Powerpoint (Part of Microsoft Office) and Freelance (Part of Lotus Smart Suite). There are, however, certain business needs like the publication of annual financial statements, long and graphic-rich operational manuals, to mention but a few examples, that can only be accommodated effectively by professional publishing software packages and these packages are the focus here.

2.2.4.4 Professional DTP software vendors

Grotta (2000) says that the professional DTP market is owned by Quark with QuarkXpress. Adobe with InDesign, Photoshop, Illustrator, Acrobat and PageMaker Plus are providing stiff competition, however. According to Corel (2000) other major players are Corel Ventura, PageMaker (Aldus Canada Ltd) and FrameMaker (Frame Technology Corp).

2.2.5 Electronic mail (e-mail)

2.2.5.1 Introduction

Spencer (1994:203) defines electronic mail as:

The process of sending, receiving, storing and forwarding messages in digital form over telecommunications facilities.

2.2.5.2 Application of e-mail

Goulde (1991) describes e-mail as an application that routes messages to multiple users, predefined mailing lists or groups. All of the packages allow for the saving of messages to folders. Security is provided by password access. Some packages include graphic editors in addition to text editors, bulletin-boards-system support, conferencing capabilities, remote user access, automatic message forwarding and provisions for file attachments.

2.2.5.3 Historical development of e-mail

Miller (1994) comments that e-mail has been around for more than 20 years. It started with the mainframe systems such as IBM's PROFS. The use of internal e-mail systems became more popular when companies started to install local area networks and at that time the e-mail market was dominated by Microsoft mail and cc:Mail from Lotus.

Moore (1999) reported that Microsoft abolished MS mail and provided Exchange Server which is an enterprise e-mail system with built-in workflow features. Lotus, on the other hand, combined the best features of cc:Mail and Lotus notes (groupware product) into a product called Lotus Notes/Domino which is a complete corporate groupware, application development and application delivery system solution with specific focus on the development and hosting of *Internet* and *intranet* applications.

2.2.5.4 New trends in e-mail

(i) E-mail as a workflow and document management tool

ComputerWorld (1999) reports that there is now a trend for third-party developers to develop document management and group collaboration tools on Exchange or Domino as a platform. Examples are PortalSoft Technology Inc.'s sales and project-tracking application and Eastman's suite of imaging and document managing software. It is interesting to note that the third party developers are concerned that Microsoft or Lotus may add to Exchange or Domino the features that third party developers are currently developing. This is an indication of how these products might develop in the future.

(ii) E-mail and customer service

Gunn (1995) suggests that e-mail has grown phenomenally, especially if one is doing business on the Web. E-mail is a good way of staying close to your customer and customers like e-mail because there is no per minute telephone charge while holding on for a customer service representative. This has led to companies being bombarded with e-mail from valued customers and in order to address this problem, robots have

been developed for the Web. Goulde (1991) explains that the way it works is that the '*mailbot*' intercepts messages to a particular address and, for example, sends a message back acknowledging receipt, giving information and re-routing the e-mail to the most relevant person for further action.

Goulde (1991) discusses an example of an automated response system named BeyondMail that uses BeyondRules, an application language, to perform everyday e-mail tasks like sending a copy of the latest advertising budget to certain users when they request it. BeyondRules can function as a foundation for groupware where rules are set up to scan on-line news services for certain keywords and sort them by subject matter into items that are then forwarded to the appropriate people. There are still certain limitations as natural language understanding has not yet developed as far as speech recognition, which results in customers not getting meaningful responses.

Shaffer (1999) believes that customer service without human intervention is the wave of the future and we are seeing developments in customer interaction, call centre automation and message routing. Vendors and software in this market are Kline Server from Big Science of Atlanta, Adante of Carlsbad, Egain Communications and Ask Jeeves, to name a few.

Both Shaffer (1999) and Gunn (1995) contend that the opportunity in customer service without human intervention lies in a company being able to reduce the cost of customer support. Automated e-mail is also an excellent option when one wants to serve one's clients at a time convenient to them.

(iii) E-mail and mobile Workers

Thomas (1999) writes that e-mail, together with mobile phones and laptop computers, has created a new breed of employees called mobile workers who do their office work at home or anywhere. In the US one-tenth of the workforce is already without a fixed place of work. American business is way ahead of Europe in this regard.

Thomas continues to add that the benefits of this trend are that staff spend less time travelling, organisations save on expensive office space and productivity is boosted. However, there are costs like loneliness, lack of communication, complexity of control, an erosion of corporate culture and high job turnover. The real test for all the relevant technologies will be how they can replicate human contact, but people are also adaptable and should get used to it. A new tendency is for informal groupings of mobile workers to spring up in social places like cafés.

Thomas (1999) also pointed out that it is essential to collect information about the customer on the ground, in a service economy where information trends and customer satisfaction are crucial. Mobile working complements this.

2.2.5.5 E-mail software vendors

The most popular LAN based e-mail products are Microsoft Exchange Server and Lotus Domino Mail Server. Pompili (1999) reports that the Domino Server does ship in three versions namely Domino Mail Server for messaging only, Domino Application Server for developing custom Notes and Web applications, and Enterprise Server which clusters Domino servers. Other mail applications are Eudora mail, Groupwise and Pegasus.

2.2.6 Electronic Facsimile

2.2.6.1 Introduction

Spencer (1994:221) describes traditional facsimile machines as:

The use of computer technology to send digitised text, graphics and charts from one facsimile machine to another.

In this context the fax is sent by a personal computer (PC) to another PC facsimile or traditional facsimile machine. Many people believe that facsimile technology is dead but Banker (1999) reports that large companies still spend up to 40% of their phone bill on faxing which means that for the time being, the facsimile forms still part of office automation. Another reason why facsimile is still going to be with us for a while is given in an article by *Purchasing* (1999) in which it is said that faxes are still used to convey urgent messages because of the real time functionality and confirmation capabilities involved. As this dissertation focuses on medium to big business, the focus here is on high volume corporate faxing which is normally facilitated by a fax server which can be part of the file server or a dedicated machine on a LAN that manages all of the organisation's incoming and outgoing faxes.

2.2.6.2 Features of electronic facsimile

Berinato (1997) says that the most common features of fax servers are:

- fax management such as routing of faxes within the organisation, keeping a log of sent faxes and received faxes, and notification of faxes that remain unread after a certain period,
- automatic fax-back functionality which, according to Gunn (1995), is effective when customers/dealers call in and select from a voice-mail

style menu of options the information they need (e.g. price lists). The fax-back system then automatically sends the relevant document.

- least cost routing which includes sending faxes via the Internet or at times when reduced telephone tariffs are applicable, or via a closed network to a phone line that is closer to the fax destination, or via the optimum path that reduces the phone bills,
- dissemination of faxes to a number of destinations simultaneously,
- load balancing where a fax server shares part of its load of faxes with another fax server on the LAN in order to speed up the transmission process.

Fax servers have gained acceptance because of cost savings but in this author's view, one of the most important advantages from an office automation viewpoint, is that an employee can prepare documents with virtually any word processor and save a lot of time when sending the same fax to multiple destinations. Moreover, all this is done in an instant which, as Berinato (1997) points out, cuts down on a lot of wasted time when people have to sit and wait for the fax machine. The other advantage which will become more pertinent when business intelligence is discussed later on, is that fax servers products are now linking into other systems in the organisation such as ERP systems (*PC Week*, 1999).

2.2.6.3 New trends in electronic facsimile

Internet faxing is a relatively new technology and with the promise of substantial cost saving, should become more important. There are currently two standards in Internet faxing according to Kern (1999) and that is real-time Internet faxing (T.38) and store-and-forward (T.37) both with their own advantages and disadvantages. Kern says that there are

more deployments of the store-and-forward standard but believes that the real-time Internet faxing will become more prevalent.

2.2.6.4 Electronic facsimile software vendors

Examples of the major fax server software packages are RightFax (by Right Fax Inc.), WinFax Pro (by Symantec) and Gold-Fax (by DPD International). All these products provide for tight integration to e-mail, and Microsoft Outlook and Microsoft Exchange are specifically mentioned in their product overviews.

2.2.7 Video conferencing

2.2.7.1 Introduction

PC User (1996) states that video conferencing systems combine audio and video to help users in different offices work together on projects. Spencer (1994:572) describes it comprehensively using the term 'teleconference' as follows:

A conference among people remote from one another who are linked by telecommunications devices. Considered an alternative to travel and face-to-face meetings, a teleconference is conducted with two-way video, audio, and as required, data and facsimile transmission.

Turban and Aronson (1998) contend that the major benefits of video conferencing are, as suggested above, the face-to-face communication between people from different locations, simultaneous communication by several people, the use of different types of media to support conferencing and the use of voice which is more natural than the keyboard.

2.2.7.2 Application of video conferencing

Turban and Aronson (1998) see video conferencing as a supporting tool for collaboration between people, especially people working in same time/ different place of the *time/place communication framework*. This technology allows users to work on the same document, sketch on a collaborative whiteboard, exchange data files and talk in real time with colleagues scattered around the world. Video conferencing is definitely one of the most important developments to support groupware software, which is discussed later in this chapter.

2.2.7.3 Historical development of video conferencing

Turban and Aronson (1998) point out that the first generation of computerised video conferencing was conducted in special rooms with large screens, cameras and coder/recorders but that the technology has now moved to the desktop using special equipment such as PC videophone and LANs. Behr (1997) suggests that video conferencing on the Internet is expected to grow as the technology matures since it promises to save even more money.

2.2.7.4 Video conferencing software vendors

Desktop video conferencing software ranges from high-end systems to low-end systems and there are numerous players in this market. VocalTec Inc, Intel Corp, IBM, Lucent Technologies Inc, and PictureTel Corp are mentioned as some of the companies with video conferencing products. The available Internet conferencing tools named by Bradley and Hilvert (1997) merit special mention. They are Netscape Conference, Microsoft NetMeeting and Simplecomputing's AudioVision. This seems to be the area where video conferencing is likely to grow the most.

2.2.8 Voice recognition (speech recognition)

2.2.8.1 Introduction

Turban and Aronson (1998:252) describe voice recognition or speech recognition as:

the process of having the computer recognise the normal human voice.

Turban and Aronson (1998) state that voice recognition consists of recognition of words and understanding of speech.

2.2.8.2 Application of voice recognition

Voice recognition starts off with voice input to a microphone. The speech signal is then converted into binary words which are then compared to previously stored binary representations of words and phrases. When a binary word is matched then speech recognition is achieved and the spoken word appears on the video screen or is passed along to a *natural language processor* for meaning analysis.

Examples of practical applications of voice recognition are given by Turban and Aronson (1998) such as dictation of documents, computers answering enquiries about reservations, providing price information and notifying people of emergencies detected by sensors.

2.2.8.3 Historical development of voice recognition

Voice recognition can be classified (Turban & Aronson,1998) into systems that recognise individual words and others that recognise continuous speech. The systems can also be further classified as speaker-dependent or speaker-independent. The word recogniser and speaker-dependent systems are less complex and less costly than the continuous speech recognisers and the speaker-independent systems.

These systems have only recently become more affordable and the development has advanced far enough for us to see an increase in its commercial use.

2.2.8.4 Voice recognition software vendors

Computer Shopper (1998) opines that the main vendors are Dragon Systems (NaturallySpeaking), and IBM (ViaVoice). *The Asian Review of Business and Technology* (1997) reports that IBM's VoiceType technology can convert speech to text at up to 100 words per minute and at 97% accuracy. The system also records dictation.

2.2.9 Office integration software

2.2.9.1 Introduction

The integration of all the stand-alone software packages was a major step towards improving personal productivity across all levels of workers in the office and it also laid the foundation for the development of all the software that is discussed below. Spencer (1994: 304) describes office integration software as:

An applications software package containing programs to perform more than one function. A package typically includes related word processing, spreadsheet, database and graphics programs. Since the information from the electronic spreadsheet may be shared with the database manager and the word processor (and vice versa), this software is called integrated.

Forbes (1988) confirms this in his article indicating that the most common features of integrated systems include word processing, spreadsheet analysis, graphics, database management, e-mail and the ability to add third-party business applications.

2.2.9.2 Application of office integration software

This integration of software packages like word processing, spreadsheets, etc., supported the trend towards decentralised management, vast volumes of data and the rapid spread of technology. The objective of this was to provide users with tools that facilitate the automation of almost everything they need to accomplish in carrying out their daily tasks. Strom (1988) elucidates further that the benefits of office integration software are that the software allows for the automation of entire procedures and the simplification of data processing. An example of this is where workflow automation or automatic project management facilitates a manager's communication of specifications and deadlines, directly on users' screens. Completed tasks are immediately sent on to other users' workstations and where deadlines are not met, e-mails will be triggered to people to whom the relevant users report. This level of automation deals with personal productivity but the integration results in increased group productivity. Another benefit of integrated software modules is derived from the consistent user interface among all the products. This results in ease of learning, coupled with a tremendous saving in training time and costs.

Lockwood (1990) indicates that the integrated office platforms aim to provide a computing environment that turns the PC into something more than an 'information-crunching communications hub'. They enable users to tap into, exploit and disseminate company information electronically across departments, hierarchies and locations.

2.2.9.3 Historical development of integrated office software

According to Lockwood (1990), integrated office software started off in the mainframe arena with IBM-Office Vision, which was a collection of software that provided IBM mainframe and AS/400 users with a

calendar, e-mail and diary-keeping function. Fawcett (1994) reported that by 1994 IBM had provided users with a more scaleable office system that operated on a LAN.

Higgins (1992a) listed other examples from the mainframe arena, namely HP's Cooperative Computing Solution for the knowledge worker which replaced the original product, NewWave. Other examples of the earlier integrated office software are cited by Fortune (1983) and Strom (1988) as IBM's PROFS, AT&T's Rhapsody, Wang Laboratories' Office, NCR Corp's Cooperation and DEC's All-in-1 for Mini Computer.

Regarding the personal computing environment or LAN, Goulde (1991) writes that one of the first integrated office software products came from the Higgins company, namely Enable Software. Higgins (1991) reported that not very long after that, Microsoft and Lotus initiated strategies known as 'Information at your fingertips ' and 'Working Together ' respectively which promised most of the functionality of the integrated office integration software as developed by the mainframe vendors.

2.2.9.4 Integrated Office software vendors

Today Microsoft dominates the integrated office software market for personal computers with their Office Suite followed by Lotus's Smart Suite and Corel Office Professional Suite.

2.2.10 Workflow Systems

2.2.10.1 Introduction

Turban and Aronson (1998: 314) describe workflow software as:

.. a powerful business process automation tool that places systems controls in the end user departments. It is highly flexible and can be designed to automate almost any information processing system.

2.2.10.2 Application of Workflow Systems

Turban and Aronson (1998: 314) classifies workflow software into three types:

- *Administrative: These include expense reports, travel requests and messages.*
- *Ad hoc: These include product brochures, sales proposals and strategic plans.*
- *Production: These include credit card mailings, mortgage loans and insurance claims.*

Turban and Aronson (1998) also opine that the main purpose of workflow systems is to automate capabilities by providing end-user features such as tracking, routing, document imaging and other features in order to improve business processes. This means that workflow covers the routing of documents and encompasses the movement of data within groupware applications such as Lotus Notes. Dykeman (1998) adds that a major advantage of workflow tools is that they support organisations in proactively compressing and automating business processes, and in developing and managing these processes. Another advantage mentioned by McCusker (1993) is that workflow software moves a process from stage to stage, making sure that the task is completed in the correct order while reducing paper usage and shortening resolution time.

McCusker (1993) claims that workflow software works best when implemented in conjunction with re-engineering. This is particularly true when the workflow software has measurement and analysis features included, because this enables users to measure how long it takes for things to happen relative to whatever re-engineering strategies are employed.

2.2.10.3 Historical development of workflow systems

McCusker (1993) says that most workflow tools developed out of document imaging systems, but some come from vendors of forms-generation and e-mail products.

According to Dykeman (1998) the new trend in workflow systems is called 'wide-area-workflow' and this is where the workflow engine is more independent of the user environment and interacts with the business environment via e-mail, Web interfaces or the telephone. An example of such an application is where the system checks and notifies a representative wherever the person is that an insurance application submitted by him/her is incomplete. Previously a workflow clerk would have had to contact the relevant representative for the missing information. This article also predicts further developments in areas such as *geographical information systems* (GIS) and sophisticated visual process models. Many workflow software packages are now Web-based and incorporated in groupware.

2.2.10.4 Workflow systems vendors

Workflow systems range from high-end systems to low-end systems and there are numerous players in this market. Action Technologies' Action Works Metro and Ultimus's Workflow suite are mentioned as suitable for a great variety of forms and complex approval cycles whereas Jetform

Corporation's InTempo and Keyfile Corporation's Keyflow are appropriate for simpler workflow processes. There is also a trend that some of the vendors, not in the traditional workflow market, also provide workflow tools within their existing products and an example here is Lotus Note's workflow tools.

2.2.11 Electronic document management systems (EDMS)

2.2.11.1 Introduction

According to Goodfellow (1999:25) an EDMS is generally defined as

A system for capturing, indexing, storing, tracking revisions and providing controlled access of electronic documents. The most common types of documents within a EDMS are word processing files, but other types of electronic files can also be stored within a system.

2.2.11.2 Application and new trends in EDMS

Goodfellow (1999) explains that EDMS systems can either be performed automatically behind the scenes or manually, in which case the user is required to file each electronic document. What happens in effect is that when a user is ready to save a document, an expanded version of the 'save' dialog box appears which requires additional information. Information like date, time and document author is usually captured automatically.

The real power of EDMS is the ability to search across department boundaries, which facilitates timely access to the latest revisions of critical documents. Most systems have incorporated document imaging into their system. The trend towards incorporating the Internet and *intranet* with EDMS expedites access to document repositories around the world. Another trend in EDMS is to use intelligent searching of document repositories and tie this together with other information

sources such as corporate databases, ERP systems, and e-mail and groupware systems.

2.2.11.3 EDMS vendors

Goodfellow (1999) says that one of the pioneers and industry leaders in the world of EDMS is PC Docs/Fulcrum. Xerox is another vendor with a low cost strategy with DocuShare as their product. Goodfellow (1999) also reports that the number of vendors offering EDMS is estimated to be more than 70, but the Gartner group believes that this will change to four major players and 16 niche players by the end of 2001.

2.2.12 Groupware

2.2.12.1 Introduction

Groupware uses all the office automation software discussed so far, some to a lesser degree but some, like workflow and EDMS, to a greater extent. Turban and Aronson (1998: 312) describe the term 'groupware' more formally as:

Software products that support groups of people engaged in a common task or goal. The software provides a mechanism to share opinions and resources.

The current interest in groupware (Goulde 1991) is being driven by the pursuit of enhanced work group effectiveness. The reason for this is that business has realised that personal productivity does not necessarily lead to improvements in either group or enterprise productivity and effectiveness.

Vaughan-Nichols (1991) maintains that the key to the long-term success of groupware is fast execution speed and tight integration amongst products that provide e-mail, remote connectivity and easier access to

data functionality. This means that if you have connectivity with everyone in the company, vendors and customers, then you can work as a team that is blind to organisational boundaries and technological differences, which offers a better chance of improved productivity.

2.2.12.2 Application of groupware

Goulde (1991) opines that the key functions for work group computing are e-mail, information sharing, document management and office automation. The software foundation of groupware is e-mail that facilitates communication in text. Another vehicle for communication is video conferencing which is important to help tap the workgroup's creativity. Scheduling is also a supporting tool for setting up meetings and a recent trend is to structure meetings for increased productivity by using techniques such as electronic meeting techniques (Robbins, 1998) to filter out personalities. Group decision tools can be useful, for example Expert Choice and CM/1.

Specific applications of groupware

Stevenson (1993) indicates that some of the groupware packages focus on managing information through data storage, data tracking, open discussions and messages. An example here is a corporate customer support system which consist of routing the help requests, archiving the solved problems and solutions and then supporting staff discussions and messages.

Stevenson (1993) also mentions an interesting groupware product called GrapeVINE that takes a different approach to groupware. This product essentially collates topics of interest from all incoming information and then routes the information to the appropriate people.

Kramer (1999) discusses the application of groupware as a tool for project management. Groupware is the natural tool for teams to co-ordinate project schedules, sort out the details of project documents and keep team members up to date. The desire for external partners to take part created the drive for Web-based collaboration. A new feature by Lotus called 'instant messaging' streamlines communications by enabling team members to see who is on-line. This accelerates reaction time because team members can communicate in quick-chat format rather than drawn-out e-mail messages.

Knowledge management is also a natural application for groupware according to Kramer (1999), because knowledge management is a mechanism for collecting and distributing information dispersed in corporate documents from internal file systems, databases and the Internet. Both Microsoft and Lotus invested heavily in search engines that build collections of documents from the aforementioned sources.

2.2.12.3 Historical development and future challenges of groupware

Miller (1994) reported that the first applications of groupware were simply traditional word processors, spreadsheets and graphic programs augmented by workgroup features. An example was spreadsheet features that allowed multiple user updates of particular ranges over a network.

Today groupware has many applications as discussed in the previous section. Kramer (1999) believes that the next hurdle for the groupware vendors and organisations is to find a way to track employee knowledge. The author believes that in order for this to work, organisations themselves will have to actively foster a culture of learning and

knowledge sharing, and only then will groupware systems facilitate the integration of an employee's knowledge into the existing groupware systems.

One of the problems with groupware is that many companies use it for little more than e-mail. It is therefore important for organisations to realise that groupware is only a tool that helps users to work as a team and that employees have to be ready to use this tool. This means that users will have to be made aware of the benefits of sharing information and re-engineering processes for the group. Only then will groupware enhance group efficiency and effectiveness.

2.2.12.4 Groupware vendors

Kramer (1999) reports that the three leading groupware server software packages are Lotus' Domino/Notes, Microsoft's Exchange and Novell's Groupwise. Third party developers are developing specific groupware solutions for the aforementioned groupware servers. An example is Eastman Software's Workflow that has document management, discussion and contact management on top of Microsoft Exchange. E-room from Instinctive Technology lets users share documents, hold discussions and conduct surveys. There are also Web-based project planning tools like Open Text, Livelink Internet and Inovie Software's Teamcentre.

2.3 CONCLUSION

There has been tremendous improvement in the office automation products since the early 1980s when the focus was on personal productivity, to a more group-oriented focus today. Pellissier (1999) believes that most organisations have invested in most of the office

automation products and it is the aim of the author to prove this with research which forms part of this dissertation.

The most important developments in this quadrant are workflow, video conferencing, EDMS and groupware and it is important for South African businesses to realise that successful businesses are those that know how best to harness the creative energies of workers loosely organised into ad hoc teams. Groupware, workflow, video conferencing and EDMS, if used to their full potential, can assist organisations in creating effective and efficient work teams by bringing together valuable information and the best and most relevant skills for the particular project. All this is done independent of location. Stevenson (1993) believes that these software packages can also facilitate the flat organisational structures that are so necessary to meet the rapidly changing needs of today's business climate. This means that the only office automation products in South Africa that can help business gain competitive advantage are groupware, workflow, video conferencing and EDMS, if applied correctly. The rest are used by all medium and big business in South Africa and provide only comparative advantage.

Another interesting phenomenon that emerged from the above research was that products such as EDMS and groupware and, to a lesser extent, workflow, exhibit database features which constitute the subject of discussion in the next chapter. This is in line with Pellissier (2000,76) who states that:

.. there is evidence that the products in the different quadrants of the matrix, are continuously improving and competing with those in the other quadrants.

CHAPTER 3

DATABASE APPLICATIONS

3.1 INTRODUCTION

The 2nd quadrant of the Information Delivery Classification Matrix is database applications and Turban & Aronson (1998: 80) define a database as:

.. a collection of interrelated data organised to meet the needs and structure of the organisation and can be used by more than one person for more than one application.

They explain further that the database management system (DBMS) is the software program that creates the database, allows for easy single access to the database and facilitates the adding, updating, deleting, manipulating, storing and retrieving of data. The term database in this dissertation will be used interchangeably with DBMS.

In the sections that follow the concept of databases will be further explored by looking at the application, benefits and problems of databases followed by a discussion of the historical development and future trends of databases. This chapter will then conclude with a discussion of the types of databases and the major players in the respective markets.

3.1.1 Application of databases

Haskin's (1999) description of databases as highly structured programs that manage a wide array of information, is a very apt one.

The essence of databases is the collection of data and as Turban & Aronson (1998) explain, the data in databases comes from many different sources, some of which are:

- Internal sources like transaction processing systems and operational data from functional areas,
- external sources such as marketing research data, industry data, etc. and
- private data such as assessments of situations.

The biggest database applications today are mission-critical, transaction-processing databases that operate on mainframes and lately mainly in the client server, personal computer environment. The smaller to medium databases are normally customised transaction-processing or record-keeping databases of certain functions within a business.

Databases also form a base from which data is extracted and used in other applications such as ERP and BI systems. This is where the real power of databases lies, namely when data is extracted in a format that provides the user with knowledge about relationships and trends of variables that improve decision making.

3.1.2 Benefits of databases

A DBMS provides many benefits to business. The major ones are listed below:

- Databases supplement the standard operating systems to allow for greater integration of data, complex file structures, quick retrieval and changes and better data security (Turban & Aronson, 1998).
- A DBMS can serve several applications efficiently by centralising all the data and thereby minimising redundant data. This in effect makes

the management of data more effective by facilitating centralised control and security of data (Laudon & Laudon, 1997).

- A DBMS provides a way to manage the information overload of business by facilitating the data to be queried and displayed in many different and meaningful ways in support of decision making.

3.1.3 Problems with databases

Many problems are encountered in the implementation of databases, some of which have been addressed or ameliorated with complementary technologies. When implementing a DBMS, one must consider issues such as the following:

- The quality and integrity of data are paramount as these determine the value of a database in the first place (Turban & Aronson 1998).
- With the implementation of a new DBMS, connectivity and compatibility problems are always an issue.
- The author believes that there are not enough skilled people who understand both business and DBMS well enough to meet the demand for the development of optimum DBMS as and when they are needed.
- DBMS implementation times and implementation methods need to be managed for optimum benefit.
- The dynamic business arena makes specifications for systems redundant at an alarming rate. The same can also be said regarding the growth of user needs during the development of new systems.
- Newer technologies in the DBMS arena, like object-oriented database management systems (OODBMS), lack mature international standards (Larson, 1995).

3.1.4 Historical development of, and Future trends in database software

According to O'Neil (1994) there are a number of different approaches to structuring access to information in a database and this has had a profound influence on the development of databases. The first approach, as reported by Turban and Aronson (1998), was that of the hierarchical database model which arranged data items in a top-down order, creating logical links between related data items. These databases were accessed by using an indexed sequential access method which stored all data in one large file with additional files called 'indexes' that speeded up data access.

Another database model of the same period was the network or CODASYL database with a structure similar to the hierarchical database, but with a set of records in one layer that might have two different containing hierarchies in the next layer up. This feature allowed the networked model to represent certain real world data structures more easily than was possible with the hierarchical model.

According to Shaw (1988), the real break-through in data structuring came with relational database management systems (RDBMS) which store data in smaller files (tables) making it easier to keep data consistent and to maintain it. The RDBMS is viewed simply as a collection of tables, each composed of one or more columns and zero or more rows. The means by which tables are stored and retrieved are hidden from the user. This was a major breakthrough as much larger databases could now be constructed with the elimination of many copies of the same data in the system. It also allowed users to tailor data more precisely to their specifications.

Zarley (1986) reports that the RDBMS are designed around structured query language (SQL), a querying method developed by IBM used in

their DB2 *mainframe* database. The American National Standards Institute (ANSI) ratified SQL as the standard relational database language in 1986, according to Shaw (1988). He goes on to add that the trend in 1986 was that many individual departments within large corporations had their own computing solution which ran on different platforms like DEC VAX, IBM *mainframes* and Apple Macintoshes. This caused tremendous problems whenever managers needed integrated information from all these different platforms. Freedman (1987), however, pointed out that distributed database management systems solved this problem by providing access to databases that are dispersed across a network of computers. The distributed database management systems automatically conduct the search through the maze of databases and then transmit the needed information to the user, creating the impression that information is stored on one PC only.

The next development was reported by Rauch-Hirdin (1988) as that of LAN DBMS servers which became the principal storage media for local databases. Freedman (1989) concludes that the advent of LAN database servers provided a cost-effective alternative for minicomputers and *mainframes* for mission-critical and departmental applications. Database servers improve performance by centralising departmental database operations and data-integrity functions on a network server, leaving each PC free to process only data access and query applications.

The next major event in the database arena came about when the object- oriented database technology was launched in 1990 (Turban & Aronson 1998). OODBMS facilitate the analysis of data at a conceptual level, with the emphasis on the natural relationship between objects. This database technology defines data as objects and each object contains conventional data and procedural code. Rowell (1998) argues

that OODBMS are more flexible than RDBMS and support more abstract types of data such as sound, data, graphics and video files. Sherer (1990) observes that the feeling in the industry was that object-oriented databases outperform RDBMS when handling data with highly complex relationships, but RDBMS are better for transaction-oriented applications. Baer (1999) explains that the kinds of applications in which object-oriented databases are traditionally used, are telecommunications, financial services, health care and transportation. He continues to add that deregulation, increased competition and increased demand for customer service are creating the complex data relationships at which OODBMS excel.

Stedman (1998) confirms that today OODBMS are aiming at electronic commerce, on-line catalogues and the world wide web applications that involve large amounts of multimedia data. Baer (1999) believes that object-oriented databases have the potential to solve problems in any industry in which processes are so complex that RDBMS cannot keep up. The problem with OODBMS at this stage is that it is difficult to find developers and database administrators who can handle them. Baer (1999) goes on to add that expectations are that the OODBMS market will increase tremendously, especially with the growth of object-oriented languages such as Java.

Stedman (1998) draws attention to the next trend which is the retaliatory action of the major relational database vendors, namely to produce a hybrid system of object/relational database management systems (ORDBMS). These hybrid systems which, in effect, are a relational database combined with an object layer, are expected to out-sell the pure object-oriented database systems simply because object-oriented database vendors do not have the clout of the hybrid system vendors. The fact that relational database vendors have seen a decline in

revenues, according to Krill (1998), makes competition even worse for the object- oriented vendors.

Another recent development in the history of DBMS is mentioned by Hammond (1998) who draws attention to the fact that database vendors are developing strategies to provide Java-enabled enterprise databases. The aim is here to provide speed and flexibility for developing and deploying databases, while adding the interoperability, portability and enhanced object capabilities which are desirable for Web commerce. Hammond (1999) comments in particular that the application of mobile databases gives users an edge. Mobile databases are used for data capturing and enquiries on mobile devices by workers or partners such as travelling salespeople or distributors, while the main database contains all the critical customer and business process information that keeps the business going. According to his research, a 39%-a-year growth rate is forecast for the mobile database market.

Also of note is that the prices of hardware for database servers have come down significantly which has enabled mid-size business to implement bigger and more powerful databases. This is reported by Dyck (1999).

From the above discussion one can see the importance of the major types of databases and this is the focus of the next section. The next section also contains a discussion of the major players in the respective markets.

3.2 TYPES OF DATABASE APPLICATIONS

Databases are used for different purposes and for that reason database products are classified in this dissertation as desktop databases, hybrid

systems and robust enterprise-level database applications. The database technology of enterprise DBMS applications in use mainly consists of relational databases but there is also a trend towards implementing OODBMS and ORDBMS, and these technologies are discussed in more detail below. This section also includes discussions on database products of the major vendors, and these lists of products and their application will clearly illustrate the practical application of the future trends of mobile databases and Web databases discussed.

3.2.1 Desktop databases

3.2.1.1 Introduction

Desktop databases are relational databases priced for the lower end of the database market. These database systems offer flexibility and end-user programmability and are found in all organisations because the IT departments cannot possibly create and maintain all the small databases in the organisation. These databases are less expensive and have less powerful features than enterprise DBMS. Rather than trying to provide a formal definition for desktop databases, the author feels that it is appropriate to sketch the circumstances that surround the use of desktop databases. With the advent of the personal computer, database systems were developed for the personal computer and this placed more power in the hands of non-technical users, many of whom started off by building database applications that consisted of simplistic lists of, for instance, personal information regarding customers and suppliers. As is customary in the IT arena, new needs for more information resulted in the enlargement of the existing databases or the creation of new databases to include even more information. Eventually these databases grew to such an extent that they began to support some business processes or even something more complex, namely a whole function of the business. Given the history of desktop databases it is

therefore not surprising that they are found in all businesses big or small. Jenkins (1995) states that in many cases these databases outgrow the end user and then the IT department normally takes over and writes a robust enterprise database program that mimics the functionality of the original database.

This discussion of desktop databases would not be complete if it were not noted that the desktop databases of today have the majority of the features of the enterprise DBMS but are not designed to be as robust in availability, complexity of functions, number of concurrent connections, data recovery and data security.

3.2.1.2 Desktop database vendors

The major players in this market are Lotus with Approach, Microsoft with Access and Corel with Paradox. Each of these big three companies have office suites that include these databases but they are usually found in the professional rather than the standard editions (Haskin,1999).

3.2.2 Hybrid databases

Hybrid database systems are programs used mainly for other purposes but with strong database functionality. In this regard specific reference is made to spreadsheets still widely used for small database applications. Spreadsheets are designed for a wide range of applications in business, engineering, mathematics and science, and have database capabilities which do not have all the flexibility that is provided by the desktop databases. Another hybrid database is Lotus Notes, a groupware product combined with a database. Lotus Notes has functions like tracking, broadcasting and team discussion which places it as groupware software in the first instance, but features like the reference store which

has database characteristics means that it can be classified as a database as well.

3.2.3 Enterprise database management systems

3.2.3.1 Introduction

The enterprise DBMS are robust databases that are designed to accommodate hundreds and thousands of simultaneous users logging on from around the world. The systems have mechanisms to ensure that users do not step on one another's toes. Some other features are listed below.

- Enterprise RDBMS must offer fault tolerance and high availability for mission-critical OLTP applications such as order entry and supply chain management.
- The database servers must be able to support millions of customer records in thousands of separate tables.
- Sophisticated security controls can be customised to fit particular business needs.
- They must support many other technologies such as parallel processing, thin clients, Web application servers, Web site content management, diverse replication architectures, electronic commerce, data warehouses, very large databases, data mining and on-line analytical processing (OLAP), object-oriented functions and special extended data types.

3.2.3.2 Enterprise DBMS software vendors

Langley (1999) states that the leading database products are Oracle, Informix, Sybase and IBM DB2, with the Microsoft SQL server being the relative newcomer. These vendors and their products are discussed next.

(i) Oracle

Langley (1999) stated that Oracle is the world's best known relational database supplier. He goes on to add that Oracle was founded in 1977 and brought the first commercial relational database implementation to the market. Oracle still leads the market by a slim margin ahead of IBM and Microsoft. Oracle's database products over the past few years, arranged from most recent to older versions, are included in Table 1 below.

Table 1: List of major database-related products by Oracle

Product Name	Application
Oracle8i Lite	Mobile database
Oracle 8i	Core ORDBMS specifically designed as an Internet development and deployment platform
Oracle 8	ORDBMS. The object capabilities can be used for niche applications that involve video, audio and geo-spatial data.
Oracle 7	Relational DBMS only. Still an enormous demand for it.
Oracle 6 (1988)	Included the transaction-processing subsystem option which established Oracle with mission-critical OLTP

Source: Adapted from Oracle.com (2000)

(ii) IBM DB2

IBM has been in the database market the longest. IBM is well known for its hierarchical IMS database that still runs 90% of the world's major corporations' mission-critical OLTP systems. Watterson (1998) reports that IBM is focusing on e-business, has moved aggressively into the Java arena and is offering the most comprehensive support for extended

object/relational data types. The following is a list of the relational database products by IBM:

Table 2: List of major relational database-related products by IBM

Product Name	Application
DB2 Everywhere	Mobile database
DB2 Universal Database	Enterprise DBMS (ORDBMS technology)

Source: Adapted from IBM.com (2000d)

(iii) Sybase

Sybase has also been in the database market for a long time and they are currently focusing their efforts on mobile computing. They are the mobile database leader and below is a list of their DBMS products.

Table 3: List of DBMS products by Sybase

Product Name	Application
SQL Anywhere Studio	Mobile database
Adaptive Server Enterprise	Enterprise RDBMS for OLTP, Internet support and decision support systems.

Source: Adapted from Sybase.com (2000a)

According to a white paper from the Sybase web site (2000b), there is a Sybase Java initiative underway to develop the capabilities of the relational Adaptive Server to store Java objects which represent Sybase's ORDBMS strategy.

(iv) Informix

Informix is another major contender in the enterprise DBMS market. Watterson (1998) stated that Informix's CEO indicated that their focus regarding DBMS is high-performance OLTP and Web-content

management. He also indicated that Informix is very involved in object technology, which can be seen in their acquisition of Illustra and their strategic partnership with Cloudscape Inc. Their products related to this quadrant are listed in Table 4 below.

Table 4: List of major DBMS products by Informix

Product Name	Application
Cloudscape	Provides enterprise mobile computing solution
Cloudscape	100% Java database. Cloudscape together with Informix Dynamic server is the ORDBMS product offering of Informix
Informix Dynamic Server	Enterprise DBMS (Relational database technology) Designed for the most demanding OLTP, e-commerce and Web applications

Source: Adapted from Informix (2000c)

(v) Microsoft

Microsoft is the relative newcomer in the enterprise DBMS market and their focus is the lower end of the market.

Table 5: List of major RDBMS products by Microsoft

Product Name	Application
Microsoft SQL Server	This server supports mobile applications
Microsoft SQL Server	Enterprise DBMS (Relational database Technology).

Source: Adapted from microsoft.com (2000)

Dyck (1997) reported that Microsoft followed a completely different approach from Oracle and Informix regarding the application of ORDBMS technology. Their strategy is to add database functionality to their objects instead of adding object functions to their database. The latest product information on Microsoft SQL Server 2000 (beta 2) does

not mention ORDBMS technology, which seems to indicate that this strategy is still being pursued today.

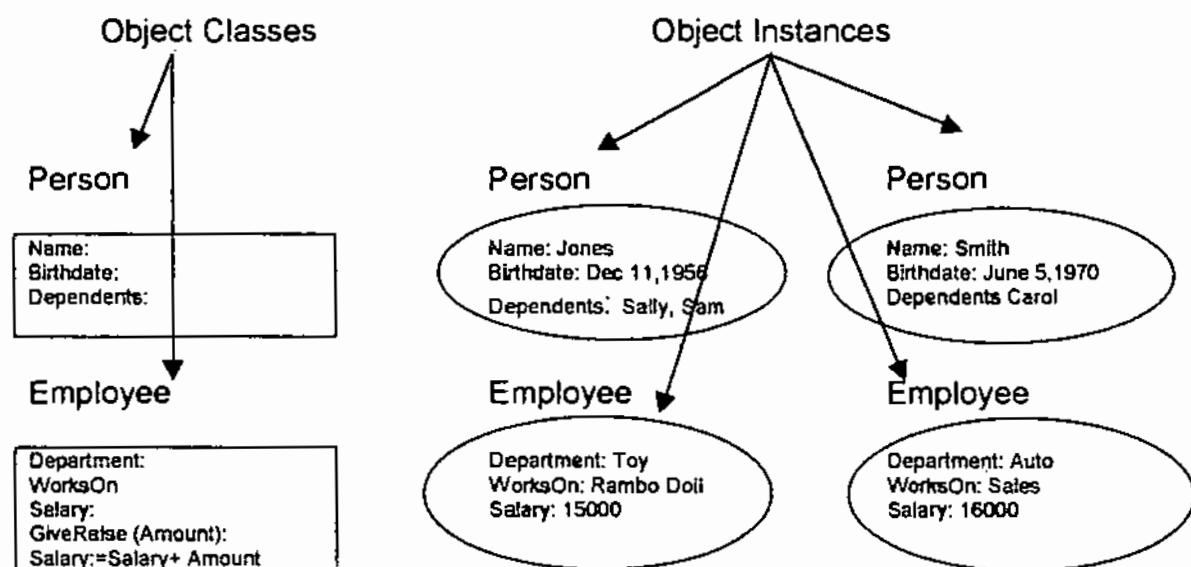
3.2.4 Object-Oriented Database Management Systems (OODBMS)

Larson (1995) explains OODBMS best by contrasting them with relational databases. He states that a RDBMS is record-oriented in that data are viewed as a collection of record types (or relations) whereas OODBMS consist of objects which represent real-world objects and entities. The goal of OODBMS is then to maintain a direct correspondence between real-world and database objects.

OODBMS technology is a very technical subject and without going into too much detail, one can note Larson's (1995) brief description in which he explains that OODBMS contain several object classes¹; each class may consist of one or more object instances². These concepts are graphically displayed in Figure 3 below.

¹ An object class can be thought of as a template or blueprint from which several object instances can be made. An object class describes a set of homogeneous objects and each object class has several attributes (i.e. name, birth date etc.) and operations (i.e. give raise) that may be applied to the object instances.

² An object instance represents a single real world object or entity.



Source: Larson (1995)

Figure-3: Object classes and instances

The biggest selling point for OODBMS is stated by Baer (1999), namely that OODBMS outperform RDBMS at handling complex relationships among data. Business areas with complex data structures at which OODBMS excel are, for instance, engineering design, expert systems and multimedia applications. Larson (1995) added that another advantage of object-oriented design is that re-use is encouraged, which results in a tremendous saving of development time for new applications. There are typically existing object class libraries that perform similar functions that programmers are looking for in a new application, and these object classes can easily be modified and copied. Another facet of the re-use is the inheritance of properties which is the ability of one object class to re-use the data structures and methods of another object class without re-implementing them.

Stonebraker (1998) and Larson (1995) point out certain disadvantages of the OODBMS systems:

- OODBMS have not been optimised for thousands of simultaneous users accessing and updating mission-critical data.
- OODBMS have been slow to add SQL support, thereby making some of the operational tasks very difficult to code.
- OODBMS systems are not compatible with existing RDBMS, nor can the latter be suitably upgraded.
- Modifying and debugging of OODBMS applications can be difficult because of the distributed nature of the application.
- OODBMS also lack mature international standards.
- The cost of retaining programmers is higher than with RDBMS.

The above disadvantages reinforce the statement by Stonebraker (1998) that the main reason for OODBMS not taking over from the RDBMS is that these systems are normally the operational lifeblood of most large organisations and IT managers would therefore not be open to trade the power, maturity and robustness of RDBMS systems for newer, less proven technology. He predicts, however, that the combination of object-oriented technology and relational technology might change this situation. This hybrid of the two said database technologies is discussed in the next section.

3.2.4.1 OODBMS software vendors

The main vendors in the pure OODBMS market include:

- GemStone from Servio Corporation – based on SMALLTALK
- Ontos from Ontos, Inc based on C++
- O2 from O2 Technology O2C
- ObjectStore from Object Design bases on C++
- OBJECTIVITY/DB from Objectivity Inc based on C++
- Versant from Versant Object Technology based on C++

3.2.5 Object Relational databases

Stonebraker (1998) states that one of the greatest shortcomings of the RDBMS is that it only stores numbers and character strings and where applications require the management of more complex objects, this must be simulated outside the DBMS system. He proposes, however, that ORDBMS might save IT managers responsible for mission-critical DBMS systems from having to choose between a rich object model and scalability.

The technology of ORDBMS mentioned above is described by Lee The (1994:49) as a hybrid database technology and he elucidates further by describing it as the combination of

..object oriented features with all of the abilities of standard RDBMSS to store, retrieve and analyse tables of the usual data primitives (text, integers, dates, etc) using standard Structured Query Language. ... The OO quality of ORDBMSS extends to several aspects: you can use, even define data-type objects like images, maps, and sounds; you can define methods of working with them, like compress, play or filter all the red out; and you can use objects from within the standard relational framework, like running a query on all audio objects to determine which ones are speech and which ones are just music.

In my view, the statement by Stedman (1998) that object relational technology provides some of the benefits of objects without forcing users to turn away from familiar relational technology, describes the main reason why this technology will succeed over a pure OODBMS. Stedman also mentioned in the same article that the relational database vendors such as Oracle and Informix propose that these hybrid systems should be able to handle the same data complexity as pure OODBMS but, at the same time, they caution that there might be some trade-off regarding speed. However, they feel that the comfort of keeping the familiar relational database techniques is well worth it.

The leaders of these hybrid products are Oracle and Informix and their products as well as the ORDBMS products of the different vendors were mentioned above.

3.3 CONCLUSION

The biggest contribution that DBMS systems have made to business was to provide a tool to gather large amounts of data in a structured way, and this facilitated enhanced productivity in the organisation. There are, in broad terms, very large users and then medium to small database users. The large corporations are serviced by the enterprise RDBMS vendors that provide large organisations with systems that are high in reliability, availability and speed and are used for mission-critical OLTP. The medium to smaller organisations, on the other hand, use either desktop databases or hybrid systems for their database needs. The result is that that almost all organisations today have at least some form of database in use in their organisations.

The influence of the Web and mobile computing is very visible in the products offered by the main DBMS vendors. The new development that is unique to this quadrant, is the battle between object-oriented and object-relational databases. At this stage relational database technology is still preferable for high volume transaction processing but OODBMS are particularly suited to areas that require complex data structures, such as engineering design, expert systems and multimedia applications. This means that the big issue will be whether one will see pure OODBMS being applied in business or the hybrid ORDBMS version. As mentioned above, this battle will most probably go to the ORDBMS vendors purely because the technologies have both different and complementary advantages and a combination of the two technologies seems to fulfil the need for massive mission-critical transaction

processing as well as the need for handling complex relationships among data. In addition, the clout of the hybrid system vendors, who in effect are most of the existing enterprise RDBMS vendors, should not be underestimated.

Of interest again is the fact that almost all the major vendors of this quadrant have products that fall into the next two quadrants and that some of the features of these products are incorporated into the DBMS systems. This confirms Pellissier's (2000) belief that the products in a particular quadrant are continuously improving and competing with products in the other quadrants.

Another big contribution of database applications is that they provide a way of managing the information overload of business. This is done by providing the platform from which data can be extracted to be used in ERP systems which is the next quadrant (refer to Chapter 4) of the Information Delivery Classification Matrix. Even more importantly it serves as an important source for business intelligence which is the 4th quadrant (refer to Chapter 5) of the Information Delivery Classification Matrix.

CHAPTER 4

SYSTEMS APPLICATION (OLTP- ESPECIALLY ERM)

4.1 INTRODUCTION

In this chapter one will see how some of the technologies in office automation and database products are integrated into one enterprise system. To a large extent this was made possible because enterprise RDBMS vendors mastered the requirements of on-line transaction processing (OLTP).

OLTP mainly focuses on recording business transactions like sales, receipts, reservations, etc. With the development of RDBMS, the way was paved for systems that integrate business transactions and other internal processes in the organisation which, in effect, is an enterprise resource planning (ERP) system.

In view of the fact that OLTP is used for order entry systems, supply chain management and other mission-critical applications that are encompassed in ERP systems, ERP systems will constitute the main focus of this chapter. This discussion will begin with a brief look at OLTP, followed by an in-depth analysis of ERP systems in terms of their application, benefits, inadequacies, new trends, and the main vendors and their products.

4.1.1 On-Line Transaction Processing (OLTP)

According to Haag, Cummings and Dawkins (1998:120) OLTP can be described as information systems that manage information by:

... gathering input information, processing that information and updating existing information to reflect the gathered and processed information.

Watterson (1998) states that OLTP systems used to run on entrenched database products like IBM's IMS which is based on the hierarchical and network/ CODASYL data models. A prerequisite for OLTP systems is the management of many concurrent data-entry connections, where the norm is short transactions corresponding to database inserts. Examples of high-end OLTP systems are systems that record transactions for telecommunications, banks, stock markets and airline reservations. These systems have to be highly reliable and available. In this market, IBM's mainframe-based hierarchical IMS is still the leader. In fact IBM (2000c) states that 90% of the world's major corporations rely on IMS.

Enterprise RDBMS vendors entered the OLTP market later as they had to deal with mastering the requirements of handling many concurrent transactions and providing high availability. The Enterprise RDBMS vendors in this market were discussed in the previous chapter and names such as Oracle, IBM , Informix are some of the important players in the ERP market. As mentioned, further discussion in this chapter will be confined to ERP systems since OLTP forms a part of ERP systems.

4.1.2 Enterprise Resource Management (ERM) (evolved from ERP)

The term 'ERM' is often used interchangeably with the term 'ERP', but this is strictly speaking not correct as the former is wider in scope and encompasses ERP together with other elements of management. This happened as the functionality of ERP systems evolved. ERP is the more

common term and will be used in this dissertation. Bylinsky (1999b) maintains that ERP systems serve as a backbone for keeping a corporation's books more efficiently than was done with older, less integrated systems. The overall aim of ERP systems is to improve efficiency by rapidly moving financial and other data throughout the organisation where and when it is needed.

Deloitte Consulting (1998:2) defines ERP systems as many information systems that work together with the aim of:

.. co-ordinating efforts throughout the organisation in order to share information, automate processes and produce and access information in a real-time environment.

From the above one can conclude that the main purposes of ERP are:

- To facilitate the automation of business processes throughout the business.
- To share information across functions throughout the business in order to improve efficiencies.
- To provide crucial management information of the business as a whole for analysis and decision-making purposes.

4.1.2.1 Applications of ERP

Freedman (1999) writes that the most widely deployed ERP systems worldwide are those that track financial data. Another extremely important application of ERP is in the field of human resource management (HRM). The HRM system deals with human resource administration needs and the reallocation and optimisation of human resources. An Informix white paper (2000a) on ERP systems states that the third major business area that ERP systems cover is the manufacturing field which is aimed at streamlining internal processes

such as inventory, material and resource planning, bill of materials and just-in-time ordering. ERP systems also include the supply chain management modules that facilitate procurement and distribution of components, raw materials and other resources. Other processes in the enterprise are also covered, such as project management, treasury management and more. The discussion regarding the main ERP vendors and their products will indicate the other areas of focus.

4.1.2.2 Benefits of ERP systems

The following are some of the major benefits that result from the application of ERP systems:

- ERP systems link internal operations and provide a platform for continuous improvement. Information integration leads to improved responsiveness and increased efficiency throughout the organisation (CSIPER Consulting, 1999).
- ERP has transformed business processes resulting in operating efficiencies such as reduced cycle times (CSIPER Consulting, 1999).
- Enterprise-wide information improves demand forecasting and order scheduling which leads directly to higher customer satisfaction.
- ERP systems facilitate the best deployment of the workforce and help with the identification of gaps in resources and capabilities for strategic planning.
- ERP systems create a supporting environment for job satisfaction as can be seen with employee self-service programs that allow employees to direct their own benefits, training and development and investigate alternate career opportunities. Robbins (1998) states that organisations with satisfied workers are usually more effective organisations; thus ERP makes effectiveness in organisations possible.

All of the above translate into cost reduction and customer satisfaction and retention.

Although ERP systems have many benefits, there are still inadequacies in them which are spelled out in the next section.

4.1.3 Inadequacies in the ERP systems

Bylinsky (1999a) suggests that traditional ERP systems do not fulfil all the needs of business and he specifically highlights processes that support 'value-driven manufacturing'. He maintains that this is the case because traditional ERP vendors used ineffectual assumptions for material and resource planning (MRP) systems, advance planning and scheduling, customer relationship management (CRM) and other tasks. Another problem with conventional ERP systems is complexity of installation. Bylinsky (1999a) reports that according to a computer industry researcher of the Gartner Group, only half of the companies that bought SAP in the past five years have put it to full use. Bylinsky (1999b) also draws attention to the fact that, because ERP systems do not facilitate the new practices of value-driven manufacturing, they can hamper innovation.

The inadequacies of ERP systems created a gap in the market which is being filled by 'ERP extension' software (Pehanich,1999). This software improves some of the specialised modules of the existing ERP vendors and facilitates e-commerce. A point of interest is that some of this ERP extension software does not even need to plug into an ERP system. ERP extension software is one of the main new trends in ERP which is discussed next.

ERP systems, because of their complexity and specific focus, cannot provide non-technical managers with adequate decision support systems such as real-time ad hoc reporting and analysis. The solution to this lies in business intelligence tools which are discussed in the next chapter.

4.2 NEW TRENDS IN ERP

ERP strategies have shifted, according to Pehanich (1999), from cost reductions and operating efficiencies to revenue growth. This change is driven by globalisation and the fact that ERP systems can now incorporate information regarding business trading partners and customers. Examples of this are Web-based applications that allow seamless integration to suppliers, vendors and customers. The new trends in ERP systems and extensions are to be found in integration with the Internet as the platform and improvements in the value chain. These developments are known as e-commerce, customer relationship management (CRM) and supply chain management and will be discussed below.

Another trend worth mentioning is the incorporation of new technologies such as geographic information systems (GIS) into ERP. This improves decision making as data can be viewed in ways not previously possible. Althoff (1998) illustrates this with a practical example from Schindler Elevators that uses GIS data which is incorporated into their SAP ERP system to dispatch elevator repairmen more efficiently and is expected to save \$8 million dollars per year.

Lastly an interesting development: ERP vendors are targeting *mid-size business* because of factors such as market saturation, the efficiencies engendered by the Internet and changes in hardware technology and costs. This trend will also be discussed below.

4.2.1 E-commerce /Internet-based ERP

Electronic commerce according to Turban and Aronson (1998: 857) is

..buying and selling products and services using computers and networks..

The commercialisation of the Internet changes the way we do business and in order to facilitate this, all the ERP vendors and ERP extension vendors have added business-to-business (B2B) and business-to-customer (B2C) solutions to their systems. The *New Straits Times* (1999b) suggests that with these B2B and B2C solutions, business will be able to connect its traditional value chain directly with an end-user or distributor.

Aspect Communications (2000) believes that by presenting customers with more ways to contact a company, business and customer loyalty increases. Freedman (1999) claims that e-commerce allows companies to reach new markets, operate around the clock, shorten product development cycles, enhance customer service, and all this at lower cost. In some instances the consumers can help develop and tailor the products they seek, which is a definite recipe for customer satisfaction. The *New Straits Times* (1999b) added decreased order handling and processing time, just-in-time manufacturing and the resulting lower inventories and associated cost to the list of benefits mentioned.

The by-products of e-commerce are manifold but the information that it generates warrants attention. The information is particularly powerful for use in making a sale and one sees companies that call themselves *informedians* springing up to facilitate business in one-to-one marketing. From this we can see that CRM software will most probably be the

biggest beneficiary of e-commerce. E-commerce was also a major instigator of the development of new ERP trends like CRM, supply chain management and the occurrence of ERP vendors targeting *mid-size* business. These are discussed below.

4.2.2 Customer Relationship Management (CRM)

4.2.2.1 Introduction

Vaas (1999) describes CRM as a robust sales force automation (SFA) application. She goes on to explain that whereas SFA applications manage contacts, accounts and sales opportunities, CRM does all that and more. It includes front-office applications that deal with customers, customer and product information, marketing encyclopedias, product configuration engines and the software also has the ability to integrate with back-end systems. In summary, she describes CRM as software that facilitates customer satisfaction and retention. CRM systems are designed to bring business closer to the customer with better service through the analysis of data. This makes it possible for business to anticipate customer needs, which results in quicker reaction time and a focus on what the customer values.

There are CRM systems available that consist of some or all of the following components:

- SFA application which manages contacts, accounts and sales opportunities.
- Front-office applications that deal with customers, and collect customer and product information.
- A marketing encyclopedia consisting of rich information about products and pricing, competitors, decision issues, objection handling tools, brochures, presentations and videos.

- A product configuration engine.
- Integration into back-end systems such as financials, inventory and ERP systems.

Certain CRM applications (Siebel, 2000) are geared for professional service organisations that provide for resource assignment, contract management, risk management and subcontract management. These systems provide the consultants and service professionals with the necessary information to work significantly more effectively.

Most systems provide for mobile computing, placing the data right at the point of the sales activity. Naturally, with the impact of the Internet, e-CRM is provided by some vendors. This allows for customer interaction via the Internet and the accompanying information can provide in-depth insight into customer behaviour.

4.2.2.2 Benefits

The main benefits of CRM systems can be divided into operational benefits and the benefits that can provide a business with a competitive edge. The benefits are grouped according to the classification below.

(i) Operational Benefits

- Sales staff are relieved of administrative drudgery and can spend more time with customers and sell more products.
- Call centre functionality (Siebel, 2000) provides sales staff with comprehensive information profiles about customers, accounts, products, past purchases, current opportunities, outstanding quotes service records and service level agreements that help them to provide a more value-added service.

- Customers can get a clear view of product information and order status.
- Delivery times can be reduced, as can cancellations due to errors.
- With the product configuration engine, customers can get a customised product that better fulfils their needs.
- CRM modules that are geared towards professional service organisations are able to utilize knowledge gained and tracked in previous projects and share this information among project team members (Siebel, 2000).
- Davison and Uhlman (1999) state that CRM also integrates the supply chain and workflow systems, and implements electronic business processes which result in customer service operations that are more effective and efficient.

(ii) Competitive Edge Benefits

These systems collect and analyse information to provide insights into customer behaviour. Hill (1999) claims that CRM promises an understanding of which customer is valuable today and which customer will be valuable in the future, and this enables business to offer the customer what he or she wants in the manner he or she wants it, which ultimately leads to customer loyalty and in turn leads to increased shareholder value.

Hill (1999) also makes an interesting point in suggesting that customers also benefit from CRM in that they receive meaningful, relevant messages and promotional offers.

4.2.2.3 Problems

Vaas (1999) cautions that CRM is not easy to implement. He states that it is important to have a suitable outside consultant and an internal project team consisting of at least IT, sales and upper management representatives. Hill (1999) adds that process and people issues can make or break a CRM implementation. And then, a fact that is very important and not to be overlooked, one needs an underlying system that is robust enough to support the additional load that CRM data creates.

4.2.2.4 Conclusion

The fact that one can divide CRM benefits into operational and competitive edge or strategic benefits raises the interesting point of whether one can classify CRM in the 3rd quadrant only or whether it should move to the 4th quadrant. This is the subject of discussion of the next chapter. It is the opinion of the author that the CRM features that are targeted for operational needs such as sales force automation fit into the 3rd quadrant but as soon as CRM is used for analysis of customer behaviour then CRM software should be placed in the 4th quadrant, but more on that in Chapter 5.

CRM will become more and more beneficial to business as *clickstream* information is incorporated into the CRM systems. This will be particularly relevant for the strategic components of CRM. All in all, CRM systems provide business with a competitive edge, perhaps the most important competitive edge, and one that no business can afford to lose out on.

4.2.3 Supply chain management

4.2.3.1 Introduction

It is a well known fact that one of the biggest challenges facing a customer-focused organisation is to satisfy customers without incurring the costs of oversupply or excess inventory. As was mentioned before, e-commerce is a major contributor to the development of ERP extension software that focuses on improving supply chain management software and has addressed the disappointments experienced by on-line customers during the Christmas shopping period in 1999. This underlines the fact that supply chain management is an area of tremendous importance. The reason for the disappointed on-line customers was, as Nachtwey (2000) stated, that the demand for products distributed by e-commerce stores exceeded supply. This could have been prevented if the supply chains were tightly integrated with the selling activities of the businesses, allowing the supply chain to respond in real time to changes in demand. With all the software vendors providing B2B and B2C solutions as discussed in the e-commerce section, this should be a problem of the past or become less of a problem as the products mature in this field.

Integration of the value chain via the Internet is only part of the solution involving improvements to the supply chain. One of the key success factors for using the Internet as a sales channel or for e-commerce is that one must optimise the *supply chain*. This is the focus of the remainder of this section.

At this point it is important to explain what is meant by supply chain management and for this purpose, the author adopts Mac Donald's (2000) description of supply chain management as anything to do with the planning, sourcing, making and moving of raw materials as they

travel through the pipeline to become a finished product in the hands of the end user. The aim of supply chain management is mainly to eliminate unnecessary operating costs from the supply chain and this can only be done through collaboration with trading partners throughout the supply chain. CSIPER Consulting (1999) explains that what supply chain management systems actually do is to interact with the existing ERP system by providing linked suppliers with the necessary information to supply a company with inventory when needed and in the correct quantities. The supply chain software also facilitates internal processes like planning, making and moving of the raw material. All the information that emerges from the supply chain management software can then in turn feed applications like CRM.

Although the experience of online shoppers during the Christmas period of 1999 brought renewed attention to supply chain management, 80 per cent of 200 large US manufacturers were by then already planning to launch a major supply chain initiative, according to a survey done by Deloitte and Touche Consulting Group in 1998 (Logistics Management Distribution Report, 1998). These businesses also indicated that they required certain important components in supply chain management software. Below is a list in order of importance:

- Warehouse-Management Systems
- Performance Measurement
- Production scheduling
- Freight Payment
- Distribution scheduling
- Transportation Management
- Capacity Planning
- Maintenance
- Supply chain optimisation

- Custom clearance.

In order to show how the ERP extension vendors have addressed some of these needs, a few of the available supply chain management solutions are chosen for review, namely component and supplier management, manufacturing execution systems, and product data management.

4.2.3.2 Component and supplier management (CSM)

Althoff (1998) states that CSM builds a bridge between design and procurement. It is a decision support system that aids designers in selecting optimal parts according to business and technical criteria. The result is the use of standardised parts, effective management of parts and suppliers such as optimum volume ordering and reduction in the number of suppliers used, which leads to cost savings. It also means that the time taken up by procurement of parts is minimised.

4.2.3.3 Manufacturing execution systems (MES)

MES, according to Bylinsky (1999a), is software that simulates a factory in every way, including routing of products and direction of processes. This creates flexibility in the way a product is made. In an article on the subject, Camstar (2000) maintains that industrial managers and consultants all agree that control of the manufacturing floor is the key to better competitive performance. MES software allows inter alia for:

- a plant-wide view of the entire manufacturing process through tracking and control of all orders, materials, operators, processes and equipment,
- the implementation of consistent manufacturing procedures and documentation, and

- the collecting and analysing of quality and yield data for continuous improvement.

Bylinsky (1999a) writes about a variant of MES, dynamic performance monitor (DPM) software, that brings value creation right down to the production line. The software monitors the process variables such as pressure, temperature, liquid level and product composition. An example of such an application is the situation in which the consumption of raw materials like chemicals is monitored, with the software displaying coloured dials that indicate whether processes are within limits. The effect of this software is that it provides plant operators with information that improves decision-making right there on the production line.

Bylinsky also discusses another variant of MES, 'flow manufacturing', which allows for fast changeover for different products on the same line, as orders come in. Other advantages of flow management are reduced assembly areas, a cut-down on part inventory and improvement of the order-to-manufacturing cycle time.

4.2.3.4 Product Data Management (PDM)

Althoff (1998) points out that PDM systems link design and manufacturing. They provide a tool to organise and manage product information. They also have workflow features that route designs to the appropriate people for sign-off. PDM systems cut product costs and reduce manufacturing errors and cycle time by ensuring that the latest, most current product information is accessible when and where needed.

4.3 ERP TARGETS MID-SIZE BUSINESS

ERP systems were traditionally aimed at the large organisations. Mid-size business could also not afford to implement ERP systems because they were too expensive and complex to implement. Carlson (1999), a U.S.A.-based reporter, reported that the high-end ERP market is now becoming saturated according to the ERM and CRM program director of the IDC research company. He consequently expects ERP software implementations to grow as the affordability of ERP systems increases.

It is the experience of the author that the current status of most *mid-size* businesses is that they still use some kind of traditional accounting application (general ledger, accounts payable, accounts receivable and a tax or credit application) with some loose standing applications that together form some sort of a ERP system. This view is confirmed by interviews done by Strategic Finance (Carlson, 1999) with three Chief Information Officers of *mid-sized* companies. Carlson also referred to the opinion of Jean-Luc Alarcon, CEO and research director of SPEX (a software evaluation and consulting firm) that about 80% of *mid-size* business are still doing budgeting and consolidation on spreadsheets or with some sort of semi-annual process. This is also in line with the experience of the author. Of note is the fact that the interviewees all agreed that reporting and analysis are the key to day-to-day success. They are all frustrated with the report-writing capabilities of their respective systems and stressed that one needs to be very technical to get some of the information out of the systems.

The above research and opinions indicate that *mid-size* businesses are cognisant of a need for an integrated enterprise-wide information system. Neff (1999) states that there are other reasons, apart from affordability, that drive mid-size business to implement ERP. These include the fact that certain industries' conditions are characterised by a lot of

streamlining, consolidation and excess capacity and that there is the general move world-wide towards ISO-type quality requirements.

SAP, the biggest vendor in the ERP market, illustrates the fact that ERP vendors are preparing to service mid-size business with a strategy called mySap.com (refer 4.4.1) that targets the *mid-size* market. Neff (1999) strengthens this notion with predictions from Marcam, a Cambridge ERP systems vendor, that 80% to 90% of new ERP system installations will be by mid-market companies. JD Edwards also projects that the mid-market segment will grow at 20 to 30 % annually.

Wilkenson (1998) suggests that trends such as the use of hardware like thin clients (network computing) can also promote the use of ERP systems by *mid-size* business as they reduce costs and provide a more manageable environment for the complex ERP systems. Mid-size business can also look at outsourcing as a means of bringing down the cost of entry of ERP. According to Gould (1999), SAP did a market study and found that 80% of Automotive suppliers surveyed are amenable to the idea of outsourcing ERP.

Neff (1999) states that ERP vendors will have to adapt their products to *mid-size* business because large organisations often do business process re-engineering studies with outside consultants before or while they implement ERP, which will not be the case with *mid-size* organisations that will most probably do re-engineering after ERP implementation. This is because of budgetary, time and staff constraints. This is also why *mid-size* business will look for scalable ERP systems and for ERP systems that can handle a wide variety of needs.

According to Freedman (1999) it is important for *mid-size* business to choose the ERP packages that best meet their business needs, the hardware (i.e. servers & clients) requirements, add-on's tailored for what is unique in the particular industry, and lastly to use the available Internet technologies that enable ERP and Business Intelligence systems to reach their full potential. Pehanich (1999), however, cautions that *mid-size* firms have to identify their real problems before they invest millions in ERP. Root problems like productivity issues should be solved first before implementing ERP.

4.4 ERP VENDORS AND THEIR PRODUCTS

Bylinsky (1999b) reported that the largest ERP vendors in order of sales turnover in 1999 were SAP (\$ 5billion), Oracle (\$2.4 billion), PeopleSoft (\$1.3 billion), JD Edwards (\$979 million) and Baan (\$743 million). The fastest growing ERP company is Industrial & Financial Services (IFS) based in Sweden. Niche players in the ERP extension market are Siebel Systems, Pivotpoint, Aspect Development, Camstar, Foxboro and many more. The ERP extension vendors offer state-of-the-art ERP modules designed specifically for CRM and manufacturing. What follows is a discussion of the largest vendors and their products, as well as a brief look at the ERP extension vendors mentioned and their products.

4.4.1 SAP AG

Key (1999) and Boey (1999b) illustrate that SAP has formidable strength in the ERP market with its installed base of more than 10 000 customers and 20 000 installations which include many of the world's largest corporations.

The company's first product line was R/1 which was a real-time accounting transaction program. R/2 followed R/1 and mainly tied external databases and communications systems into the ERP system. All these systems operated on mainframes. The next product was R/3 which was designed to operate in a client/server environment and show companies how they are functioning and where they can improve efficiencies in distribution, manufacturing, finance and human resources. In September 1999, SAP launched mySAP.com, an 'overall go-to-market business strategy' (BERNAMA, 1999) which is expected to harness the company's 27 years of delivering solutions to companies globally. MySAP is a comprehensive and open e-business environment allowing companies to do business via the Internet.

The *New Straits Times* (1999a) and Boey (1999a) reported that MySap.com application areas are e-commerce, customer relations management and strategic enterprise management, business intelligence, supply chain management, human resources, logistics, manufacturing, financials, knowledge management, industry-specific templates, virtual training classes and professional support.

Key (1999) states that MySAP.com moves an organisation beyond the virtual walls of a company to include the company's suppliers, distributors and customers. The aim is to reduce inventory and squeeze out more inefficiencies.

MySAP.com application components are (SAP, 2000):

Table 6: List of products by SAP

Product Name	Product Name
SAP Advanced Planner and Optimizer	SAP Knowledge Warehouse
SAP Business Connector	SAP Logistics Execution system
SAP Business-to-Business Procurement	SAP Online Store
SAP Business Information Warehouse	SAP R/3 Enterprise Resource Planning
SAP Corporate Finance Management	SAP R/3 Financials
SAP Customer Relationship Management	SAP R/3 Human Resources
SAP Employee Self Service	SAP R/3 Logistics
SAP Environment Health & Safety	SAP Real Estate Management
SAP Internet Sales	SAP Strategic Enterprise
SAP Complementary Software	

Source: Adapted from SAP.com (2000)

The Business Times (1999) also states that SAP is customising its applications so that clients only have to buy or rent what they need. SAP allows customers to configure and evaluate applications on-line before implementing them. Once a decision to purchase is made, customers can choose to implement their solution in a hosted environment from SAP or one of its partners.

4.4.2 Oracle

Oracle (2000b) ERP products covers the following application fields:

Table 7: List of applications covered by Oracle products

Applications	Applications
Financials	Projects
Human Resources	Self Service Web applications
Internet Procurement	Supply Chain Management
Manufacturing	

Source: Adapted from Oracle.com (2000)

4.4.3 PeopleSoft

PeopleSoft (2000a) have a modular approach to their ERP system. They started off with a focus on applications of human resources and finance but have expanded into core business processes such as MRP, project performance analysis, supply chain planning, manufacturing operations and eBusiness. The company also developed industry-specific applications for industries such as health care, higher education and financial services. The treasury management module seems to stand out as a specific application in the PeopleSoft product offering. The PeopleSoft Select range of products is aimed at medium-sized business. PeopleSoft reports that they currently serve more than 3000 customer organisations.

4.4.4 JD Edwards

JD Edwards (2000) delivers approximately 6000 customers with a standards-based, interoperable and highly customisable infrastructure

called the ActivEra Solutions for all business needs. The ActivEra Solutions comprise:

- OneWorld, their latest solution which is promoted to change old economy companies into virtual enterprises ready to compete in the new economy of super information highways.
- Active Supply Chain
- Active Customer Relationship Management
- Active Procurement
- Active Marketplace
- Active Knowledge Management
- Active Enterprise (includes finance, human, resources, payroll, capital asset and project management).

4.4.5 Baan

Baan's flagship is their ERP system and according to Baan (2000) this includes distribution, finance, manufacturing, project, sales, enterprise planning, procurement, warehouse management and service. BaanBIS Data is a product that extends the value of BaanERP applications to intranets and extranets. Gray (1998) reported that Baan has a componentisation strategy that gives users the option to use only the modules/applications that they need. Baan (2000) claims more than 12000 sites worldwide.

It has been reported in the media that as a company, Baan is experiencing financial and management direction problems, and it is therefore important to follow future developments in this regard carefully before deciding on implementing BaanERP systems.

4.4.6 Enterprise Extension software vendors

4.4.6.1 Customer relationship management (CRM)

There are many players in this market. The following discussion will centre around the major players in this market. All of the five big ERP vendors offer CRM modules.

Siebel Systems

Siebel (2000) is the industry's leading provider of Web-enabled front office applications and full-process marketing automation with tools to assist marketing professionals to successfully manage campaigns. Siebel products involving CRM aspects are listed in Table 8.

Table 8: List of CRM products by Siebel

Product Name	Application
Siebel Sales Enterprise	Comprehensive tools and information including opportunity and sales pipeline management, profile and account management and marketing encyclopedia.
Siebel Professional Service Management	Comprehensive functionality for service organisation which includes resource assignment, contract management, risk management, subcontract management and knowledge database of previous projects.
Siebel Service Enterprise	Provides for service request management with instant call routing and assignment, service environment profiling and multiple methods of problem resolution.
Siebel Call Centre	Integration of Siebel Sales Enterprise and Siebel Service Enterprise.

Table 8 (continue): List of CRM products by Siebel

Siebel Field Service	Complete service request management, service activity management, account management, intelligent assignment and dispatch, parts usage, trunk inventory, knowledge bases of known problems and solutions.
Siebel Marketing Enterprise	Application for full campaign management and execution capabilities with interactive customer, product, sales and channel business analysis to design and segment those campaigns.
Siebel InterActive	Automatically and continuously gathers relevant personalised information about customers, industries and competitors from sources inside and outside the organisation and delivers 'ActiveBriefings' that are matched to specific customers, prospects or territories of each user.
Siebel Product configurator	Allows for product configuration by option selection or Siebel SmartScript that leads sales person and customer through a profiler process for automatic configuration.
SiebelNet	Enables companies to outsource the infrastructure that is necessary for Siebel software solutions.
Siebel Wireless & Siebel Handheld	Methods provided for accessing time-critical customer data from mobile phones etc.

Source: Adapted from Siebel.com (2000)

An interesting module by Siebel is the Siebel D & B Integration Solution which allows it to access leads on more than 27 million businesses from D&B WorldBase database and also allows for the elimination of credit risk early in the sales cycle.

Siebel also has a product range for small to *mid-size* companies that consists of e-Business for Workgroups, Siebel Sales for Workgroups, Service for Workgroups and Call Center for Workgroups.

SAP

SAP's CRM forms part of mySap.com. SAP (2000) states that all the CRM challenges are covered by its software such as sales force automation (SFA), contact management, sorting prospects, sales tracking and forecasting, pricing and marketing encyclopedia and a product configuration engine. All this is integrated with the Internet providing for Internet sales and services and a service interaction centre.

JD Edwards

The product for CRM is Active Customer Relationship Management and is a comprehensive collection of applications that manages all phases of the customer life cycle. JD Edwards have partnered Siebel Systems and IBM in broadening their scope of effective solutions (JD Edwards, 2000).

IBM

According to an IBM Data Management white paper (IBM, 2000a) DecisionEdge is IBM's CRM solution that allows organisations to analyse customer behaviour in order to increase market share and customer profitability.

PeopleSoft

PeopleSoft acquired The Vantive Corporation to provide CRM solutions. Their CRM products are to be found in Table 9 (PeopleSoft :2000b).

Table 9: List of CRM products by PeopleSoft/Vantive

Product Name	Application
Vantive Enterprise	An integrated software suite built around the customer and consisting of the modules discussed below.
Vantive Field services	Product Configuration management, Contact Centre, Service Requests and work orders, Service entitlements, Technician dispatch & scheduling, spare parts inventory management and purchasing
Vantive Help Desk	Access to diagnostic information, streamlined problem management and resolution, asset tracking
Vantive Sales & Marketing	Sales & marketing automation. Provides opportunity management and sales productivity tools
Vantive support	End-to-end management of call centre and customer support operations with automated call routing, call tracking, entitlement processing, workflow, problem resolution, proactive revenue generation, performance measurement and service management
Vantive eBusiness applications	Enables users from both inside and outside the enterprise to manage critical business information anywhere, anytime.

Source: Adapted from Peoplesoft.com (2000)

Oracle

Oracle's (2000b) CRM offering includes the products in Table 10.

Table 10: List of CRM products by Oracle

Product Name	Application
Oracle Call Centre and Telephony	Transforms customer service and help desk-oriented call centre into a powerful revenue generating, multi-channel access contact centre with the emphasis on managing customer relationships.
e-Commerce	Encompasses dynamic technologies and business processes that link the enterprise with customers, suppliers and communities by linking all the significant customer touch points, from direct sales and tele-business to indirect sales and the Web. It also connects every circle in the delivery chain.
Oracle Marketing	A set of analytical and campaign tools to be used to help with the planning, executing and analysing of marketing programs for increased return on investment and customer retention.
Oracle Sales	Tools for maximising sales, increasing sales effectiveness and aligning sales behaviour with objectives.
Oracle Service	Facilitates end-to-end service delivery and customer care through functionality in support, scheduling and dispatching, spare parts, logistics, service billing, mobile field service and service contract management

Source: Adapted from Oracle.com (2000)

Baan

Included in the BaanERP system (Baan, 2000) is Baan Sales, which provides sales, marketing and customers with service automation for field sales, telesales, marketing and customer service. BaanERP Service includes product configuration, call management, contract management, history and statistics, service order control, service requirements planning, preventative maintenance planning and service order scheduling.

4.4.6.2 Other CRM software vendors

Other CRM vendors that seem to be important in the CRM market are mentioned by InfoWorld (1999):

- Pivotal Software Inc product with Pivotal Relationship,
- Rubric Software's Enterprise Marketing Automation software ,
- Clarify with eFrontOffice and
- Saratora Systems.

4.4.6.3 Supply chain management software

From the background discussions of the companies below, one will see that the software vendors in this market developed from founders with strong manufacturing backgrounds. Oracle is the only player of note of the major five ERP vendors in this niche market. The author believes, however, that as we live in a day and age of mergers and acquisitions we will soon see these companies being gobbled up to improve the current product offerings of the major five.

- **Component and supplier management (CSM)**

Aspect Development Corp - Bylinsky (1999a) reports that this company was started by an entrepreneur with a Ph.D. in mechanical engineering. This software house assembled data on seven million electronic parts, two million mechanical components and a million office products which has a major advantage in that it saves design engineers from spending time searching through fat paper catalogues.

- **Manufacturing execution systems (MES)**

Camstar – Camstar (2000) MES products are InSite (for Windows NT) and MESA (for IBM AS 400). Amongst other features InSite provides a model for complex workflows in the factory for analysis of alternative routes that includes products based on plant conditions, automatic rework routing and quality dispositions.

Oracle's strength lies in flow manufacturing and process manufacturing software and this makes it stand out from the big five ERP vendors.

Pivotpoint – Bylinsky (1999b) states that Pivotpoint's CEO had 17 years of experience in manufacturing when he started the company. One of the advantages of using this software is that it does not force the company to change its operations to suite the software as is the case with the software of the traditional ERP vendors. Their flagship product (Pivotpoint,2000) is Point.man which includes a comprehensive module on manufacturing. The company also offers two MRP products (Minxware and GrowthPower). Another product of note is Thru-put (supply chain management software) for improving on-time delivery, order-to-ship cycles and excess inventory.

- Dynamic performance monitor (DPM)

Bylinsky (1999b) writes that Foxboro is a maker of factory controls that developed software that they describe as 'real-time economic management' which bring value creation down to the production line operator. Foxboro (2000) states that the flagship of their product offering is the Intelligent Automation Series. This series is designed to measure, control and provide real-time information to meet the requirements of today's process plants. Typical customers are in the chemical, oil and gas, pulp and paper, metals and mining and pharmaceutical industries, to name but a few.

4.4.6.4 Other supply chain management software

As with CRM, all the ERP vendors have supply chain management modules as part of their product offerings, as noted in the discussion of each vendor respectively.

4.5 CONCLUSION

ERP systems bring all processes within an organisation together into one integrated system and simultaneously provide real time mission-critical operational workflow for the enterprise. The result is cost reductions, customer satisfaction and customer retention. However, ERP systems are still very complex and do not adequately provide for strategic decision support directly. This inflexibility can be seen when ERP systems are unable to provide management in real-time with non-standard reports for strategic planning and decision-making purposes. ERP systems also do not focus on tools for in-depth analysis of the entire business landscape, which is a prerequisite for strategic planning. This business need is addressed in the fourth quadrant with business

intelligence that uses information, amongst other things, from ERP systems.

This means that being operationally effective or having an effective ERP system in place might provide a business with competitive parity, but to gain a competitive advantage, business needs to progress into deep analysis and understanding of data in order to spot unique opportunities and identify problems earlier than competitors. Pellissier (1999) predicts very appropriately that competitive advantage will come from what organisations do with the information, in other words, strategic exploitation of the information. This is why business can ill afford not to progress towards using business intelligence tools, which is the fourth quadrant of the Information Delivery Classifications Matrix and the next subject of discussion.

CHAPTER 5

BUSINESS INTELLIGENCE

5.1 INTRODUCTION

This chapter is concerned with the software that is classified in the 4th quadrant, known as the 'business intelligence quadrant'. This is where business uses IT as a strategic tool to gain a competitive advantage over its competitors.

In order to explain the term 'business intelligence' (BI) a definition is taken from Richard *et al* (1999: 108) where it is stated that:

Competitive Intelligence or Business Intelligence can be defined as both a process and a product. In the former sense, Competitive Intelligence involves the legal and ethical means that a company uses to utilise information. On the product side, it provides insights into the activities of the competition. This information can also include the present and projected behaviour of suppliers, customers, technologies, markets, products and services, and the general business environment.

Richard *et al* (1999) also states that companies have historically applied BI for strategic planning but it is only recently that there has been a move towards automating the gathering and analysis of competitive intelligence information by using computers. The discussion in this chapter centres around the computer systems that support BI and the author sees this as comprising data warehouses, BI tools and strategic decision support systems. The data warehouses serve as a platform for business intelligence tools. The BI tools are designed as front ends to the data warehouses and are known as 'on-line analytical processing (OLAP) systems' and 'data mining software'. Strategic decision support applications such as executive information systems (EIS) and some of the ERP extension software are also included in the classification of BI

systems to align with both the aforementioned historic use of CI and Pellissier's (1999) view that the 4th quadrant consists of software that acts as a support for strategic planning and decision making. Freedman (1999) expands on this by saying that BI solutions integrate strategic, operational and financial data from both external and internal sources with analytical tools to ensure effective and efficient decision making.

Lattig (2000) opines that two of the mayor players in the BI market have different strategies regarding the delivery of BI systems. Oracle believes that what is necessary for BI is to tightly integrate CRM and ERP. The BI systems must then be self-service systems that run against transactional data. Cognos, on the other hand, believes that BI systems must be platform-independent in order to extend across a broad range of data sources.

This paper will present BI software systems by discussing the aspects of BI in terms of the components of BI systems, the current attitudes of business towards BI, the forces that drive BI, the benefits of using BI systems, the problems to contend with regarding BI and the latest trends in BI systems. Finally the main BI products and their vendors will be discussed.

5.2 COMPONENTS OF BUSINESS INTELLIGENCE SYSTEMS

BI systems comprise data warehouses, OLAP, data mining and strategic decision support systems and are discussed below in that order.

5.2.1 Data warehouses

The *Graphic Arts Monthly* (1999: 71) describes data warehouses as:

.. databases consisting of cleansed, reconciled and enhanced data integrated into local business subject areas for the purpose of improving the corporate decision making process. Typically, they are enterprise-wide in scope so that executives can readily understand company-wide sales or the complete business relationship with a given customer.

CSIPER Consulting (1999) adds that data warehouses are a vital BI infrastructure that helps business to bridge the gap between operations and strategy.

There are two challenges for data warehousing that need to be addressed in the future. According to Sullivan (2000) the time has come for data warehouses to broaden their scope to encompass text in addition to the traditional numeric data. Sullivan calls these 'document data warehouses' and sees documents as potentially significant but largely untapped resources for BI. The other challenge, according to White (2000), is for data warehouses to be able to handle the potentially huge data volumes created by the Web *clickstream* as users interact with e-business applications.

5.2.2 OLAP

Watterson (1998) comments that OLAP systems are high-powered software front-ends and data manipulation systems that sit on top of data such as a data warehouse. Lamb (1997) suggests that OLAP allows users to study data in a multidimensional manner, implying that they can drill down to details or view summary slices of data as required. The software facilitates the slicing and dicing of data for *ad hoc* queries associated with decision support systems. Turban & Aronson (1998) add that OLAP includes activities such as generating queries, requesting

ad hoc reports, performing statistical analysis and building multimedia applications. Hyperion's (2000) OLAP tools, which the author believes are fairly representative of other OLAP tools, for instance allows for viewing, reporting and exploring of data along business dimensions such as products, customers, geographies, time periods and many more. OLAP tools also provide for analysing past business performance and modelling forecasts of future business direction. Statistical analysis used in OLAP addresses issues in CRM such as ranking customers based on profitability and determining correlation strengths between issues such as customer profitability and demographic factors (Hyperion, 2000).

In summary, OLAP allows a user to follow a manual, iterative process of data exploration and discovery (Lamb, 1997).

5.2.3 Data mining

Whereas OLAP has been around for a while, data mining was introduced relatively recently, in the 1990s, and offers an alternative, automatic method of discovering patterns in data (Lamb, 1997). Turban & Aronson (1998) describe data mining as software tools that find patterns in data and infer rules from them. IBM (1998: 25) defines data mining more comprehensively as:

...the extraction of implicit, previously unknown and potentially useful information in data.

Lamb (1997) reports that data mining finds its roots in both historical and recent developments in statistics, *artificial intelligence* and *machine learning*. Data mining techniques include *neural networks*, *rule induction*, *decision trees*, *statistics/time series analysis* and *visualisation* (for further information on the abovementioned techniques, refer to the

glossary). The question of how OLAP and data mining fits together is best explained by the following diagram from Lamb (1997, 4):

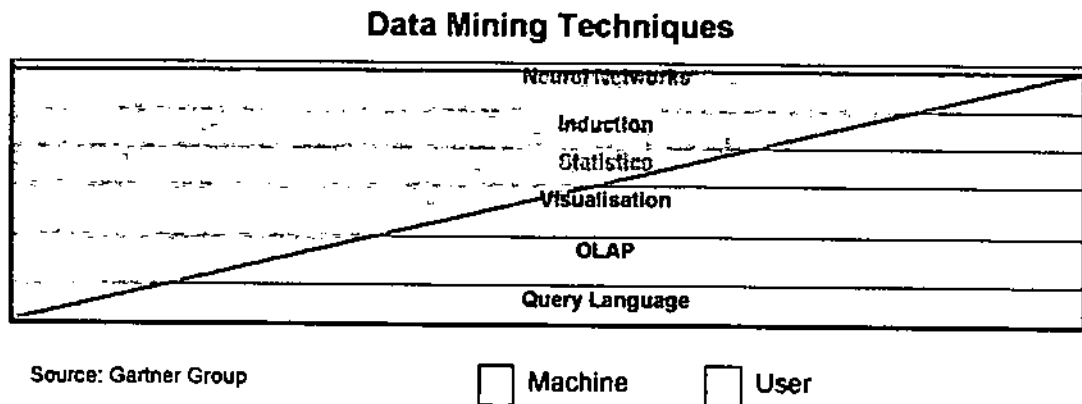


Figure 4: Data mining Techniques

Lamb (1997) maintains that data mining is suitable for analysing data sets that would be difficult to interpret using OLAP. He elaborates on the complication level which OLAP technology handles with difficulty because data becomes too large to navigate manually, or is too dense or non-intuitive to comprehend easily. Data mining makes sense when an organisation is faced with an overwhelming data set which is becoming the norm if one wants to incorporate *clickstream* data into business analysis.

IBM's (1998), knowledge discovery techniques used in their BI product offering are used to show how data mining techniques are applied in business. These discovery techniques are:

- Clustering, where entities with common properties are grouped together,
- classification, where synergies between different types of entities are explored,

- associated discovery, for example analysis of which products tend to be purchased together,
- prediction by exploring changes in established patterns,
- sequential pattern discovery where the tool search for subsequent related activities like investing in fire extinguishers shortly after buying a barbecue, and
- similar time sequence discovery where the software searches for apparently unrelated events which may be influenced by external factors such as rate of exchange.

The above discussion shows that data mining helps management to understand key business issues such as customer segmentation and potential buying and loyalty behaviour, provides management with the means to prioritise spending, and analyses credit risk and more. The result of data mining is that management has the opportunity of making decisions based on relationships in data that were unknown to them before. This gives a business a tremendous advantage over the competition.

Authors like Kimball (2000) believe that data mining will be coming of age in the next decade and that the focus will be on behaviour as the ever-increasing data sources provide more detail that describes the customer, citizen and Web site visitor. The author believes that OLAP will still play a role as the results of data mining can highlight certain aspects for additional scrutiny which can create a differentiated competitive advantage when OLAP is combined with the input of a talented human being.

5.2.4 Strategic decision support systems

The author sees strategic decision support systems as all those software systems that specialise in specific areas of strategic planning and decision making that normally use OLAP and or data mining tools to analyse data.

5.2.4.1 Executive information systems (EIS)

The author felt it necessary to include EIS software as an example of strategic decision support systems as EIS software is primarily designed for the information needs of top management whose main responsibility is strategic planning. In addition, the software uses OLAP and data mining technology for analysis of data.

Turban & Aronson (1998: 389) defines EIS as

.. a computer-based system that serves the information needs of top executives. It provides rapid access to timely information and direct access to management reports.

Turban & Aronson (1998) go on to add that EIS is user-friendly, provides for contextual visualisation, exhibits advance exception alerting and reporting features and drill down facilities for detailed investigation. Moreover, they state that EIS is designed to support top management by helping them to discover problems and opportunities by scanning the business environment both internally and externally.

5.2.4.2 ERP extension software.

CRM was discussed at length in the previous chapter and it is only necessary to point out here that the CRM components that focus on the strategic analysis are classified as business intelligence. This means that

all CRM systems that use BI tools to provide insight into customer behaviour form part of BI. This is also the area that makes CRM one of the hottest topics in the computer software world today.

The advent of exciting *clickstream* information is the dream come true for the marketing analyst, since information is now available for every action of every visitor to a Web site. This creates almost unimaginable masses of data and for this, data mining is the only technology (Winter, 2000) that can effectively be used for analysis of customer behaviour. Hill (1999) adds that the main data mining CRM applications are segmentation and predictive modelling and with the use of BI tools, the marketer's ability to target campaigns should improve.

The strategic component of CRM is an area for major development if one takes note of what Winter (2000) has to say, namely that most *clickstream* analysis has focused on operational use and that the next step will be to better understand the customer, which implies that customer behaviour analysis on *clickstream* information is in its infancy.

5.3 THE ATTITUDE OF BUSINESS TOWARDS BUSINESS INTELLIGENCE

After examining the components and application of BI systems, the author believes that it is appropriate to investigate the attitude of business towards computerised BI systems by looking at the results of recent surveys in this regard.

Richard *et al* (1999) report on an attitude survey that was done on CEOs and CIOs from 550 firms in the U.S. regarding the application of BI. The study indicated that although BI is important to them, there is a tendency for firms to under-invest in it. This survey also highlighted the fact that there is considerable interest in BI among CEOs and CIOs and they

believe that the benefits from BI are well worth the time and resources employed. Another interesting result of this survey is that there is a tendency for CEOs to be more BI-aware and active than CIOs. This is an indication that IT departments will have to increase their knowledge about BI and start working with the CEOs and other users of BI within their organisations regarding the implementation of BI systems.

Lattig (1999b) reported on a related survey, this time on CIOs at American Corporations, where it was found that 70% of IT managers at the Fortune 1000 companies are expecting to improve the companies' business intelligence capabilities over the following two years. Lattig (1999b) opines that the objective of the CIOs in this regard is to learn more about customers and to provide the decision makers with accurate and relevant data.

The vendors of BI systems believe that there is not enough awareness of the benefits of BI. Taschek (1999) believes this is the case because the vendors are not selling their product correctly and suggests that they should start showing business how BI products can cut costs or increase the value of the business. There are, however, many initiatives by vendors underway in this regard. Lattig (1999c) reported that IBM was busy with a big advertising campaign to make users aware of their BI and warehousing products. Oracle announced new partnerships in order to promote their BI solutions and in particular their acquisition of Thinking Machines which will enable them to integrate Thinking Machine's CRM application with Oracle's existing BI solution. Taschek (1999) reports that Seagate has gone so far as to implement a marketing strategy in which they give the software away for free to demonstrate BI to companies. In the same article he notes that Mike Schiff from Current Analysis thinks that the move by Seagate might be the jumpstart that the BI market needed.

The above surveys indicate an overall increase in awareness by U.S.A. business that BI systems are important and need to be implemented. As can be seen from the previous paragraph, BI vendors are contributing towards this increased awareness but there are also certain other forces that will drive an increase in BI implementation. This is the next item under discussion.

5.4 FORCES THAT DRIVE BUSINESS INTELLIGENCE

The most important force is the pressure on business to enhance shareholder value by increasing revenues, reducing costs and competing more effectively. This can only be done by gaining competitive advantage. Pellissier (1999) suggests this can be done by data gathering and analysis (or BI) that facilitates the matching of internal strengths to profitable opportunities.

Related to the above, Lattig (1999c) stresses more specifically the customer retention issue which pressurises CIOs and Vice Presidents into doing anything they can to keep customers. He proposes that customer loyalty can be fostered by dint of individualised marketing. Davison and Uhlman (1999) regard data warehousing and BI as excellent IT tools to utilise in customer relations.

Another force mentioned by IBM (2000b) is the need to manage and model the complexity of today's business environment. Here the power of Web information seems to be the most prominent factor, and Nachtwey (2000) introduces two issues of relevance. First business needs to know how to use the Web information to make a sale, manage its supply chain, etc. The other side of Web information is that the Internet, as a market medium, represents an evolution towards perfect

efficient markets where consumers have perfect information. Another complexity issue of particular importance is the ability to retain knowledge within the organisation. Gordon (1999) argues that knowledge management enhances the decision-making capacity of top-level executives and expands the perspective of middlemen. He sees knowledge management as the strategy of organisations to capture or tap the collective experience and wisdom, including the 'tacit' know-how of people, and to make it accessible and useful to everyone in the organisation. Knowledge management, if successfully implemented, can save costs. Gordon (1999) supports this with the example of Ford. Ford practised knowledge management and saved an actual amount of \$600 million. The company does it by focusing on collecting and delivering just the right data at the right time, regarding ideas that people can use to do their jobs better. Ford's projected total value of the knowledge management project over 3 years is \$950 million.

Then lastly IBM (2000b) stresses the need for business to derive maximum benefit from corporate business information since investment in IT systems makes up a significant percentage of corporate expenses.

5.5 BENEFITS OF BUSINESS INTELLIGENCE

To further strengthen the case for using BI systems one must explore the main benefits of BI. The author views the following as the main benefits of BI:

- Decision makers who have access to BI can gain better insights into their industry, and can better understand their competitors (Stedman, 1997). This allows them to identify their strengths quickly, pinpoint their weaknesses, uncover new opportunities, capitalise on trends and plan accordingly (Lattig, 2000).

- Business can discover shifts in the marketplace and react to them quickly (*Graphic Arts Monthly*, 1999).
- Effective BI solutions help management to create reports that easily indicate the whys and wherefores of sales, revenue, or cost figures by revealing certain underlying patterns (*ABA Banking Journal*, 1999).
- BI solutions provide a complete view of the business environment which allows for companies to utilize all kinds of business information for competitive advantage quickly and easily. (*Graphic Arts Monthly*, 1999).
- BI solutions can monitor more sources than humans can and do so with greater accuracy. This means that the many information-gathering tools of the BI professional such as financial filings, press releases, trade publications, industry analysis, conversations with industry players and executive interviews can be monitored and analysed more effectively (Reed, 1999). In fact this process can be automated with intelligent agents like Web Robot and Web Spider (Firefly Corporation) which are used to gather and alert users of all new incoming information on the Internet regarding topics of interest (Turban & Aronson, 1998).
- BI solutions provide business with the means to manage the ever-increasing data (data doubles every five years in a given organisation) for better informed and effective decision making (*Graphic Arts Monthly*, 1999).
- Learning organisations that know how to capture the knowledge of their workers can increase knowledge worker productivity with BI solutions (Turban & Aronson, 1998).

Now that one appreciates the advantages that BI solutions can bring to organisations it is appropriate to devote the next section to the problems with BI.

5.6 PROBLEMS

Lattig (1999d) maintains that there are certain problems with the implementation of BI solutions.

- A data warehouse that can handle massive volumes of data is required when you want to customise products and service for customers on an individual basis.
- A lot of time and effort from management is needed because a great deal of thought must be given to what data is really going to be of benefit. If an organisation does not have clear business goals it will not be able to structure and collect data correctly for BI purposes.
- It must be remembered that the result of any analysis is just as good as the data that was provided. This problem is to some extent addressed with the extraction and cleansing tools that are commercially available to simplify the building and capturing of the back end of the data warehouse applications.
- One must also consider the human factor. Once you have a reliable data warehouse you need to make sure that business people know and understand what BI systems can give them and how to get the best out of the system. There are success stories like Netcentives (Internet marketing firm) that has had success in this field because they were able to bridge the gap between IT and marketing by hiring marketers who understood technology and IT workers who understood marketing.
- Information is embedded in many different places in the organisation and it is a real challenge to link all these different data sources. To give the reader an idea of the complexity of this problem, Thomsen (2000) suggests a few places where knowledge is embedded apart from the conventional sources such as relational databases, ERP systems, etc. These places are formulae in OLAP systems, triggers

in relational databases, visual patterns in GIS systems, predictive models in data mining packages, classical rules and personal profiles in text-engine based applications, business procedures in rule-automation systems, and drivers in decision tools.

- Lattig (1999b) also draws attention to early implementation of data warehousing in which problems occurred because there were no clear business goals. The implementation times for the data warehousing were very long, and on top of that, the analytical applications were very user-unfriendly and only a few technical people could use them.
- Lattig (1999b) points out that it is very expensive to implement a data warehouse. The trend towards pre-packaged BI platforms by companies such as Informix, Cognos, and MicroStrategy addresses the need for simplicity (see below) and shortens the project implementation time tremendously. An interesting development is also that some of the vendors now also bundle certain applications to target small to medium-size businesses.

No discussion on the computer industry is complete without looking at future trends, which is the next section under discussion.

5.7 TRENDS IN BUSINESS INTELLIGENCE

Reed (1999) proposes that competitive intelligence is being changed by technology such as the Web, *intranets*, groupware and databases. It is then not surprising to find an article by Lattig (1999e) that states that the latest development in the BI arena is on-line business intelligence. He goes on to say that both Oracle and Microsoft are announcing strategies in this regard which they call Intelligent Webhouse and BI analytics respectively. Oracle's Executive Vice President, Gary Bloom, believes that the ability to implement a complete e-business intelligence solution

from the data warehouse through to data mining will be the key to the success of both new dot-com companies and traditional companies moving on-line. He also notes that there is not a big barrier to entry for the new dot-com companies and for traditional business to come on-line. The real competitive advantage lies in data and information that you have about your customers, which at the moment is still scattered all over the organisation.

Mike Schiff of Current Analysis agrees that analysis of online interactions is important but it must be combined with analysis from retail sales to provide a full picture of customers' shopping habits. Lattig (1999e) argues that this is clearly a gap which BI vendors can address in the future. The tools are there. The challenge is combining ERP, external data from your retailers, data from online transaction and customer research on products together to get the full picture of customers' shopping habits. The author believes that the only problem at this stage is to link customer product research on the Internet with the actual buying in a shop.

Another interesting trend is noticed by Bing (1999) namely companies on the Internet like Transium starting up that specialise in making it easier for researchers/business to access data by using technology that simplifies complex searches. The company Northern Light is Transium's closest rival.

This completes the discussion on the what, why, how and where to of BI. The last step now is to provide information on the BI vendors and their products.

5.8 BUSINESS INTELLIGENCE PRODUCTS AND VENDORS.

This section includes the most popular BI products with a description of their application in order to establish whether the BI vendors have succeeded in fulfilling the promises of the above theory of BI systems.

The names of most of the big database companies appear below because it was natural for them to move into the business intelligence quadrant. The reason for this is that they already had a strong existing skill base in database development which is complementary to data warehousing. The additional skills needed could easily be acquired through acquisitions and mergers to incorporate data warehousing, OLAP and /or data mining into their products range. Lattig (1999b) substantiates this with his article on database vendors that offer data warehouses which are designed in such a way that they serve as platforms for business intelligence solutions.

Some names are new. Companies such as Cognos and MicroStrategy follow a different strategy on BI solutions in that they specialise in BI solutions only. They offer suites of BI tools that are designed as front ends to data warehouses that provide everything from extraction to analysis.

A discussion of the major BI vendors and their products follows.

5.8.1 Cognos

Cognos is in the top tier of the BI market according to Taschek (1999). Cognos' (2000) product list covers all BI aspects that are necessary for organisations to do business in the Internet economy. Cognos offers *data marts* that provide a unified view of the business, prepackaged e-applications that save implementation time, sophisticated visualisation

and business performance management, reporting and analysis to see one's business from all perspectives. Cognos also has an enterprise BI portal to provide everyone with personalised access to information that is relevant to them. Cognos facilitates intelligent, self-service *extranets* that allow for sharing of information with customers, suppliers and partners.

As Cognos is the leader in the BI field, a comprehensive list of their products as well as a short description of their application follows below.

Table 11: List of BI products by Cognos

Product Name	Application
Cognos PowerPlay	OLAP reporting and analysis across the enterprise.
PowerPlay Web	Provides instant deployment of multidimensional analysis via the Web
Cognos Impromptu	Enterprise query and reporting
Impromptu Web reports	Reporting solutions for easy distribution and navigation of standard reports via the Web
Cognos Query	Ad-hoc query creation, navigation and exploration of corporate data via the Web
Cognos Upfront	A portal service which has a single Web-based data access point.
Cognos Visualiser	Interactive multimedia data visualisation
Cognos DecisionStream	Builds and deploys enterprise BI-ready data marts
Cognos4Thought	Predictive modelling with data mining
Cognos Accelerator	BI information from SAP
BI for Small Enterprise	Complete BI solution for small to medium-size business – gives immediate insight into key factors driving the business
Cognos DataMerchant	E-commerce for data merchandising, secure packaging and distribution via the internet

Table 11 (Continue): List of BI products by Cognos

e-Applications:	Pre-defined data marts with ready-to-use reporting and analysis solutions
Cognos Finance	Financial reporting, consolidation, budgeting and forecasting
Cognos Headstart Solutions	Predefined analysis and reporting modules for corporate data stores
Cognos NovaView	Frontend Analysis tools for MicroSoft SQL Server OLAP services
CognoSuite	A complete BI solution
Cognos Scenario	Data mining for uncovering hidden patterns and relationship in corporate data

Source: Adapted from Cognos.com (2000)

Cognos also has application development tools . These are Cognos Axiant 4GL, Cognos Powerhouse, Powerhouse Web and APL2000

As can be seen from this impressive list of products, Cognos is specialising in all the aspects of BI discussed.

5.8.2 Hyperion Solutions Corp

Hyperion focuses on extending the value of data warehouse architecture with a focus on OLAP technology. Hyperion Essbase OLAP server is their BI product. There are also more than 30 front-end tools developed by Hyperion alliance partners to complement Hyperion's tool set (Hyperion 2000).

5.8.3 Seagate

The main products and their applications of Seagate (2000) are:

Table 12: List of BI products by Seagate

Product Name	Application
Seagate Analysis	Includes <i>ad hoc</i> query, multidimensional OLAP analysis, report viewing and design and export to Excel.
Seagate Crystal Reports	Report writer tool – acknowledged leader among Windows report writers (4 million licenses shipped)
Seagate Info	Integrates all the functionality of Seagate Analysis by seamlessly connecting all users of Seagate Analysis into a scaleable system for access, analysing and sharing valuable information across the enterprise.

Source: Adapted from Seagatesoftware.com (2000)

5.8.4 Oracle

Oracle (2000a) offers its BI tools and their applications as consisting of the following:

Table 13: List of BI products by Oracle

Product Name	Application
Oracle Discover & Oracle Discover Viewer	An intuitive, open <i>ad hoc</i> query, reporting, analysis and WEB publishing tool for all levels of business users. These tools provide access from data repositories such as relational data warehouses, data marts or OLTP systems.
Oracle Reports	A comprehensive enterprise reporting tool that is easy to use with build-in wizards.

Table 13 (continue): List of BI products by Oracle

Oracle Data Mart Suite	Data mart tool which includes database software, a design tool, a data movement and transformation tool, software for end-user analysis and reporting.
Oracle Express Server & Express Analyser and objects	OLAP tool for forecasting, what-if scenarios, and financial modelling. Optimised for query and analysis of corporate data such as sales, marketing, financial, manufacturing or human resource data.
Oracle Darwin Data Mining Suite	Data mining software with embedded functions from Darwin (Product of Thinking machines). (Lattig :1999a).

Source: Adapted from Oracle.com (2000)

Lattig (1999e) reported on Oracle's launch of an Intelligent Webhouse initiative in November 1999. The objective is to help electronic businesses improve the tracking of their customers' buying patterns and preferences through their Web interactions. The products which were upgraded for this purpose were: Oracle 8i R2 , Oracle Reports 6i and Discoverer 3i and Darwin 3.6.

5.8.5 SAS

SAS (2000a) claims that they have more than 31000 customer sites in 120 countries. They have also won awards for data warehousing and decision support software. SAS's software includes an open and efficient data warehouse structure and, for exploring the data, SAS provides multidimensional data analysis with OLAP tools, query and reporting, data mining, data visualisation and applications development tools. SAS also provides specific solutions for strategic planning and

decision making like EIS, balanced scorecard, CRM, supplier relationship management, *e-intelligence* to name but a few. Of specific interest is their initiative to unite BI information with unstructured information by forming strategic partnerships to integrate the best knowledge management technologies into BI.

5.8.6 NCR

Watterson (1998) states that NCR's high-end Teradata systems run many of the world's largest data warehouses. Lattig (1999a) reported that they entered the data mining market in the middle of 1999 with TeraMiner Stats which mainly fulfils the preprocessing function of data mining. They plan to roll out TeraMiner Analytics and TeraMiner Deployment this year.

5.8.7 IBM

Watterson (1998) reports that IBM established an early lead in the data mining portion of the BI market. IBM (2000a) promotes their BI products as being Intelligent Miner for text, DB2 Intelligent Miner for Data, Visual Warehouse and DB2 OLAP server. IBM's (2000b) strategy regarding its data mining and OLAP products is to provide prepackaged business applications that facilitate the rapid deployment of advanced decision applications. IBM also has a BI partner programme to ensure integration with third party vendor BI products such as Cognos, Business Objects, Hyperion, etc.

IBM is a force to be reckoned with in the BI market if one takes into account the fact that Lattig (1999a) reported that IBM has launched a \$30 million advertising campaign to emphasise its BI software

5.8.8 Business Objects

In a product press release Business Objects (1999) announced their suite of BI tools as:

Table 14: List of BI products by Business Objects

Product Name	Application
WebIntelligence	Query, reporting and analysis solution for the Web
Business Objects	Provides powerful, interactive, easy-to-use reports to non-technical business users.
Broadcast Agent	Integrated reporting and broadcasting server that provides for reports on corporate data to be published via the Internet and other output devices
Developer Suite	Platform that provides all the tools for development of highly customised e-BI solution

Source: Adapted from Businessobjects.com (2000)

The four products are designed to work together to mass-distribute BI tools within and outside a company.

5.8.9 Microsoft

Joch (1999) comments that the SQL server 7.0 relational DBMS provides data warehousing and decision support functionality and, according to them, holds the number 3 place in the data warehousing market share. Bundled with the SQL server is an OLAP server engine to which businesses can add graphical tools (like Knosys' ProClarity) for multidimensional data analysis. The major BI vendors like Business Objects Inc., Cognos Corp, Brio Technology Inc. and Seagate Enterprise Management Software all provide front-ends that support the SQL server. Microsoft (1999) also committed themselves to data mining with

the product OLE DB for data mining which is focused on the data mining developer community.

The author is of the opinion that because the Microsoft SQL server is a lot cheaper than some of the data warehouses in the market, one will see more mid-size businesses implementing MS SQL server and OLAP for their BI needs.

Lattig (1999e) adds that Microsoft launched a Business Internet Analytics initiative to expand their data warehousing solution to include tools and processes for clickstream analysis.

5.8.10 Informix

Watterson (1998) suggests that Informix concentrates on the high end of three key areas, namely high-performance OLTP, Web content management and data warehousing.

Informix (2000) BI products are listed in Table 15.

Table 15: List of BI products by Informix

Product Name	Application
Informix Extended Parallel Server	Data warehouse
Informix Red Brick Decision Server	An informed decision solution incorporating all the facets of BI
Informix Metacube	OLAP, optimised for smarter data access, analysis and reporting.

Source: Adapted from Informix.com (2000)

5.8.11 Other Business Intelligence Vendors

An interesting development is that the biggest ERP vendor, SAP, seems to be entering the BI market with SAP BW, the Business Information warehouse which is incorporated as part of mySap.com (SAP AG,2000).

5.8.12 Executive Information Systems (EIS) Vendors

Turban & Aronson (1998) cite the two main EIS software vendors as Comshare Inc. and Pilotsoftware Inc, which will be discussed next.

5.8.12.1 Pilot Software Inc.

Turban & Aronson (1998) list Pilot Decision Support Suite as consisting of:

Table 16: List of BI products by Pilot Software

Product Name	Application
Pilot Desktop	Ad-hoc end user access
Pilot designer	Development of EIS applications
Pilot Analysis Server	Provides access to multidimensional data models and uses an Excel add-on as an OLAP front end.
Pilot Discovery Server	Provides data mining and predictive modelling
Pilot Internet Publisher	Publishes multidimensional data on World Wide Web (WWW).
Pilot Sales & Marketing Library	For specific Vertical Markets.

Source: Adapted from Pilot.com (2000)

5.8.12.2 Comshare Inc

Comshare (2000) product applications for strategic decision making are included in Tale 17.

Table 17: List of BI products by Comshare

Product Name	Application
Comshare Management Reporting & Analysis	Consists of a book of reports , allows for exploring of key performance issues, advanced data visualisation techniques, trend analysis and variances and integrates data from different sources.
Comshare Planning	Powerful multidimensional modelling, reporting, and analysis for strategic and top-down planning
Comshare Decision	OLAP solution with advanced exception alerting and reporting.

Source: Adapted from Pilot.com (2000)

5.8.13 Current status of product offerings by BI Vendors

In order to establish which BI technology the BI vendors focus on in their different product offerings, a summary table follows below.

Table 18: BI technology used by vendors in BI market

Vendor	Data warehousing	OLAP	Data mining
Cognos	✓	✓	✓
Hyperion	✗	✓	✗
Seagate	✗	✓	✗
Oracle	✓	✓	✓
SAS	✓	✓	✓
NCR	✓	✗	✓
IBM	✓	✓	✓
Business Objects	✗	✓	✓
Microsoft	✓	✓	✓
Informix	✓	✓	✗
Pilot Software	✓	✓	✗
Comshare	✗	✓	✗

From the above analysis one sees that 75% of the Vendors provide both data warehousing and BI tools (data mining and OLAP) and that all BI vendors have BI tools in their product offering. One also see that all vendors except NCR , which has strong partnership relationships with all major OLAP vendors, provide OLAP tools. Of interest is the fact that only 58% of the BI vendors provide data mining functionality. This seems to suggest that OLAP technology is the more mature technology and substantiates the statement of Kimball (2000) that the next decade will be the coming of age for data mining.

5.9 CONCLUSION

The turbulent business environment drives an increased need for BI which relies heavily on the support of IT resources.

The most important prerequisites for BI solutions to be of benefit are clear business goals, as short an implementation time as possible and then, very importantly, ease of use by all levels of management.

BI solutions are available as pre-packaged software and the real challenge will be to assess your company's strategic information needs and then select the appropriate platform. This in effect means choosing between or combining OLAP and data mining. The difference between the two lies in data mining's predictive capabilities. OLAP is a strong platform for gathering information for a corporate database but its limitation lies in that it provides only answers to questions users know that they might want answered. Data mining can improve on this with its predictive modelling capabilities.

As mentioned before, data warehouses are expensive to implement and this might be a restraint on mid-size business when it comes to implementing BI but management must look at alternatives like sharing of data warehouses, outsourcing etc. Microsoft's SQL server is targeting the lower end of the market and might provide a platform for mid-size businesses, but for advanced BI benefits, mid-size businesses will still have to look at third parties for additional BI solutions. Another commendable development is that some of the BI vendors like Cognos are also starting to provide BI solutions for small and mid-size business

One of the biggest challenges facing both business and BI vendors is to incorporate soft information like opinions, feelings, speculations, etc., into data. This can only be done with a company culture of knowledge

sharing. The author believes that incorporating the minds of knowledge workers into BI might be the beginning of another category of software which might be called Collaborative BI after SAS (2000b). Management will have to be very creative to encourage this. Ojala (1999) gives examples of such practices as encouraging personal home pages on the corporate *intranet* and rewarding the number of hits received. Celebrating achievements gained as a result of knowledge sharing is another example. Turban & Aronson (1998) suggest that the capturing of soft information can be accomplished by incorporating it in EIS systems. EIS support staff might enter some of the information and the EIS system can generate some based on historical data (facilitated by data mining technology), or by intelligent agents that are scanning new sources and internal reports. The author also believes that by incorporating voice recognition technology with mobile hardware, a rich data source of 'information thoughts' might be established by facilitating knowledge workers to verbalise and thus digitise thoughts where and when they occur.

The author proposes that there are other interesting sources of data that will have to be integrated into BI in the future and that is information that is generated by the hundreds of nanocomputers in cars, homes and offices. Kimball (2000) and others believe that all the nanocomputers will eventually merge. The author believes that when this happens one will see the same reaction that clickstream information created in BI solutions again, with the exception that this incorporation will take place much faster because of the lessons that are being learned from clickstream information currently.

The author wishes to conclude this chapter by emphasising that BI solutions are the means to gain a competitive advantage over rival companies. Companies that are first movers in leveraging the incredible

amounts of data they have scattered all over into knowledge will be the future top performers in their industry.

CHAPTER 6

RESEARCH METHODOLOGY, DATA ANALYSIS AND FINDINGS

6.1 INTRODUCTION

This research involved a *descriptive study* of software usage by medium to big businesses in South Africa. Research is a widely used term with many different definitions; in this document, however, the term 'research' refers to business research defined by Cooper and Schindler (1998: 14) as:

a systematic inquiry that provides information to guide business decisions.

The research objectives of this study are to establish the following:

- The extent to which businesses in SA are using software in terms of the Information Delivery Classification Matrix (Pellissier, 2000);
- Where the tested businesses plan to move in terms of the said matrix;
- The strategic features in BI software which are most important to business; and lastly
- Whether or not top management perceive IT as a strategic tool.

6.2 RESEARCH METHODOLOGY

6.2.1 Scope and method of study

The scope of this dissertation is a research project on a representative sample of the current and future use of software by medium to big business in South Africa.

The methodology used for this research is both qualitative and quantitative. Sampling was used to draw conclusions about the entire population as defined below. Sampling was also used to limit the scope of this dissertation and because of financial and time constraints. The type of sampling used is stratified sampling (Cooper & Schindler, 1998:238) with a segregation of the population into industry groups. Another important point to note is that a subjective approach of non-probability sampling was used and again the motivating factors for this approach were the scope of this dissertation, and the financial and time restrictions.

As mentioned before, the population was chosen with due regard for the differences which existed in the different groups (strata) within this population. The population in this case consisted of a comprehensive list of 261 companies. This list consists of a commercial list of companies for IT sales representatives, a list of all the members of the Pharmaceutical Manufacturers Association (PMA) and a list of members of AVCASA, the Crop Protection and Animal Health Association. The reason for the inclusion of the last two lists was to ensure that in the case of an inadequate response, a thorough analysis of at least one industry could be made. A sample of 23 industries (refer to Appendix 4) was chosen to represent private sector business in SA. This means that government departments, municipalities, and trade associations per se were excluded from the population. The number of firms sampled within each industry depended on the number of medium to big businesses in that particular industry within the framework of the available time and information restrictions. A category 'other' was also included as part of the list of 23 industries and consists of single samples of industries such as security, printing, bearings and laboratories and research institutions. The total number in the sample was 102 companies. A graphical display

of the questionnaires sent out and subsequently received is provided in Graph 1.

6.2.2 Data sources used

The data sources in this case were primary data that were collected. The survey instrument chosen was a self-administered questionnaire distributed primarily through electronic mail. Measures taken to improve the return rate were telephonic preliminary communication and a follow-up electronic mail letter after a waiting period of one month.

6.2.2.1 Process of compiling the questionnaire

Comprehensive research into the products in the 4 quadrants of the Information Delivery Classification Matrix (Pellissier, 2000) was undertaken. The survey questions were then developed around the 4 quadrants, namely office automation, DBMS, systems applications and BI. The first draft of the questionnaire was tested with a focused group of three people. Their feedback helped revise the questionnaire into its final format. Specific feedback included the fact that the time required to complete the questionnaire was too long and certain questions were unclear. These problems were addressed by changing the layout of certain questions and by providing respondents with more tick boxes, thus indicating clearly what type of information was required without restricting respondents to examples only. The final questionnaire is attached as Appendix 1.

6.2.2.2 Structure of the questionnaire

The questionnaire was divided into five sections, namely office automation, DBMS, systems applications, BI and a strategic and company information section. The first four sections were centred

around the 4 quadrants of the Information Delivery Classification Matrix. The sections mainly consisted of a list of the relevant types of software products with examples of the most popular products. The objective was to establish the current and future use of the software types by businesses. Each of the first four sections concluded with a question that required the respondent to indicate the extent of usage or intended usage of the main product type in that section. The last section consisted of strategic questions and the objective here was to establish the most important strategic areas required to be supported by BI software. Also included in this section was a question intended to establish whether or not top management perceives IT as a strategic tool in business. This section concluded with questions used to establish the size of the business.

6.2.3 Data shortcomings

There were some problems with the data received and the reader is requested to take cognisance of the issues below.

- Table 19 lists the industries from which an inadequate response was received. These industries are often mentioned in the analysis that follows and the results in respect of these industries should not be viewed as representative.

Table 19: List of industries with inadequate responses

Industry	No. of Respondents
Professional Services	1
Paper	1
Legal	2
Mining	2
Building & Construction	2
Hotels & Leisure	2
Telecommunications	2
Defence	3

- The respondents did not always complete all questions and the author replaced the missing values with the average response of other respondents in that particular industry. A summary of the original data is included in Appendix 2 and the said values are indicated by green shading.
- Some respondents did not rate the strategic areas in the last section of the questionnaire but did indicate that those areas are important. This information was ignored in the analysis, however. The said data is indicated by yellow shading.

6.3 DATA ANALYSIS

6.3.1 Method of data analysis

The major focus was to follow an exploratory data analysis approach combined with descriptive statistics and correlation. The techniques for displaying the data used are pareto bar charts, pie charts, frequency and other tables. The mean and range were techniques used for descriptive statistics and correlation was used to test the strength of relationships. The data analysis consists of an exploration of the individual quadrants,

the strategic section and then concludes with an integrated analysis of the Information Delivery Classification Matrix. The methodology followed for the individual quadrants was first to analyse the overall averages for all the products in a quadrant and then further detailed analysis of the industries was performed.

6.3.2 Analysis of the Information Delivery Classification Matrix in individual quadrants

6.3.2.1 Office automation

(i) General

Pellissier (1999) suggested that most businesses have already invested in office automation systems and the objective in this section was to confirm this supposition.

The pareto diagram (Graph 2) highlights the following points:

- Word processing, spreadsheets and e-mail are indeed used by all businesses.
- Groupware is also used by 84% of the businesses tested, but it should be noted that groupware software use is mainly limited to e-mail and this will be discussed later.
- Accounting packages also have a high usage, which is understandable as many medium businesses still have not implemented ERP systems. It is also interesting to note that no new implementations of accounting packages are planned which also indicates the maturity of these packages.
- DTP has been around for a long time and has a fairly high current usage rate, with very few implementations planned for the future, which again indicates the maturity of the product. The data also

indicates that DTP is not used by all and this can be attributed to the fact that some businesses prefer to outsource DTP because of a lack of specialised DTP skills in the organisations.

- Electronic facsimile has a 69% usage rate and a fairly low future implementation percentage which can possibly be attributed to the fact that there is a school of thought that the facsimile technology is obsolete (refer 2.2.6.1).
- The pareto diagram shows a relatively big drop in current usage after DTP of below 50% current usage for the rest of the office automation software types. These software types consist of newer technologies or less mature products which could be the reason why one sees a lower current usage and increased future implementation.

The last observation leads to further exploration based on grouping the software types that have a lower than 50% current usage rate into group support systems and voice recognition. Group support systems in this context consist of workflow, EDMS, groupware and video conferencing. The reason for this grouping is that although all of the aforementioned software types can be used on their own, all of these functionalities are now incorporated into the most popular groupware packages. In addition, group support systems focus on group productivity whereas voice recognition is at the stage of development where the main focus is on personal productivity and it is therefore analysed on its own. This analysis culminates in Graph 3 which highlights the following:

- Group support systems are used by 52% of businesses and 21% of businesses plan to implement group support systems.
- The average future implementation for group support systems of 21% is influenced by a 28% average for workflow systems as the highest contributor, followed by EDMS and video conferencing at 25%. The biggest influence on this overall average of 21% is the 4% future implementation in groupware which needs to be explored further. A

possible explanation for this is that most businesses have implemented groupware but are not using it to its full potential. This will be explored below.

- The current usage of voice recognition at 15% seems to indicate that business did not see its application as being of great importance, but there seems to be an increased awareness with more businesses (20%) planning for future implementation.

This leads us back to the issue of the extent to which groupware is used. The questionnaire requested the respondents to indicate the purposes for which groupware was used. Seven options were given which included the option to specify other purposes. This data is graphically displayed in Graph 4 and immediately highlights the fact that groupware is mainly used for e-mail and information sharing with far less significance being attached to the other purposes. This confirms that although groupware products have a huge installed base with a low future implementation percentage which indicates the maturity of the product, closer inspection indicates that the extent of the usage of the software type itself might not have reached its full potential. This suggests that the extent to which groupware products are used could have the potential for growth in the future. However, this was not tested in this questionnaire.

(ii) Detailed industry analysis of office automation software types

Pareto diagrams (Graph 5 to Graph 11) are included for all office automation types as used by the individual industries. Voice recognition and the group support systems are discussed in more detail, however, as this seems to be the area of development in this quadrant.

The exploration focuses on how extensively the software types are used and to what extent they are used by the individual industries. The first

aspect explored is the average percentage current and intended usage of the software type, followed by reference to the industries that do not use or plan to use the specific software type. Thereafter the industries that have the highest current usage and those that have the highest percentage of planned implementation are listed. The spread of the current and future implementations at the lower end of the spectrum are then also mentioned.

Voice recognition

Voice recognition has a low overall average installed base of 15% and 20% of respondents plan future implementations (refer to Graph 2). Graph 8 highlights the following:

- Voice recognition is currently spread across 53% of the industries tested and 63% of the industries plan to implement voice recognition.
- Hotels and Leisure, Building and Construction and Defence are not currently using voice recognition software and are also not planning to implement the software.
- The Telecommunications, Retail, Agro Chemical and Pharmaceutical industries are not currently using voice recognition but plan to implement the software in the future.
- The industries that use voice recognition the most are listed in Table 20 below as well as the industries that plan the highest percentage of future implementation.

Table 20: Highlights from Graph 8

Highest Current Usage		Highest Future Implementation	
Legal	100%	Telecomms	50%
Mining	50%	Transport	50%
Motor Vehicles	40%	Banks	42%
Rest vary from 13% to 29%		Rest all under 25%	

Video Conferencing

Video conferencing has an overall average installed base of 43% and 25% of respondents plan future implementation (refer to Graph 2). Graph 9 highlights the following:

- Video conferencing is currently spread across 79% of the industries tested and 63% of the industries plan to implement video conferencing.
- The Agro chemical industry is the only industry that does not use or plan to use video conferencing.
- The Legal industry is not using it currently but is planning to implement the software in the future.
- The industries that use video conferencing the most are listed in Table 21 below as well as the industries that plan the highest percentage of future implementation.

Table 21: Highlights from Graph 9

Highest Current Usage		Highest Future Implementation	
Telecomms	100%	Legal	100%
Mining	100%	Food & Beverages	57%
Motor vehicles	80%	IT	50%
Chemicals, Oils, Gas	75%		
Defence	67%		
42% of the rest of the industries vary between 40% and 50% with only two industries below 25%		Rest vary from 13% to 33%	

EDMS

EDMS has an overall average installed base of 44% and 26% of respondents plan future implementation (refer to Graph 2). Graph 10 highlights the following:

- EDMS is currently spread across 68% of the industries tested and 74% of the industries plan to implement EDMS.
- The Legal, Hotels & Leisure, Building & Construction and Agro Chemical Industries are not using EDMS currently but are planning to implement the software in the future.
- The industries that use EDMS the most are listed in Table 22 below as well as the industries that plan the highest percentage of future implementation.

Table 22: Highlights from Graph 10

Highest Current Usage		Highest Future Implementation	
Telecomms	100%	Legal	100%
Mining	100%	Retail	60%
Defence	100%	Other	57%
Food & Beverage	71%		
Chemicals, Oils, Gas	63%		
5 Industries between 50% and 60%			
Rest vary from 20% to 42%		Rest vary from 13% to 50%	

Workflow

Workflow has a low overall average installed base of 37% and 28% of respondents plan future implementations (refer to Graph 2). Graph 11 highlights the following:

- Workflow is currently spread across 74% of the industries tested and 63% of the industries plan to implement workflow.

- The Telecommunications, Hotels & Leisure and Defence industries are not using EDMS currently but are planning to implement the software in the future.
- The industries that use workflow the most are listed in Table 23 below as well as the industries that plan the highest percentage of future implementation.

Table 23: Highlights from Graph 11

Highest Current Usage		Highest Future Implementations	
Mining	100%	Hotels & Leisure	100%
Banks	58%	Telecommunications	100%
Legal, IT, Transport, Chemicals etc., Buildings etc.	50%	Motor Vehicles	80%
4 Industries between 33% and 43%		Defence	67%
Rest vary from 11% to 29%		Rest vary from 17% to 50%	

(iii) Findings

The major findings for this quadrant are as follows:

- Most businesses have already invested in word processing, spreadsheets and e-mail.
- DTP, fax and general accounting packages are not used by all businesses and there are no significant implementations planned for the future. This can be explained by business using or planning to use substitute products in the case of fax and general accounting packages and in the case of DTP, outsourcing seems to solve the specialised skills dilemma.
- Groupware has a high installed base but the software is not used to its full extent and one can expect to see growth in implementation of the individual group support software types or expansion initiatives

regarding the extent of usage, which could include awareness training, or custom developed or commercial add-on's for existing groupware packages.

- Voice recognition is a bit of a dark horse and my perception is that businesses in SA foresee very limited application thereof. It is also my belief that voice recognition will be incorporated as part of the operating system of the computer and will not be seen as a software type on its own in future.

6.3.2.2 Database management systems

(i) General

The most important fact that presented itself with the initial exploration of DBMS systems is that 95% of the businesses tested use at least one type of database and 24% plan to implement one or more databases. The Agro chemical industry seems to stand out with a few businesses not using or intending to use databases and the 95% changes to 98% when the Agro chemical industry is taken out of the equation.

The pareto diagram (Graph 12) summarises the average usage and intended usage of the different database types. The following points are highlighted:

- Desktop databases and enterprise DBMS are most widely used by business in SA, namely 89% and 82% respectively.
- Of note is the big dip in usage from enterprise RDBMS (82%) to ORDBMS (47%). This seems to indicate that object relational technology is still in a growing phase and not all industries see the need for future implementation thereof.
- Regarding future implementations, it is of interest that more businesses are planning to implement ORDBMS (12%) rather than

enterprise RDBMS (4%). This makes sense as object relational technology can deal with both relational and object data, which allows for a growth path for new implementations.

- OODBMS have the lowest average percentage usage, namely 13%.
- An average of 12% of businesses plan to use ORDBMS and 10% plan to implement OODBMS. This confirms the battle between OODBMS and the hybrid system of ORDBMS.
- Lotus Notes seems to have a mature installed base when one looks at the low future implementation average.

Another aspect that was explored was the extent of the use of databases in business. For this a histogram (Graph 13) is used and the following patterns are established:

- Most of the businesses have more than one enterprise-wide database in use.
- All industries use databases for at least more than one department. This means that not one of the industries had the highest frequency usage in individual databases or isolated departmental databases.
- From this one can conclude that business has moved from using databases in isolation towards sharing information more extensively across departments and in different locations throughout the entire business.

(ii) Detailed industry analysis of DBMS software types

The pareto diagram (Graph 14) shows the average use of DBMS for the different industries. Also included are pareto diagrams (Graph 15 to Graph 18) for all major DBMS types as used by the individual industries. The ORDBMS and OODBMS are discussed in more detail as the debate

whether businesses are implementing ORDBMS or OODBMS seems to be the most important topic in the database arena.

The exploration focuses on how extensively the software types are used and to what extent they are used by the individual industries. The first aspect explored is the average percentage current and intended usage of the software type, followed by drawing attention to the industries that do not use or plan to use the specific software type. Thereafter the industries that have the highest current usage and those that have the highest planned implementation are listed. The spread of the current and future implementation at the lower end of the spectrum is then highlighted.

ORDBMS

ORDBMS have an overall average installed base of 47% and 12% of respondents plan future implementations (refer to Graph 12). Graph 17 highlights the following:

- ORDBMS are currently spread across 89% of the industries tested and 37% of the industries plan to implement ORDBMS.
- Legal, Hotels and Leisure are not currently using ORDBMS software and are also not planning to implement it.
- The industries that use ORDBMS the most are listed in Table 24 below as well as the industries that plan the highest percentage of future implementation.

Table 24: Highlights from Graph 17

Highest Current Usage		Highest Future Implementation	
Telecomms	100%	Retail	40%
Professional Services	100%	Transport	33%
Paper	100%		
Mining	100%		
Rest vary from 11% to 75% . (7 industries < 50% and 6 industries > 50%)		Only 5 more industries vary from 11% to 25%	

OODBMS

OODBMS have a low overall average installed base of 13% and 10% of respondents plan future implementation (refer to Graph 12). Graph 18 highlights the following:

- OODBMS are currently spread across 53% of the industries tested and 26% of the industries plan to implement OODBMS.
- Professional Services, Paper, Retail, Hotels and Leisure, Legal, Building and Construction and Agro Chemical are not currently using OODBMS software and are also not planning to implement the software.
- Telecommunications and Insurance are not currently using OODBMS but plan to implement the software in the future.
- The industries that use OODBMS the most are listed in Table 25 below as well as the industries that plan the highest percentage of future implementation.

Table 25: Highlights from Graph 18

Highest Current Usage		Highest Future Implementations	
Mining	50%	Telecomms	50%
Other	40%	Banks etc.	33%
Transport & Defence	33%		
Rest vary from 6% to 25%.		Only 3 more industries vary from 25% to 29 %	

It is noticeable that OODBMS are used by specific industries only.

(iii) Findings

The major findings for this quadrant are:

- Most businesses use at least one type of database system.
- Desktop databases and enterprise DBMS are the most widely used.
- ORDBMS and OODBMS are not used widely, with OODBMS definitely the least known and used by specific industries only. Of interest is the fact that the future implementation for ORDBMS and OODBMS is almost the same, which seems to emphasise that SA businesses are also influenced by the world-wide struggle between the standards of ORDBMS and OODBMS.
- A very positive point for SA business is that one can say that business in SA has moved away from using databases in isolation and the use of more than one enterprise-wide database seems to be the general trend.

6.3.2.3 Systems applications

(ii) General

Systems applications consist of ERP systems, ERP extension systems and EDI and/or e-commerce. The exploration of this quadrant focused on establishing the average current and planned usage of these software types. Each software type was then further examined for specific patterns regarding the extent to which ERP modules are used in SA and the ERP software products most often used were also investigated. The ERP extension software includes CRM which is a very important topic in the software industry and the extent to which this is used or intended to be used was explored. Then lastly in the e-commerce arena B2B and B2C were further explored.

Table 26 summarises the most important current and future average usage of the systems applications software types:

Table 26: Current and future average use for systems application software types.

Descriptive Summary	ERP		ERP Ext		EDI/E-com	
	Current	Future	Current	Future	Current	Future
Industries that use systems apps	89%	58%	74%	84%	79%	95%
Overall average for the industries	60%	13%	20%	30%	48%	43%

From the above table one can see that ERP systems have the lowest future implementation percentage of the three, with EDI/e-commerce as the greatest growth area in this quadrant. One also sees that ERP is the most widely used across industries with ERP extensions used by fewer industries. The average usage of systems applications is highest for traditional ERP and lowest for ERP extensions.

ERP modules

Graph 19 is a graphical display of the extent to which ERP modules are used by the businesses tested. The information regarding the major ERP modules in use indicated that 86% of the businesses that use ERP systems use financial modules and this accords with research worldwide. The modules that follow are the inventory module, HR module, MRP module and lastly the scheduling module.

ERP vendor products

The pareto diagram (Graph 20) clearly shows that over 40% of the respondents that use ERP system also use SAP. The second most used ERP software is Oracle and BPCS, followed by JDE, Peoplesoft and lastly Baan. This is a reflection of the world-wide market share of the main ERP vendors except for BPCS. BPCS however is mainly used by the Pharmaceutical companies and the size of the sample of the Pharmaceutical industry can account for the high percentage usage. A few of the respondents that indicated that they plan to implement ERP systems indicated that they have not decided which product to implement but those that did indicate seem to prefer SAP. Other information of interest is that most ERP implementations in process are SAP implementations.

ERP Extension Software

The pareto diagram (Graph 21) illustrates the current and planned usage of ERP extension software in SA. The main areas in ERP extension software were identified from the theoretical research as CRM, supply chain management and advance planning. Graph 21 highlights the following points:

- The highest average usage and future implementation plans for ERP extension software are in CRM, which is encouraging as this is one of the most important developments in the software industry. Advance planning takes second place for current usage and future implementation, followed lastly by supply chain management.
- All three groups of ERP extension software show a trend of future implementation plans that exceeds current usage. The author believes that this is indicative of the fact that most businesses are aware of the importance of implementing these systems for competitive advantage purposes. This trend also indicates that ERP extension software usage is in the beginning stages.
- Also of note is that fact the ERP extension software relating to supply chain management is currently used the least of the three groups. This might have to be reviewed by business considering the worldwide trend of improving margins by managing the virtual value chain more effectively. There are, however, indications that some businesses are realising this, since future implementation plans are more than double the average current usage.

As CRM is the major thrust of development in the ERP extension arena, this is where this analysis focuses next. CRM consists of many different modules as discussed in Chapter 4 and because of time constraints applicable to the respondents, the information gathered was focused on the major areas only. However, the information gathered was enough to determine the extent of operational versus strategic usage of CRM. For this purpose the data was divided into customer information trends as strategic issues and SFA, front ends that deal with customers and product configuration engines as operational issues. The result of this analysis is that of the respondents currently using CRM, 89% of the usage is focused on operational processes whereas 60% is focused on strategic issues. Regarding future implementation plans, the picture

appears to be almost the same with 89% of the CRM implementations focusing on operational issues and 66% on strategic issues. This means that in SA business is moving with the rest of the world regarding CRM implementation. The question, however is, whether they focus sufficiently on the strategic aspects of CRM in comparison with the rest of the world.

EDI/e-commerce

The analysis of EDI and or e-commerce shows that 88% of the respondents are either currently using EDI and/or e-commerce, or are planning to implement it.

The information gathered on EDI and or e-commerce included the business processes that EDI or e-commerce is applied to. From this one could analyse the data for the current and planned usage of B2B or B2C. The findings were that business favours B2B implementations (54%) slightly more than B2C implementations (43%). Further data analysis also shows that 30% of the businesses are geared towards B2B only and 19% to B2C only and 24% of the businesses indicated both B2B and B2C. This seems to suggest that businesses see B2B e-commerce as the most important area.

(ii) Detailed industry analysis of systems applications software types

Pareto diagrams (Graph 22 to Graph 26) present the current and future usage of the systems applications for the individual industries.

Traditional ERP systems

Graph 22 highlights the following:

- Traditional ERP systems are currently used by 89% of the industries canvassed and 58% of the industries plan to implement ERP.
- All the industries that are not currently using ERP systems are planning to implement ERP systems.
- The Hotels and Leisure and Legal industries are not currently using ERP systems but plan to implement the software in the future.
- The industries that use ERP systems the most are listed in Table 27 below, as well as the industries that plan the highest percentage of future implementation.

Table 27: Highlights from Graph 22

Highest Current Usage		Highest Future Implementation	
Chemicals, Oils, Gas	100%	Hotels & Leisure	50%
Mining	100%	Legal	50%
Telecomms	100%		
Professional Services	100%		
Paper	100%		
Food & Beverages, Pharmaceuticals, Motor vehicles, IT other and Banks etc. all above 50%			
Rest vary from 13% to 50%		Rest vary from 6% to 33%	

ERP extension systems

- CRM is the most important component of ERP extension software and this is where the focus of the industry analysis is directed. CRM has a overall average installed base of 43% and 34% of respondents

plan future implementation (refer to Graph 21). Graph 24 highlights the following:

- CRM is currently spread across 74% of the industries tested and 78% of the industries plan to implement CRM:
- All the industries that are not currently using CRM are planning to implement CRM systems except the Paper industry which is the only one that does not currently use CRM or plan to implement it.
- Hotels and Leisure, Legal, Insurance and Building and Construction industries are not currently using CRM but plan to implement the software in the future.
- The industries that use CRM the most are listed in Table 28 below as well as the industries that plan the highest percentage of future implementation.

Table 28: Highlights from Graph 24

Highest Current Usage		Highest Future Implementation	
Professional Service	100%	Hotels & Leisure	100%
IT	75%	Chemicals, Oils, Gas	88%
Chemicals, Oils, Gas	63%	Food & Beverages	57%
Motor vehicles, Telecomms and Mining are above 50%			
Rest vary from 17% to 44%		Rest vary from 17% to 50%	

Both supply chain management and advance planning systems are used by specific industries only but there are new industries planning to implement these systems. For more detail see Graph 25 and Graph 26.

EDI/e-commerce

Graph 23 highlights the following:

- EDI/e-commerce is currently used by 79% of the industries tested and 95% of the industries plan to implement EDI/e-commerce.
- All the industries that are not currently using EDI/e-commerce are planning to implement such systems.
- The Hotels and Leisure, Legal, Paper and Agro Chemical industries are not currently using EDI/e-commerce but plan to implement such systems in the future.
- The industries that use EDI/e-commerce the most are listed below in Table 29 as well as the industries that plan the highest percentage of future implementation.

Table 29: Highlights from Graph 23

Highest Current Usage		Highest Future Implementations	
Professional Service	100%	Paper	100%
Building and Construction	100%	Legal	100%
Transport	83%	IT	75%
Banks, etc.	75%	Defence & Agro Chemical	67%
Insurance	63%		
Motor vehicles, Retail, Food & Beverages are above 50%			
Rest vary from 20% to 50%		Rest vary from 17% to 50%	

E-commerce is such a prominent subject that the author thought it appropriate to do further detailed analysis regarding the current and planned use of B2B and B2C.

The Pareto diagram (Graph 27) that graphically displays the industries where more than one respondent indicated the business processes used for e-commerce, indicates the following:

- The Retail, Motor vehicles, Building and Construction and Banking industries are all currently using B2B or plan to use B2B.
- The Food industry seems to emphasise B2C.
- Other industries that have a higher than 65% usage of B2C are Banks etc., Transport, Chemicals, Oil and Gas and Agro Chemical.

The Pareto diagram (Graph 28) is a further analysis of the current and planned use of e-commerce where the use or planned use of B2B only, B2C only and both is indicated for industries that had more than one respondent in a particular industry. From this diagram one can see the following:

- The Retail industry is geared towards B2B only.
- The Insurance and Agro chemical industries regard B2C as more important than B2B.
- In the Food and Beverages, Banks and Financial services, Transport and Motor vehicles industries, between 50% and 75% of the respondents indicated that both B2B and B2C are used in their businesses.

(iii) Findings

The major findings for this quadrant are as follows:

- In the previous two quadrants we have seen very high current implementation rates for the mature products but in this quadrant the mature product type is ERP systems and these are currently in use at an average of 60%, which is a notable difference compared to the previous quadrants.

- ERP systems also have a fairly low future implementation rate which suggests that not all businesses plan to implement ERP systems eventually.
- Most businesses that use ERP systems, use the financial module.
- SAP is the most popular ERP product of the big five vendors in SA.
- EDI/e-commerce are not currently used by all industries tested but all those industries that have not yet implemented e-commerce have future implementation plans. Many businesses plan to implement both B2B and B2C but there seems to be a slight preference overall for B2B implementation. However, in some industries the businesses seem to concentrate on B2B only or B2C only.
- ERP extension software does not have a high current usage rate but more implementations are planned for the future. All three groups of ERP extension software show a trend of future implementation plans that exceeds current usage. The CRM systems have the highest percentage for both current usage and future implementation. A point of concern, however, is that the focus of the current and future use of CRM is more operational than strategic in nature, which could lead to SA businesses falling behind their overseas competitors.

6.3.2.4 Business intelligence (BI)

(i) General

One or more of the BI components are used by 65% of business in SA and 33% on average are planning to implement one or more BI component. For the purposes of the questionnaire the BI components were divided into data warehousing on the one hand and OLAP and data mining on the other. The exploration in this quadrant focused on establishing the current and planned usage of the two groups of software types. From there the software types were further examined for a

pattern in the usage of the specific software types. The investigation then proceeded to examine the purposes for which BI software is used in SA. The BI software products currently used were also explored for preferred vendors.

Table 30 summarises the most important current average and future average usage of the BI software types:

Table 30: Current and future average use for BI software types.

Descriptive Summary	Data warehouse		OLAP/Data mining	
	Current	Future	Current	Future
% of Industries tested that use BI	74%	74%	74%	58%
Overall average for the industries	54%	24%	52%	17%

From the above table one can see that the current usage for data warehousing and OLAP/data mining is more or less the same at just over 50%. Future implementation for data warehousing is a little more than for OLAP and or data mining. The pareto diagram (Graph 29) is a graphical presentation of the current and planned usage of the two groups of BI software types in SA.

Types of BI tools

In order to establish patterns in the type of BI software that business is using, the data was analysed by grouping together the businesses that use data warehouses only, OLAP/data mining only, and those that use both. The pareto diagram (Graph 30) is a graphical display of this. The pareto diagram highlights the following points:

- Most industries have members that use both data warehousing and OLAP/data mining tools (17 of 19 industries).
- Certain industries have members that prefer to use only data warehousing or only OLAP/data mining.

- There are more industries that have members that prefer to use data warehousing only than industries that have OLAP/data mining users only.

This last point leads to the extraction of the table of percentages of only those businesses within each industry that currently use or plan to implement data warehousing or OLAP/data mining. The purpose of Table 31 was to try to establish to what extent data warehousing is preferred over OLAP.

Table 31: Summary of industries focusing on data warehousing or OLAP/data mining only

Industry	DW	OLAP/DM
Building & Construction	50%	0%
Professional Services	100%	0%
Agro Chemical	22%	0%
Other	20%	0%
Hotels & Leisure	50%	0%
IT	25%	0%
Transport	50%	0%
Pharmaceutical	28%	0%
Chemicals, Oils, Gas	13%	25%
Insurance	0%	25%
Banks, etc.	8%	8%
Motor Vehicles	0%	20%

The above table suggests that the tendency in SA is to implement data warehousing as the platform for other BI tools. It is the author's belief that some firms are going to skip their implementation of data warehousing and go straight for OLAP and data mining tools. This might be exactly what is happening with some of the members of industries such as Insurance, Chemicals, Gas and Oils, Motor vehicles and Banks

and Financial institutions that are implementing OLAP and data mining without data warehousing as the platform.

BI software purposes

The extent to which BI software is used by business was established by providing the respondents with a selection of strategic areas to choose from. This question was answered by 91% of the respondents who indicated that they use BI software. The analysis of this data indicated that businesses use BI software mostly for customer analysis, knowledge management and/or information sharing and industry market analysis. The average percentages of each strategic area are indicated in Graph 31.

BI vendor products

The use of the main BI products is graphically displayed in a pareto diagram (Graph 32) and from this one can see that the products most often used by the respondents are Crystal reports (from Seagate Software), Cognos, Hyperion and Oracle. The category EIS in the graph combines the products of the major EIS vendors such as Pilot Software and Comshare and others. The products that are used by two or fewer companies were ignored in this graph.

(ii) Detailed industry analysis of BI software types

The Pareto diagram (Graph 33) is a graphical display of the current and planned usage of BI, and pareto diagrams (Graphs 34 and 35) present the current and future usage of the individual software types as discussed below.

Data warehousing

Graph 34 highlights the following:

- Data warehousing is currently used by 74% of the industries tested and 74% of the industries plan to implement it.
- All the industries that are not currently using data warehousing are planning to implement such systems.
- Agro chemical, Defence, Legal, Paper and Professional Services industries are not currently using data warehousing but plan to implement such systems in the future.
- The industries that use data warehousing the most are listed in Table 32 below as well as the industries that plan the highest percentage of future implementation.

Table 32: Highlights from Graph 34

Highest Current Usage		Highest Future Implementations	
Telecomms	100%	Paper	100%
Retail	100%	Professional Services	100%
Motor Vehicles	80%	Transport & Defence	67%
Banks, etc. & IT	75%		
Most industries vary from 50% to 71%			
Lowest 2 industries vary from 20% to 33%		Rest vary from 8% to 50%	

OLAP and/or data mining

Graph 35 highlights the following:

- OLAP and data mining is currently used by 74% of the industries tested and 58% of the industries plan to implement data warehousing.

- All the industries that are not currently using OLAP and data mining are planning to implement such systems except the Building and Construction and Professional Services industries.
- The Defence, Agro Chemical and the industries grouped under 'other' are not currently using data warehousing but plan to implement such systems in the future.
- The industries that use OLAP and data mining the most are listed in Table 33 below as well as the industries that plan the highest percentage of future implementation.

Table 33: Highlights from Graph 35

Highest Current Usage		Highest Future Implementations	
Telecomms	100%	Defence	67%
Paper	100%	Mining	50%
Motor Vehicles	100%	Hotels & Leisure	50%
Food & Beverage	86%		
Banks, etc.	83%		
Retail	80%		
Most and rest of the industries are at 50%		Rest vary from 8% to 38%	

(iii) Findings

The major findings for this quadrant are as follows:

- The average current usage of both data warehousing and OLAP/data mining is just above 50%. This usage is the lowest of the four quadrants when comparing the mature products in the respective quadrants. Future implementation plans are also not very high compared to other growth products.
- Average current usage for data warehousing versus OLAP/data mining is almost the same.

- The above analysis also shows that most industries have members that use both data warehousing and OLAP/data mining. BI future implementations for the two groups show a slightly higher percentage for data warehousing. Another interesting point is that there are more industries that currently use or intend to use only data warehousing than OLAP/data mining, which might mean that businesses are at the stage where they are only getting their platform for BI ready but there are also signs that a few industries might implement BI without implementing data warehousing.
- BI in business is mainly used for customer analysis, knowledge management/information sharing and industry market analysis.
- The BI products mostly used by the businesses that have implemented BI are Crystal Reports (Seagate), Cognos, Hyperion and Oracle.

6.3.2.5 Strategy and information delivery systems

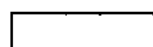
- (i) Strategic areas that business expects BI software to support.

The last part of the questionnaire was designed to establish the most important strategic areas that business expects BI software to address. The respondents were required to rank five strategic areas, allowing for other strategic areas to be noted where relevant. The strategic areas were *customer analysis*, *competitor analysis*, *market/ industry analysis*, *supply chain management*, *knowledge management/ information sharing*, the *analysis of resources and capabilities* and other. The interpretation of each term is explained in the glossary. It is important at this point to draw attention to the fact that these ratings present the perceptions of IT managers and their ratings might be different if the information were to be obtained from the CEOs of the firms involved.

A frequency table was used to analyse the ratings of the strategic areas (refer to Appendix 3). The mean of the ratings for the different strategic areas was utilised to establish the overall ranking order of the aforementioned strategic areas. Customer analysis had the lowest mean and this is therefore an indication that businesses see customer analysis as the most important area for BI software to support. Knowledge management was indicated as the second most important and after that followed market/industry analysis, supply chain management, analysis of resources and capabilities and lastly competitor analysis. Each industry, however, had a different frequency table with their particular allocation of importance and the following is a table which summarises this information.

Table 34: Summary of strategic areas as ranked by the different industries

	CUS	KM	IND	SCM	R&C	COMP
Agro Chem	1	2	3	4	5	6
Defence	3	4	2	1	5	6
Banks, etc.	2	3	1	6	5	4
Construction	5	1	4	2	3	5
Chemicals, etc.	3	1	2	4	5	6
Insurance	1	2	3	5	4	6
Food	1	5	3	2	6	4
Legal	2	1	5		3	4
Pharmaceutical	1	2	3	5	6	4
Hotels, etc.	2	1	4	3	5	2
IT	2	2	1	5	4	3
Retail	1	3	4	2	4	5
Mining	3	1	2		3	4
Motor vehicles	1	4	3	5	2	6
Paper	1		1	2	2	2
Prof. Services	3	1	2	6	5	4
Other	3	1			2	4
Telecomms	1		1	4	2	3
Transport	1	2	3	5	5	2



First choice for the Industry

It is interesting to note that with a single exception all industries' first choice is located in the first three columns, namely customer analysis, knowledge management and industry and market analysis.

(ii) Top management's view regarding the strategic role of IT

The last part of the questionnaire also focused on collecting information regarding top management's perception of IT as a supporting tool for strategic planning. Again the reader should bear in mind that the information reflects the opinion of the IT manager and not the CEOs of the firms. Eighty-one per cent of the IT managers indicated that their top management perceive IT as a strategic tool. There were 13% of the respondents who felt that their top management do not perceive IT as a strategic tool. These industries are presented in Graph 36. The industries with 50% and higher percentages have small representation in the sample and should be interpreted with this in mind. Of note however is the fact that in the Agro chemical and Transport industry a third of the IT managers believe that top management do not perceive IT as a strategic support tool.

(iii) Relationship between BI and top management's attitude regarding IT

The data was also further analysed to establish whether or not there is a relationship between the use of BI software and top management's attitude towards IT. Because most IT managers indicated that top management perceives IT as strategic, the data was not suitable for meaningful analysis. The only information available is that only 4 of the 13 respondents that indicated that they believe their top management does not perceive IT as a strategic tool, do not currently use or plan to use BI software. Another 4 of the 13 respondents who also responded negatively regarding IT as a strategic tool do not currently use BI but

plan to use it in the future. It would be interesting to see whether or not a better relationship can be found if this question is posed to the CEOs of the companies.

6.3.2.6 Relationship between ERP and BI

The author hoped to establish whether or not there is a relationship between the current use of ERP and BI, but the correlation is not strong at .26. This correlation does not change much if the future implementations are added to the current use of BI systems. The correlation changes to .43 - again not a strong correlation. This might be an indication that the use of software by some businesses does not follow the evolution of software from one quadrant to the other according to the Information Delivery Classification Matrix. In this case it means that not all businesses that have implemented ERP systems moved on to use BI software. However, there are industries that have a very strong correlation and those are: Defence, Food & Beverages, IT, Pharmaceutical, Retail, Mining, Motor Vehicles, Paper, Professional Services and Telecommunications.

6.3.3 Integrated analysis of the Information Delivery Classification Matrix

Graph 37 is a presentation of the average current and future expected usage of all the products within each quadrant. This graph shows that about 50% of the businesses in SA use products in all 4 quadrants and that the highest percentage of future implementation is planned in the systems applications quadrant, followed by the BI quadrant. One's first instinct is that BI should have been higher and this will be discussed below.

The first step was to try to relate Graph 37 to the Information Delivery Classification Matrix (Pellissier, 1999) in terms of the current usage. This

was not possible, however, because upon closer inspection the different stages in the life cycles of the products in each quadrant seemed to obscure important information. The analysis therefore proceeded with a classification of the products within each quadrant as either a growth product, a mature product or a hybrid product. The criterion for a mature product is a lower average future implementation percentage relative to the rest of the products in a specific quadrant. Time of introduction of the product to the market was also taken into account, based on information that was gathered during the theoretical research. Table 35 summarises a proposed classification of the products.

Table 35: Proposed classification of information delivery products

Quadrants	Products
Q1- Mature products	Word processing, spreadsheets, e-mail, general accounting, DTP, facsimile
Q1- Growth products	Voice recognition, groupware, workflow , EDMS, video conferencing
Q2- Mature products	Desktop DBMS, Enterprise DBMS
Q2- Growth products	ORDBMS, OODBMS
Q2- Hybrid products	Notes
Q3- Mature products	ERP
Q3- Growth products	ERP extension, e-commerce
Q4- Growth products	Data warehousing, OLAP, data mining

Graph 38 is a pareto diagram of the current usage of mature, growth and hybrid products. From this diagram one can see that the average usage of the mature products of the first three quadrants and the growth products of the BI quadrant follows the evolution suggested by Pellissier (2000). The growth products of the 4th quadrants, however, follow almost an anti-clockwise order except for the office automation quadrant. This seems to be a confirmation that the major future growth

will be concentrated in the 3rd and 4th quadrant and the 1st quadrant. The reason for the revival in the office automation quadrant has been discussed previously and is ascribed to the emphasis that business schools all over the world place on the synergies to be achieved when people work effectively in groups.

Graph 39 narrows the analysis down to the current usage of mature products of the 4 quadrants. This pareto diagram shows that the current usage of the mature products of the four quadrants is similar to the Pellisier's (1999) Information Delivery Classification Matrix. This diagram also illustrates that SA businesses have a very high average usage in mature office automation and DBMS. The mature products of the system applications quadrant are used to a lesser degree, which makes sense since the sample included medium businesses and this accords with indications from the theoretical research that ERP systems are only now penetrating the mid-size business market. According to the above classification BI products are all growth products and one must look at the next diagram under discussion to see that BI has the lowest current use and therefore fits as the last quadrant of the Information Delivery Classification Matrix.

In an analysis of the growth products (Graph 40) one can establish that the highest current usage is in BI products. An interesting point arises from this diagram and that is that the future implementation plans for SA business are higher for system applications products than for BI. This is explained by the fact that e-commerce and CRM products are part of the system applications quadrant. E-commerce and CRM are also the most important developments of the software industry world-wide, which shows that some SA businesses are planning to keep up with world trends in the software industry. Another fairly high future implementation percentage is the growth products of office automation and the author

believes this is in line with world trends of enhancing group effectiveness as the key to a successful business.

A comparison of the future implementation averages of all the software types in a pareto diagram (Graph 41) confirms that some businesses in SA are planning to incorporate some of the most important software aimed at gaining a competitive advantage. However, a question that does arise is whether enough businesses are planning to implement the most crucial software. In this case the author specifically refers to the products with future implementation percentages of between 12% and 28%, which excludes ERP extension software and e-commerce.

6.4 CONCLUSION

The detailed findings have been discussed under each data analysis heading and from this conclusions are drawn in terms of the original objectives set for this research document.

6.4.1 Extent of software usage by business in SA in terms of the Information Delivery Classification Matrix

In the integrated analysis of the Information Delivery Classification Matrix it was found that the average usage of the mature products of the first three quadrants and the growth products of the BI quadrant follows the evolution suggested by Pellissier (2000). This analysis also highlighted the following:

- **Mature products:** Businesses in SA have invested as much as they intend to in the mature products in the first two quadrants and when one moves on to the 3rd quadrant there is the average current usage percentage of 60%, which shows room for improvement.

- Growth products: The highest current usage rate for the 4th quadrant (BI) is at 53%. However, this leaves room for many future implementations if one takes into account that this quadrant has no mature products. The average current usage for the rest of the growth products is all below 50% with the lowest an average current usage of 30% in the 2nd quadrant. The average current usage of growth products in the 1st and 3rd quadrants is almost the same. The reasons seem to be the emphasis placed on enhancing group effectiveness in the case of the 1st quadrant and CRM and e-commerce in the 3rd quadrant. All these areas are very prominent areas in the IT world.

6.4.2 Where do these businesses plan to move in terms of the matrix?

- Very little future implementation is planned for the mature products in the respective quadrants, with the most being in systems applications. This can be attributed to the fact that some medium-size businesses will start implementing ERP systems now that these systems are becoming more affordable with the major ERP vendors actively pursuing market share in the medium-size business arena.
- The highest percentage of future implementation for growth products is planned for the 3rd quadrant as discussed above.
- The future implementation for the growth software types for the 1st and 4th quadrant are almost the same with the 2nd quadrant as the lowest percentage of future implementation.
- The 1st quadrant future implementation plans are concentrated on group support systems and this conforms to expectations for the reasons mentioned above.
- The future implementation for BI at this stage seems to be low if one takes into account that the average current usage is only 53%. This seems to suggest that there is a need for SA business to be made

aware of the role of BI software products and strategic planning in terms of gaining a competitive advantage over rivals, especially in the light of globalisation.

6.4.3 Which features in BI are important to business?

Customer analysis was indicated as the most important area for BI software to support. Knowledge management was indicated as the second most important and after that followed market/industry analysis, supply chain management, analysis of resources and capabilities and lastly competitor analysis. Also highlighted in the above analysis is that all industries except one industry's first choice is either customer analysis, knowledge management or industry and market analysis.

6.4.4 Whether top management perceive IT as a strategic tool or not.

Eighty-one per cent of the IT managers indicated that their top management perceived IT as a strategic tool, whereas thirteen per cent felt that their top management did not. The Agro Chemical and Transport industries are the only ones in which about a third of the IT managers believe that their top management do not perceive IT as a strategic support.

6.4.5 IT World trends manifested in S.A.

The following world-wide trends are manifested in S.A.:

- In a review of the three leading groupware server software packages, Kramer (1999) confirms that many corporations use groupware for little more than e-mail. From the research results regarding the extent to which S A businesses are using groupware, the results show that groupware is used at 78% for e-mail followed by 57% for

information sharing, and from there on the percentages for other functions drop to 30% and below.

- Many people believe that the facsimile technology is obsolete but authors such as Banker (1999) and Purchasing (1999) believe that electronic faxes still have a future as large companies still spend up to 40% of their phone bills on faxing and urgent messages are still conveyed by facsimile. In South Africa we see that 14% of the companies tested plan to implement facsimile technology, which shows that although it is a mature product, some people still believe the technology to be useful in business.
- The influence of the battle between the hybrid database technology, ORDBMS and pure OODBMS can also be seen in South Africa. Stedman (1998) stated that OODBMS still make up a sliver of the overall database business. This is also true for SA as the current usage of ORDBMS is 47% with OODBMS at 13%.
- Freedman (1999) states that the most broadly deployed ERP systems worldwide are those that track financial data and this is the case in S. A. as well.
- Key (1999) and Boey (1999b) report that SAP has the biggest installed ERP base in the world and from the research results we can see that SAP has by far the biggest ERP installed base in S.A. in relation to the other ERP vendor products.
- Richard *et al* (1999) reported that the results of an attitude survey done on CEOs and CIOs of firms in the USA shows that there is a tendency to under-invest in BI. The point was raised earlier in this article that the author is concerned that the future implementation percentages might be too low, which means that the aforementioned tendency also applies in S.A.
- Taschek (1999) stated that Cognos is in the top tier of the BI market and that Seagate is another leader in this market. In S.A. Seagate's

product Crystal reports is used most with Cognos second, which seems to be in line with world trends.

6.4.6 Conclusion

It is encouraging to see that there are businesses in South Africa that have applications in all four quadrants as this means that there are businesses that use IT as both an operational and a strategic tool. The author is, however, concerned about the future implementation percentages for BI software and feels that leadership should be urged to move beyond using IT as an operational tool and focus on the strategic value that IT can create for the organisation. It is therefore suggested that the Information Delivery Classification Matrix be utilised to monitor the status of a particular business against that of other businesses in its industry.

In order to stress the importance for business to move into the BI quadrant, the author would like to conclude with a statement found in the SAP corporate overview (2000), where it is stated that with globalisation, expansion, diversification, mergers and acquisitions, and the opportunities of the Internet, the requirements for a co-ordinated view and management information have assumed greater importance than ever.

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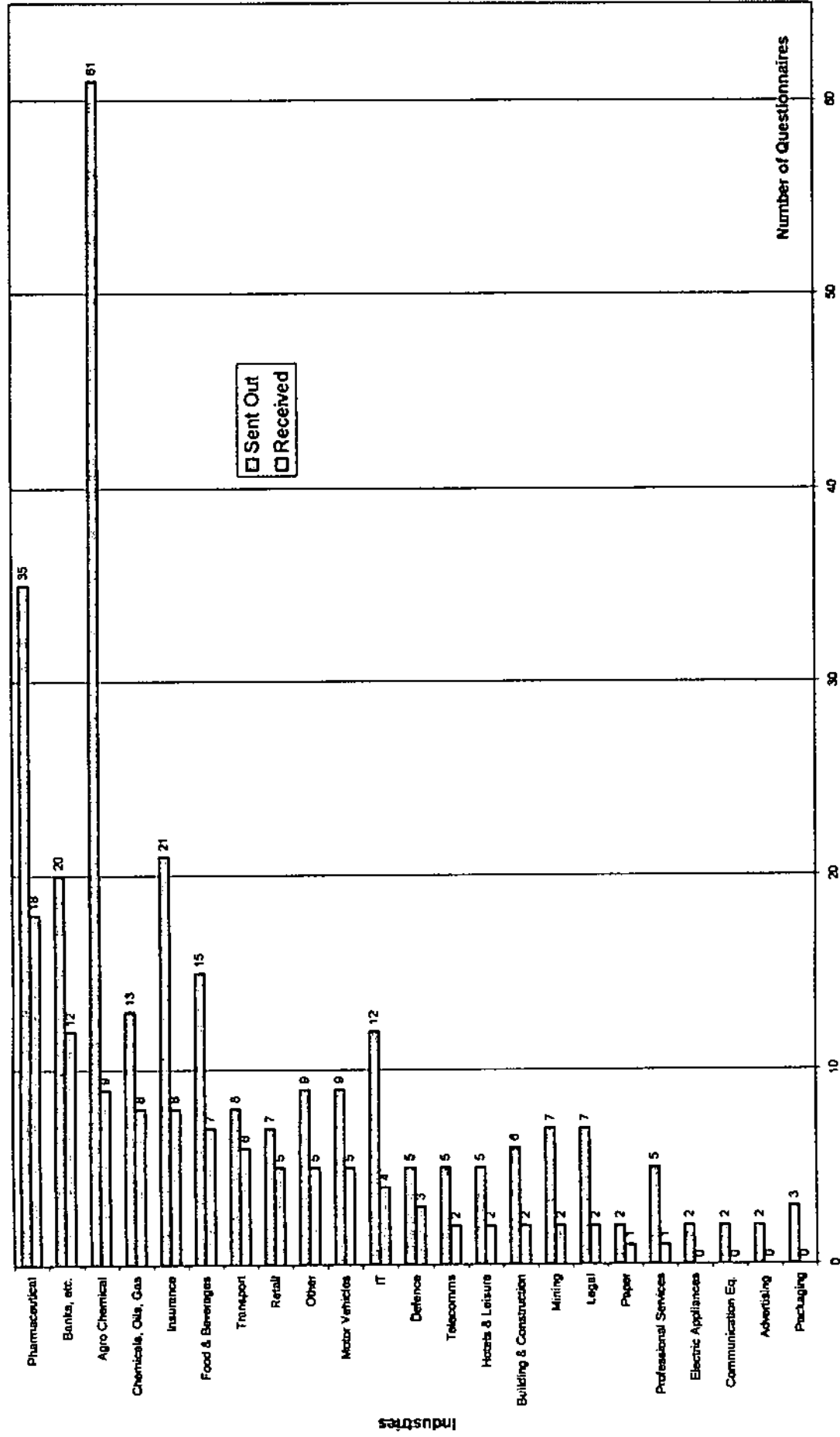
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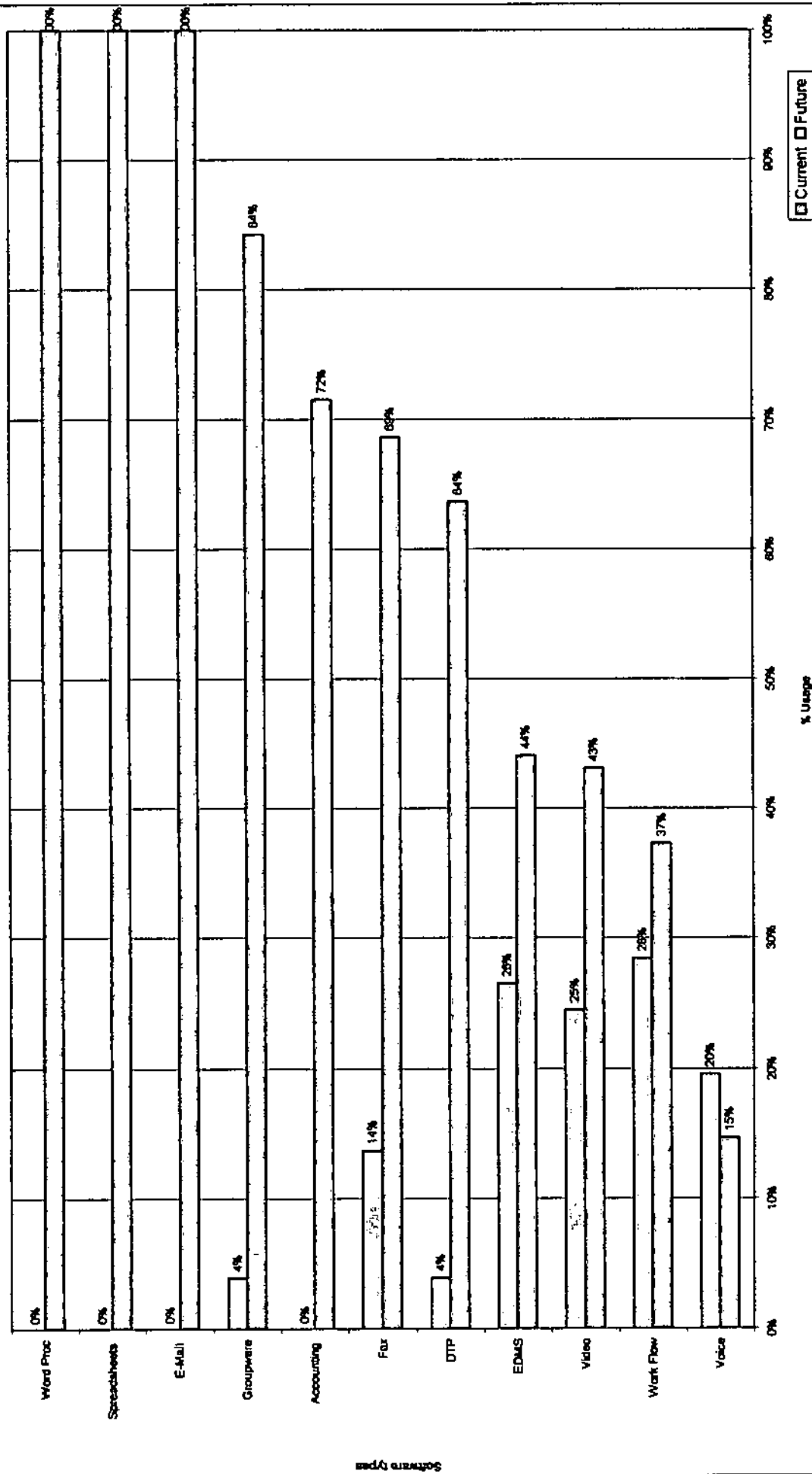
GRAPHS

Analysis of data received vs. sent out



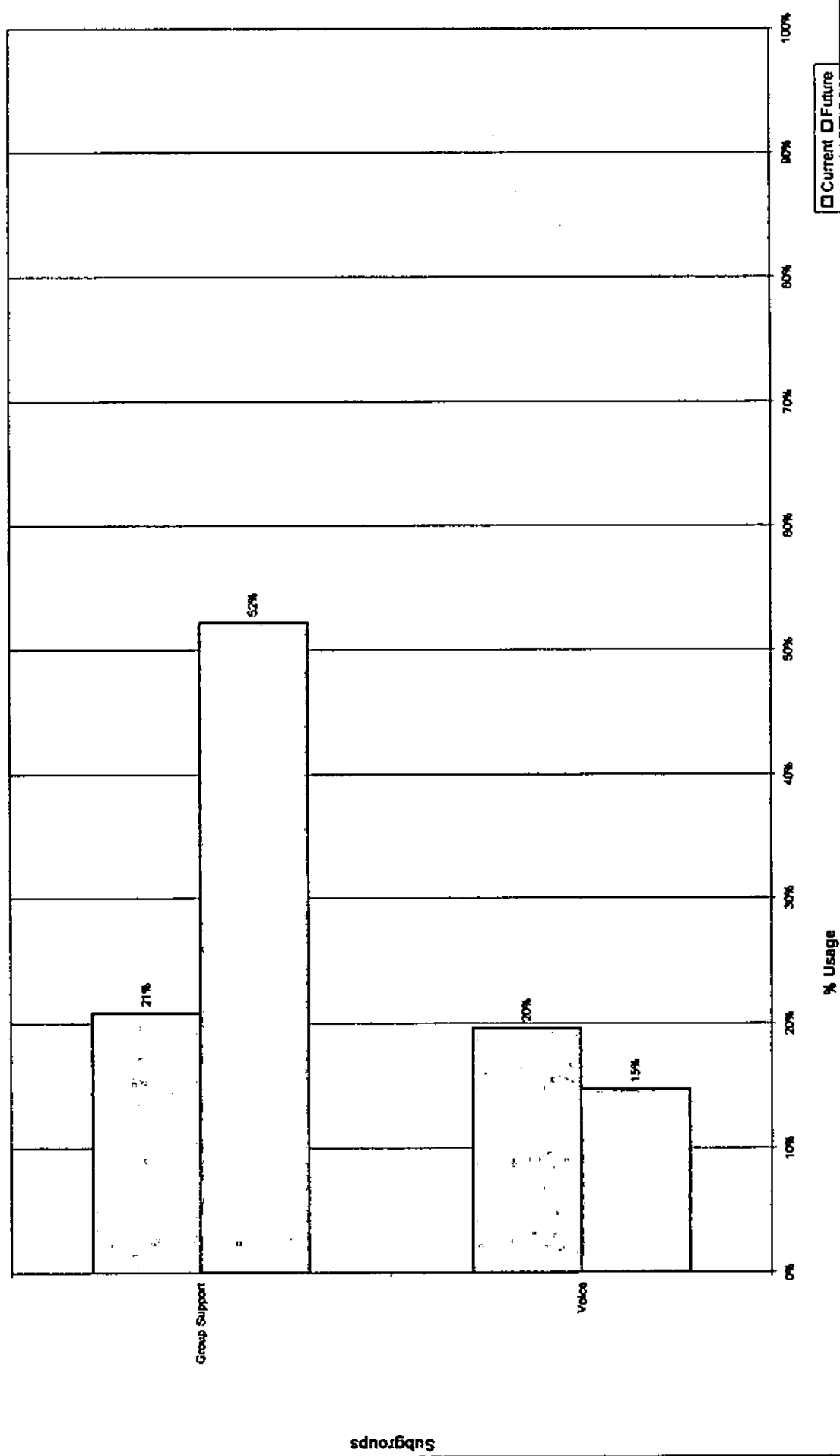
Graph 1

Office automation: current & planned usage



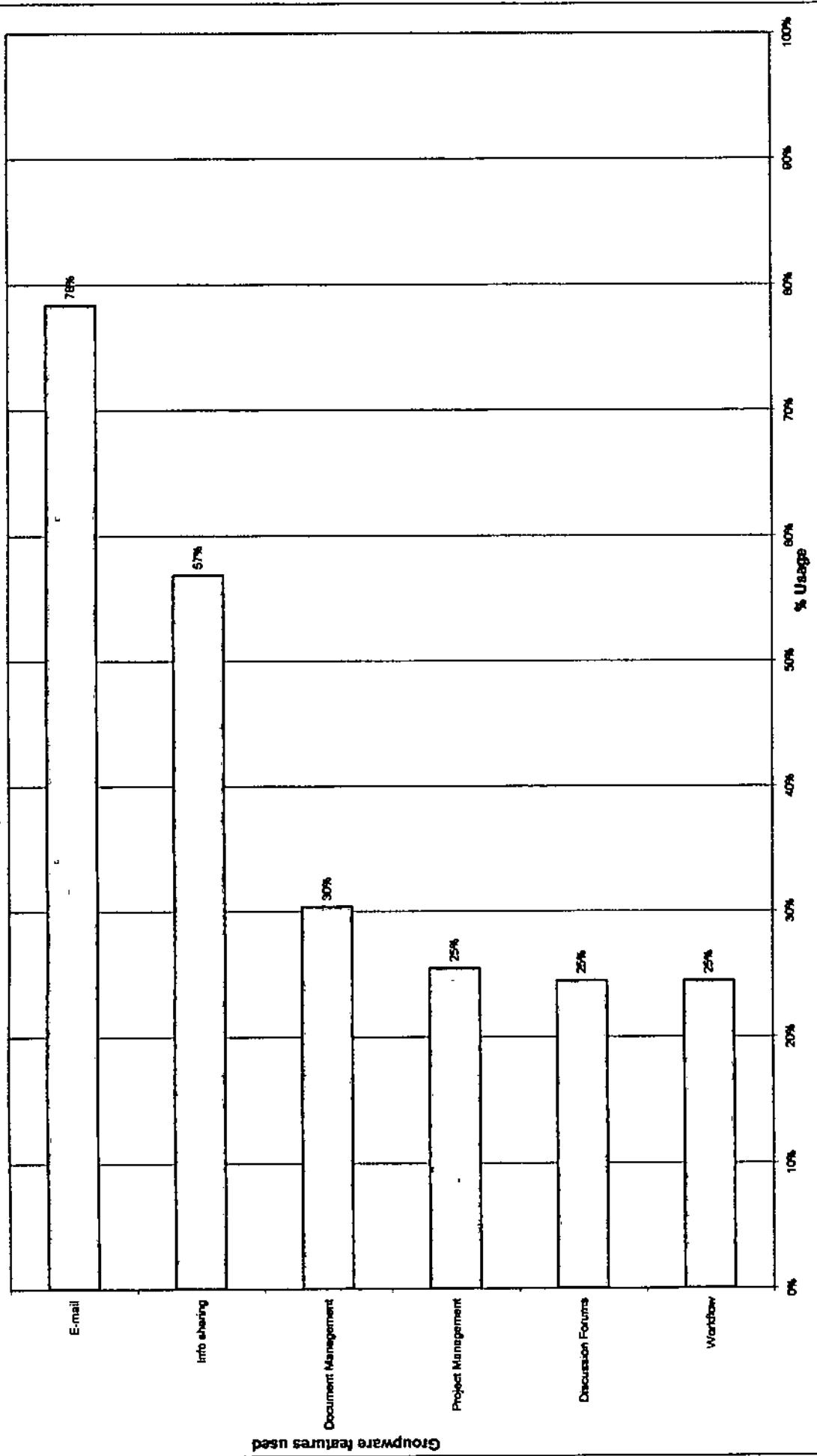
Graph 2

OA software types < 60% current usage



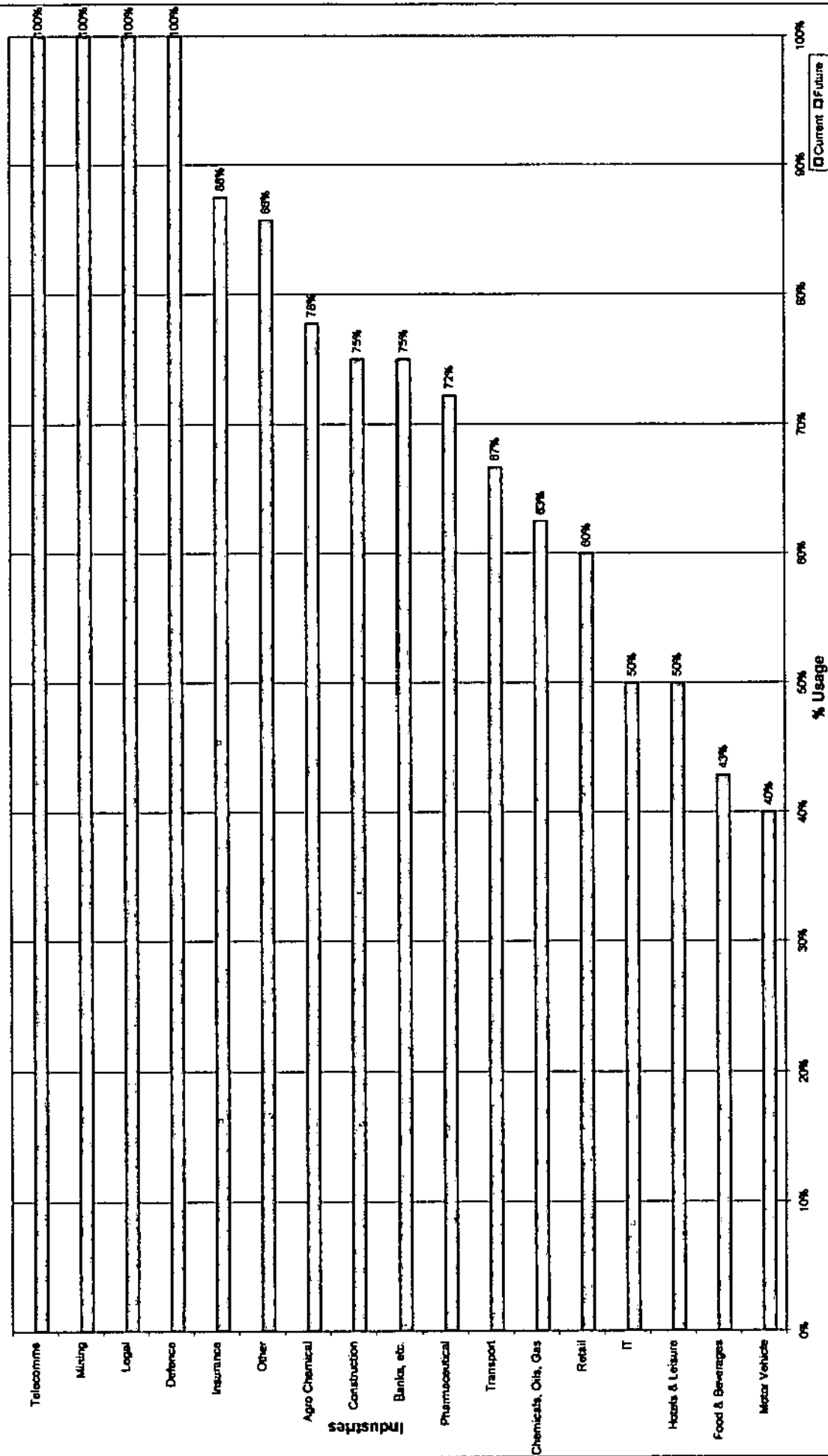
Graph 3

Groupware usage in SA



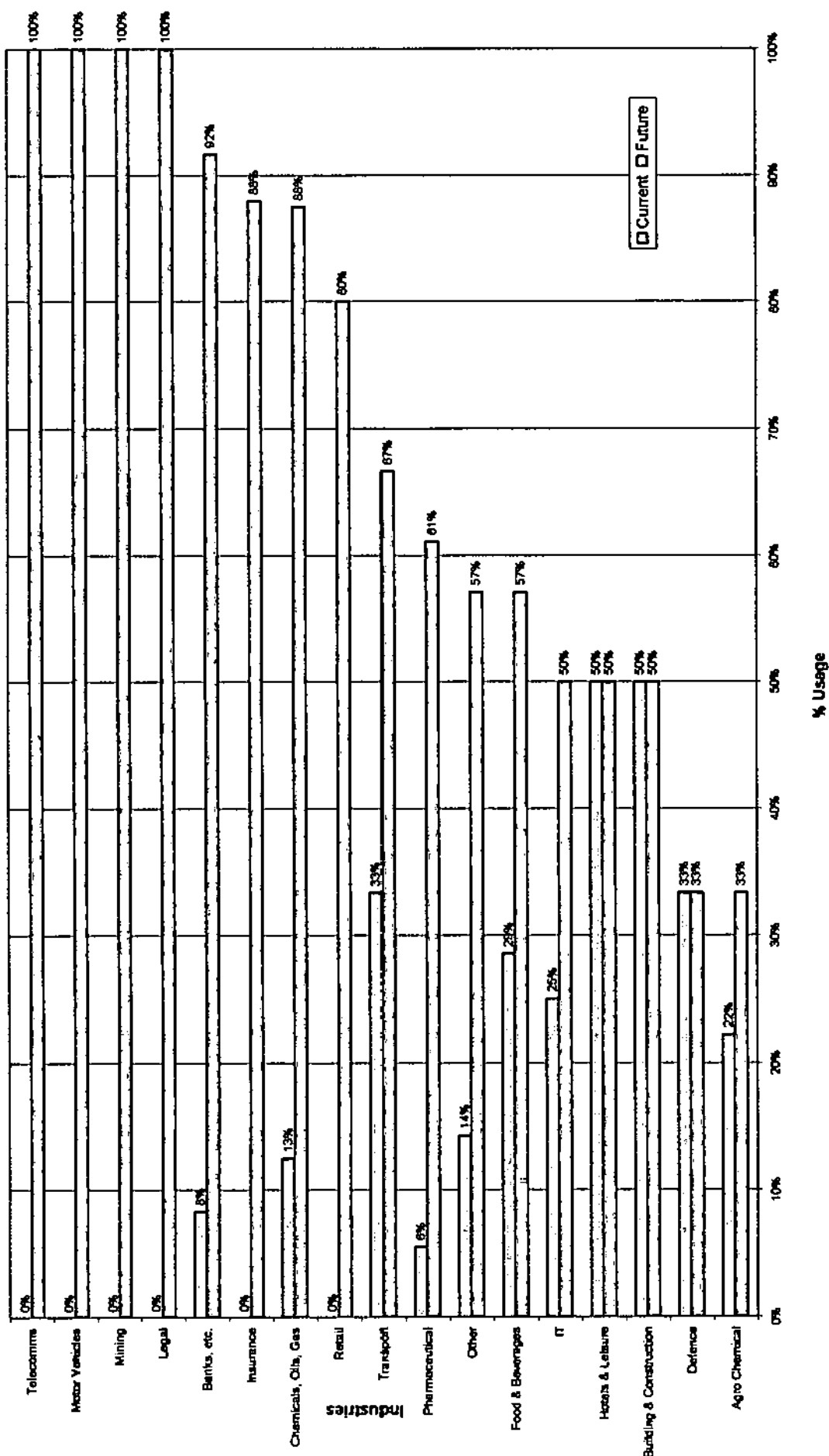
Graph 4

General accounting packages: current & planned usage



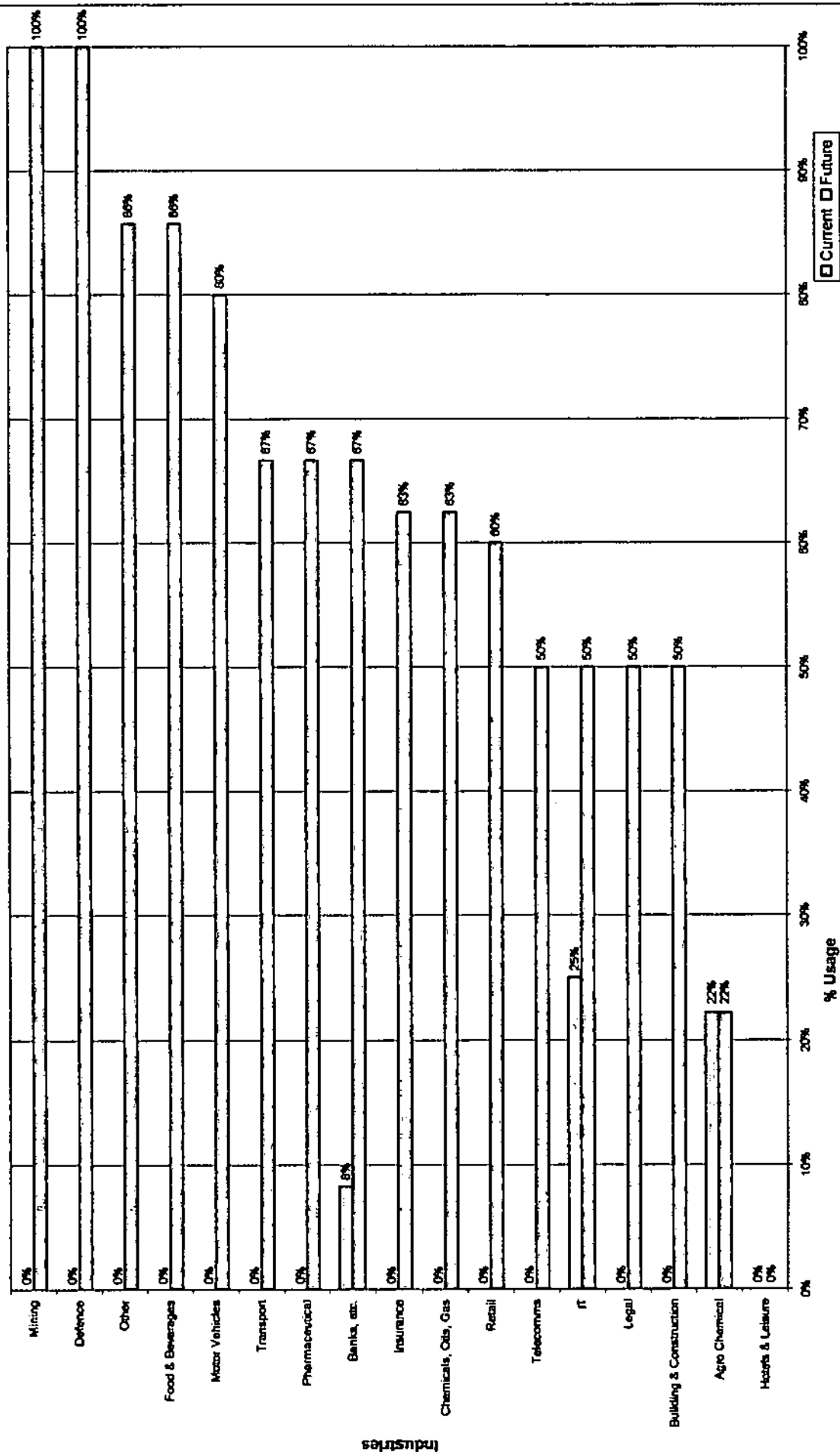
Graph 5

Electronic facsimile: current & planned usage



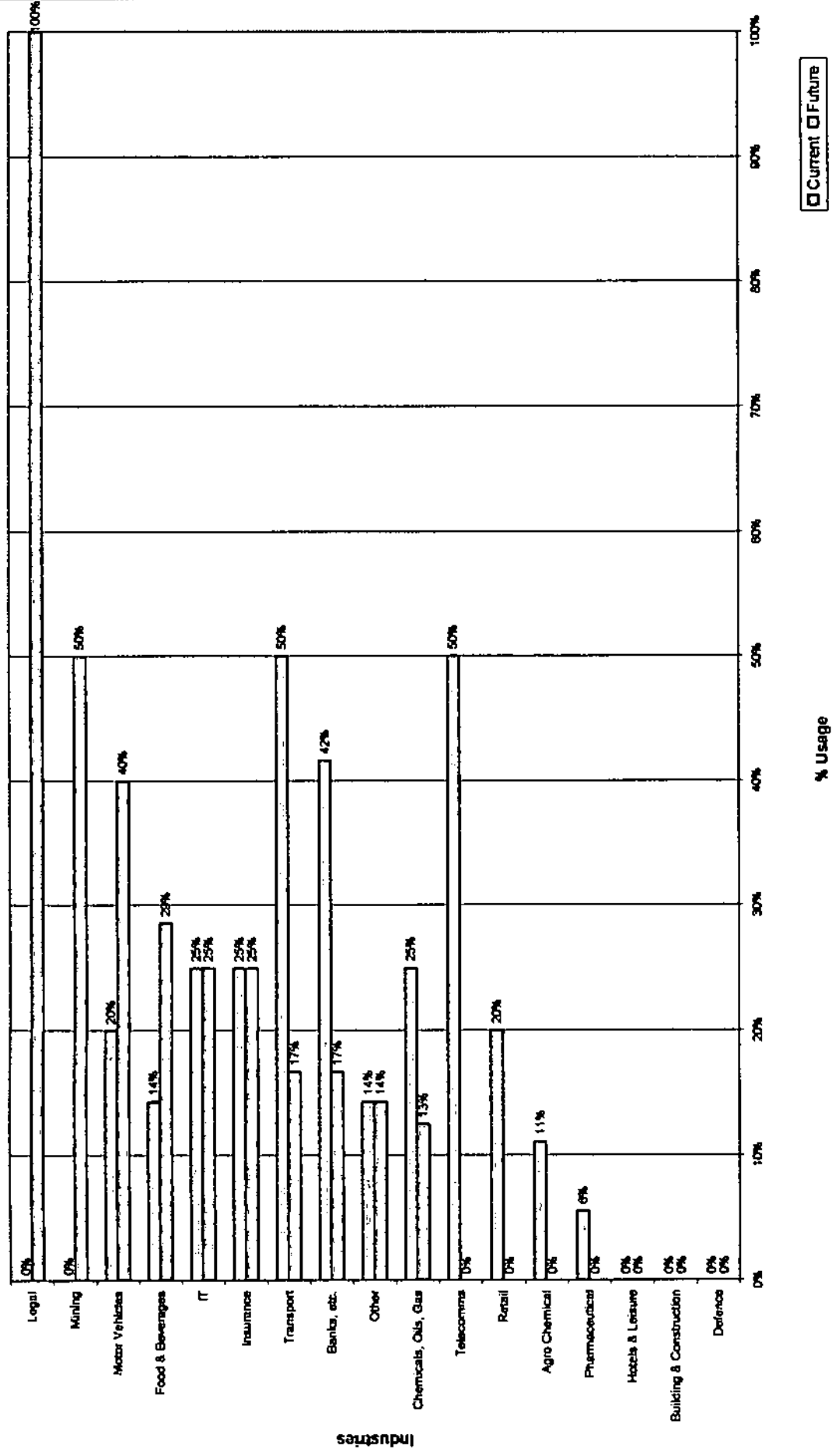
Graph 6

DTP: current & planned usage



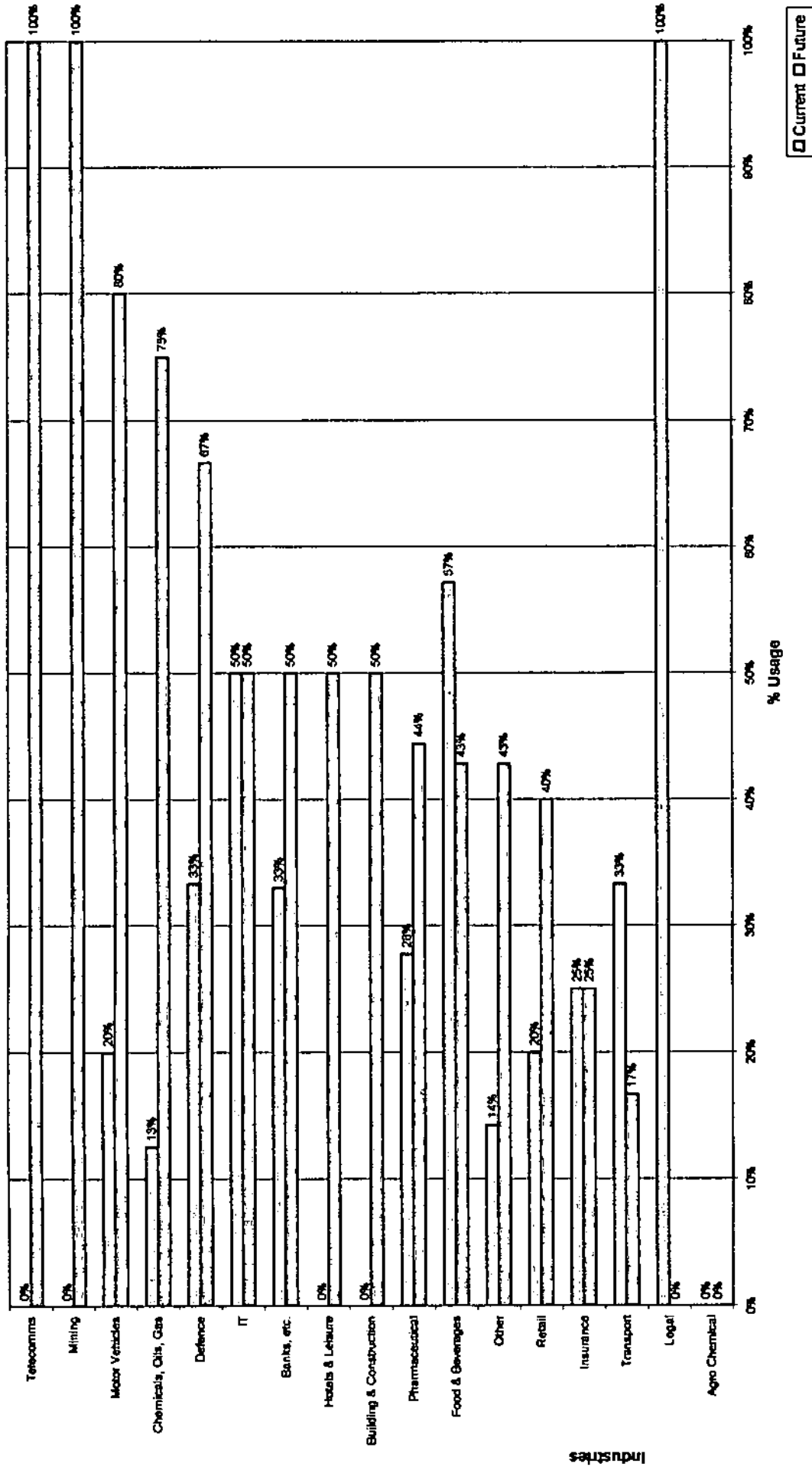
Graph 7

Voice recognition: current & planned usage



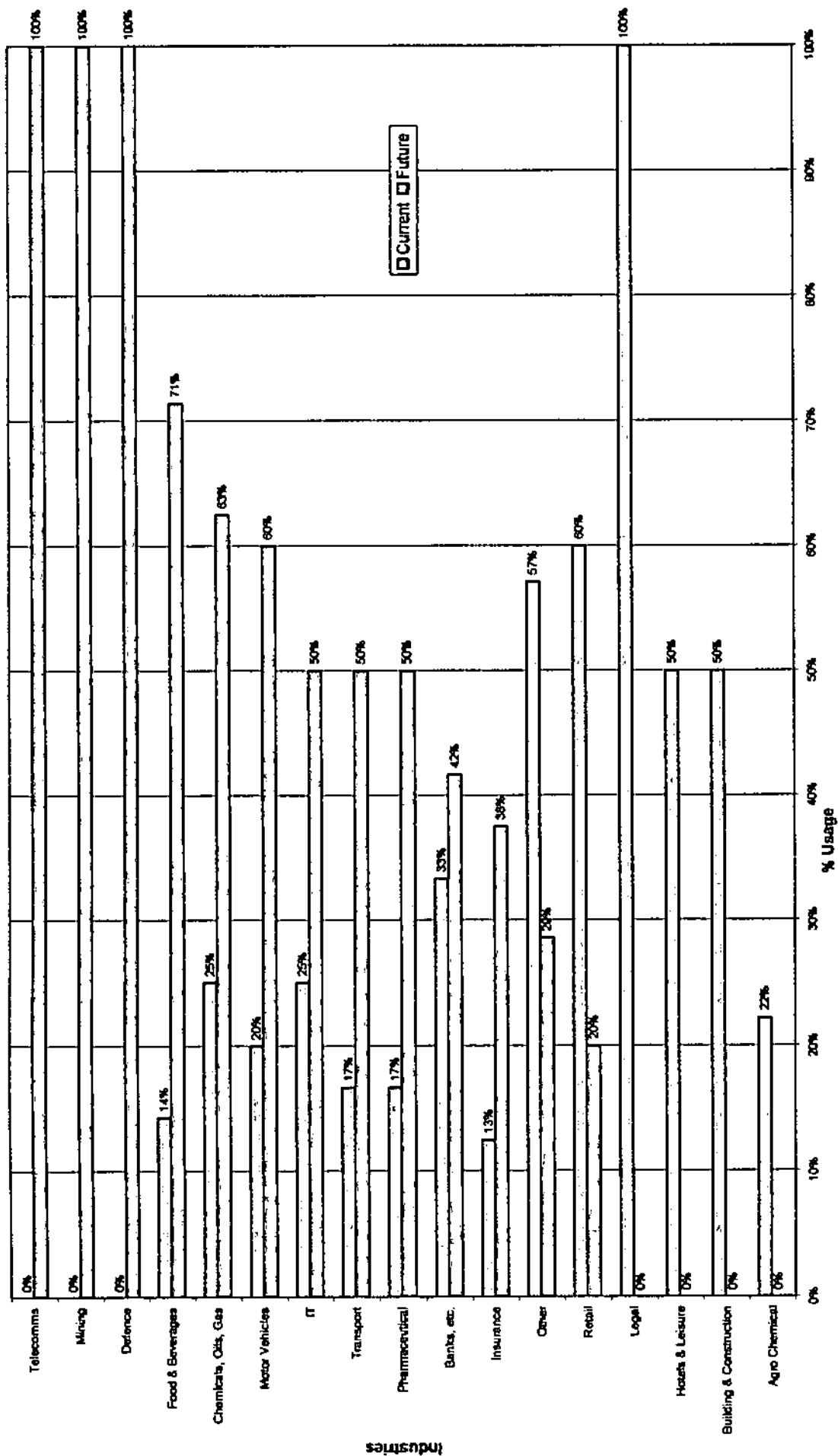
Graph 8

Video conferencing: current & planned usage

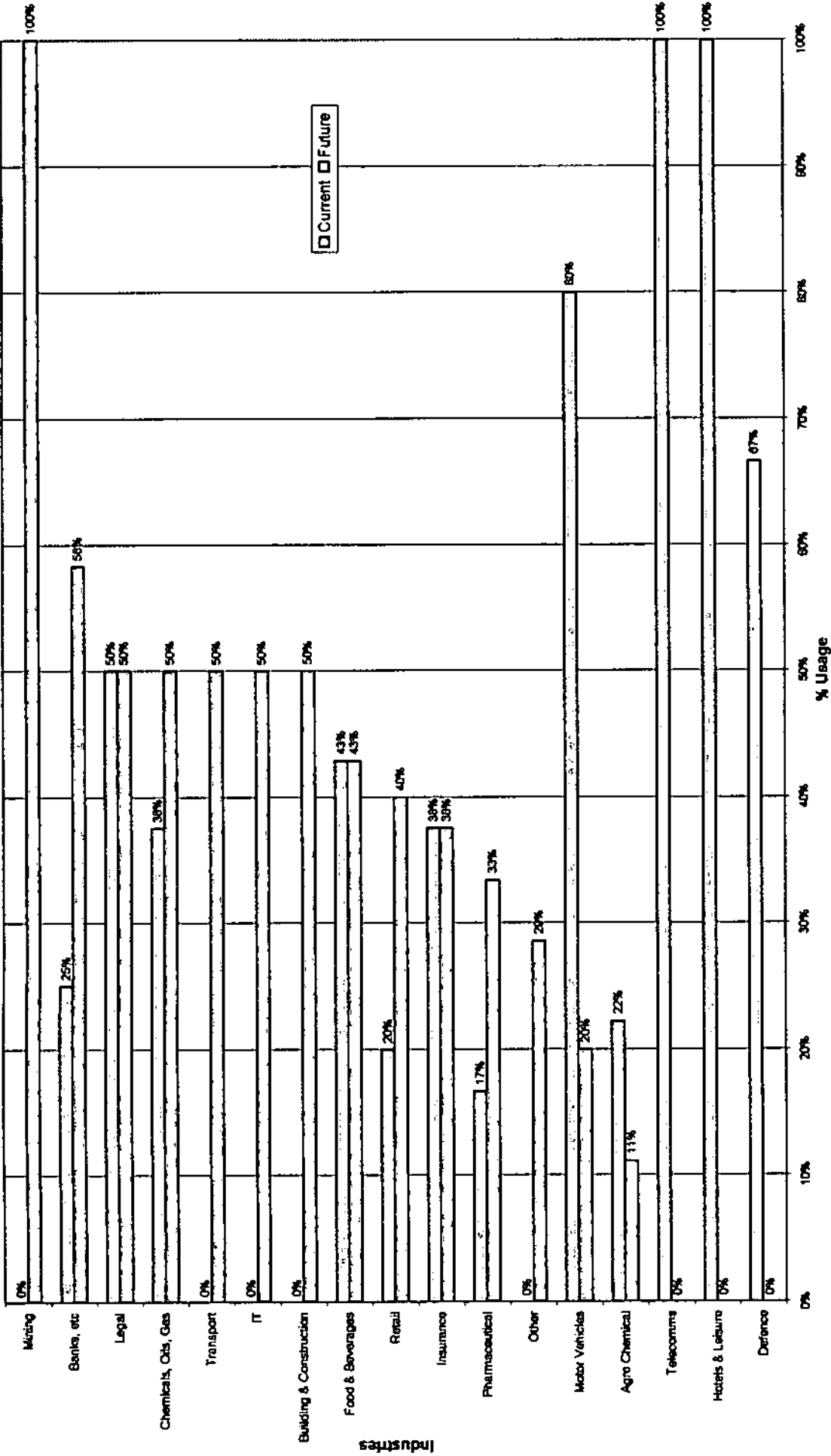


Graph 9

EDMS: current & planned usage

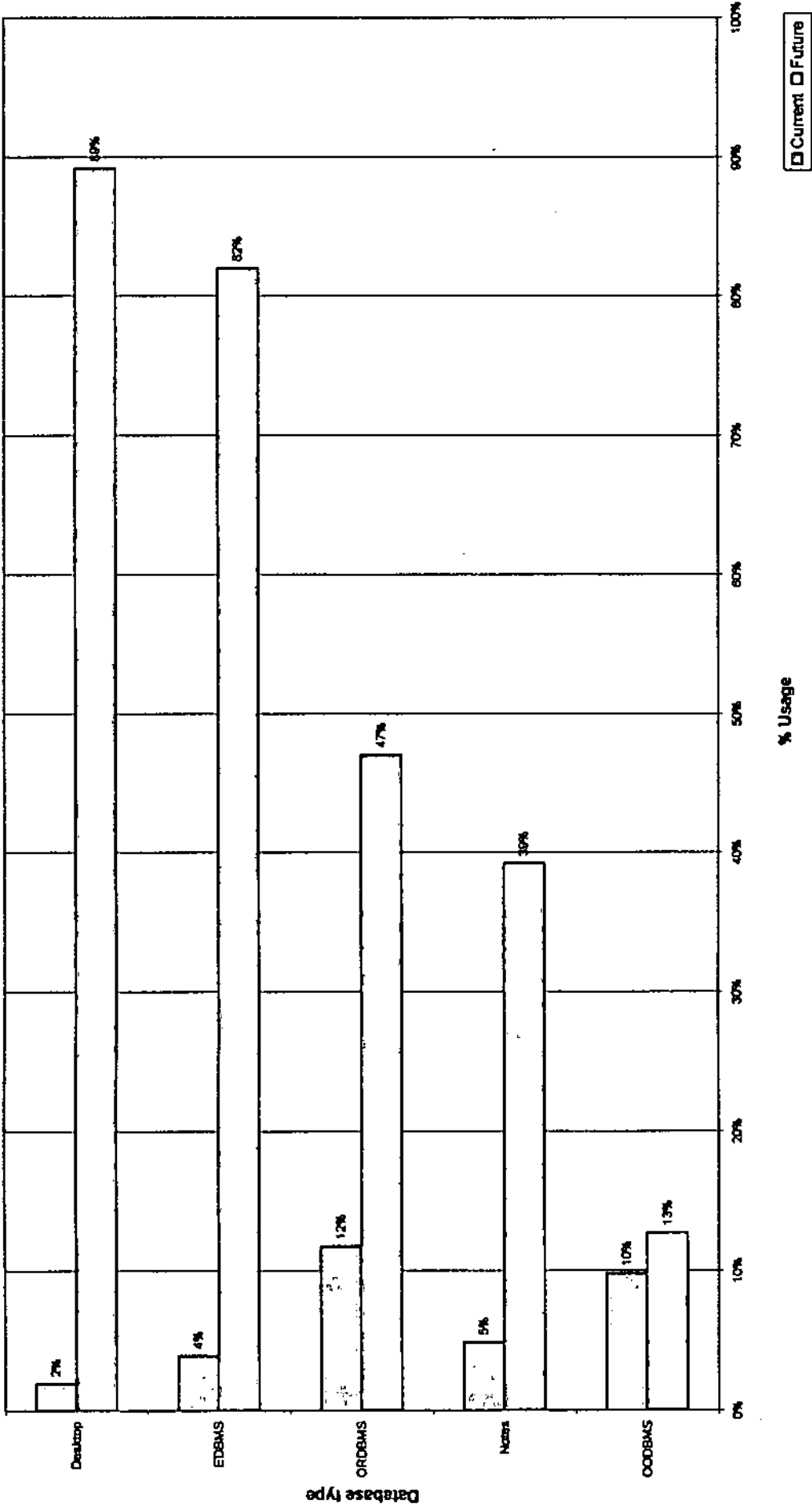


Workflow: current & planned usage

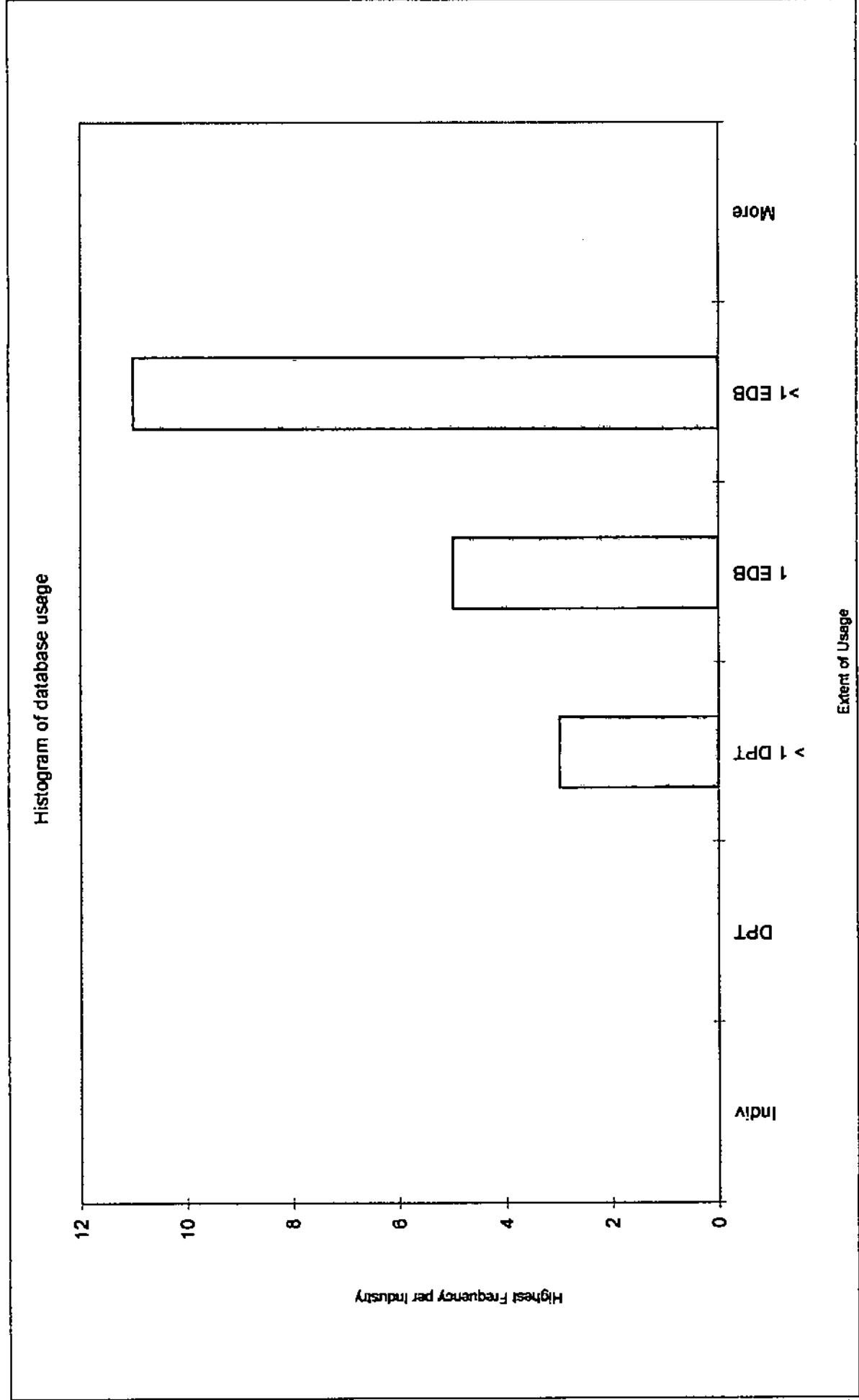


Graph 11

DBMS: total usage by database type

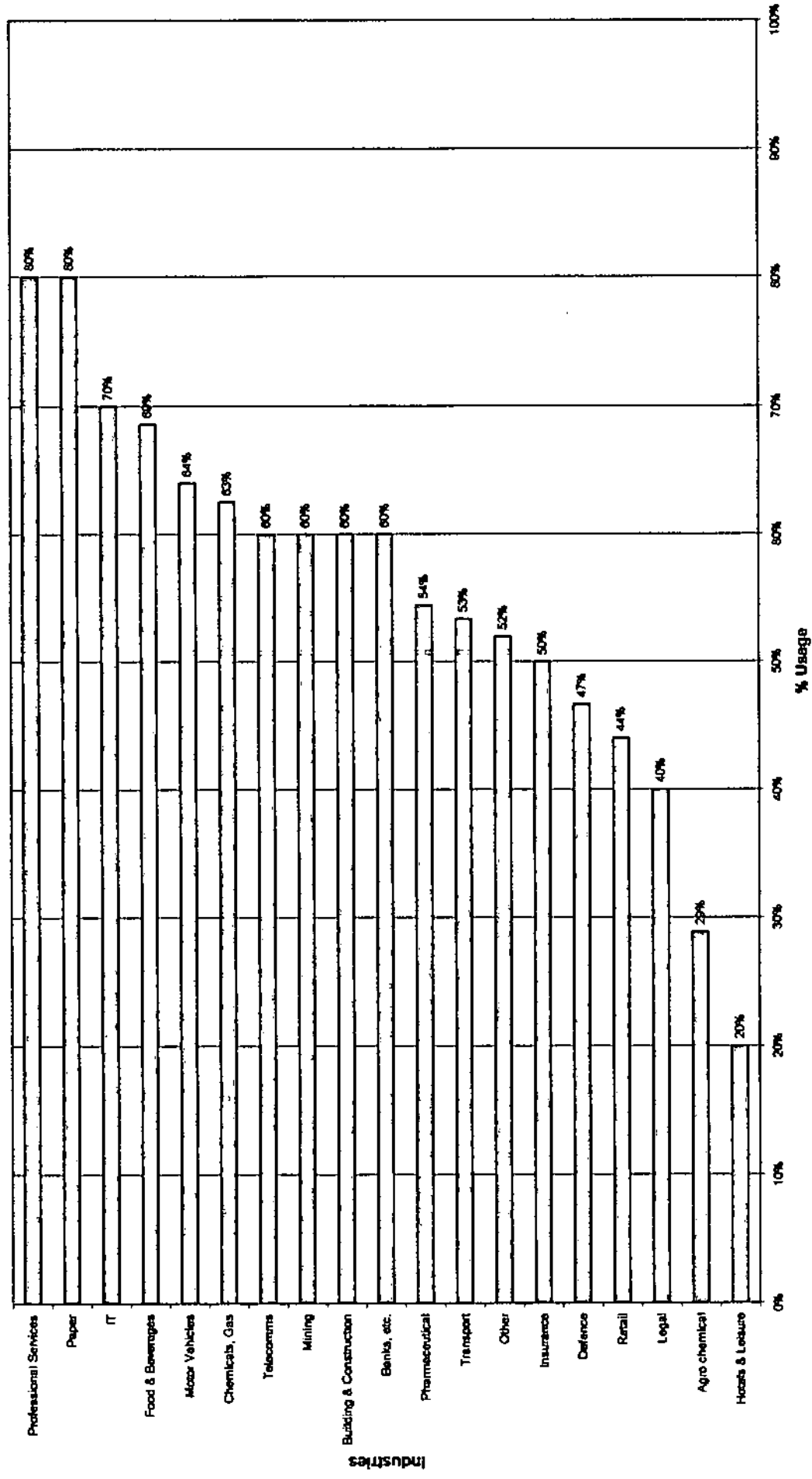


Graph 12

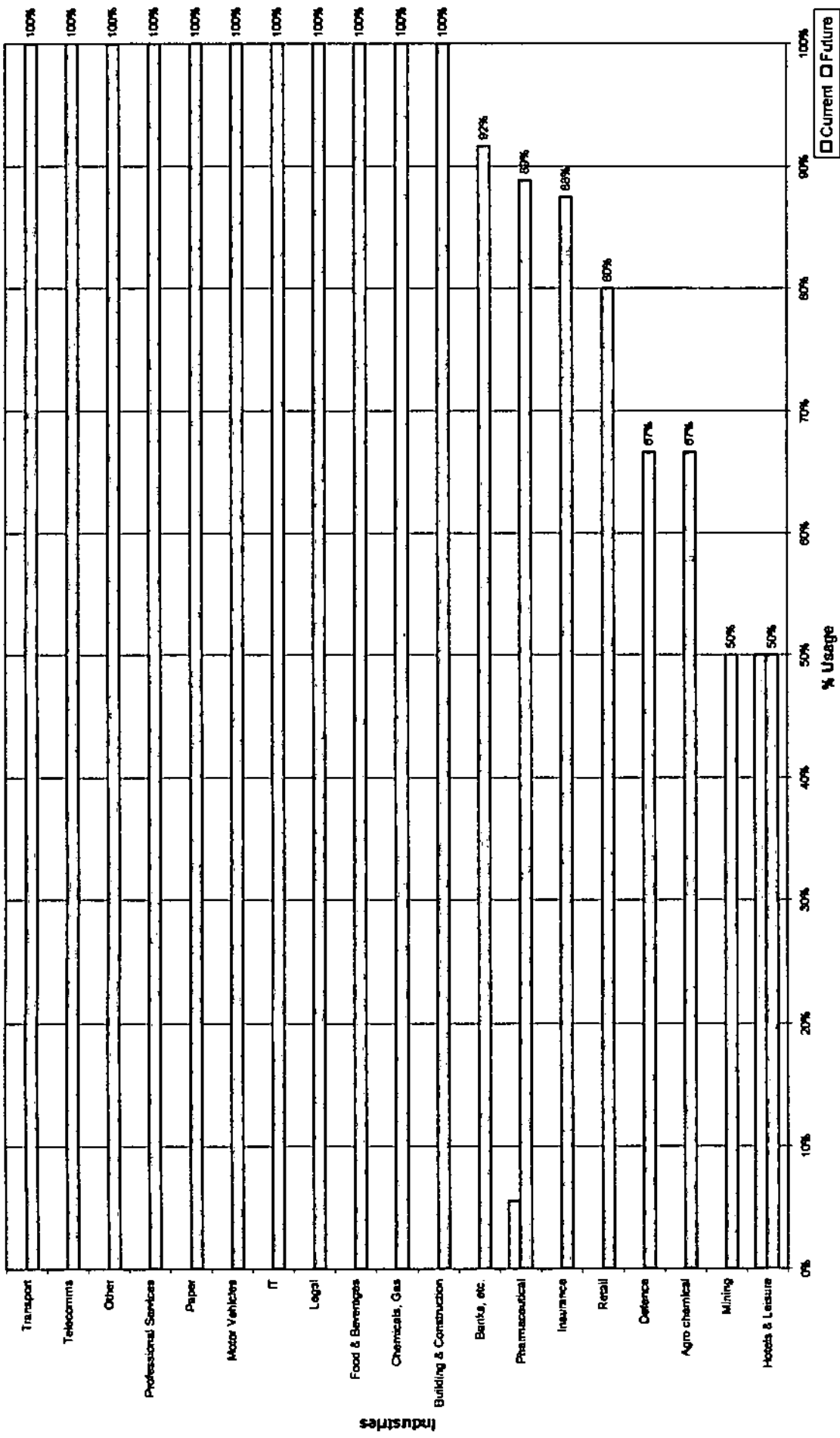


Graph 13

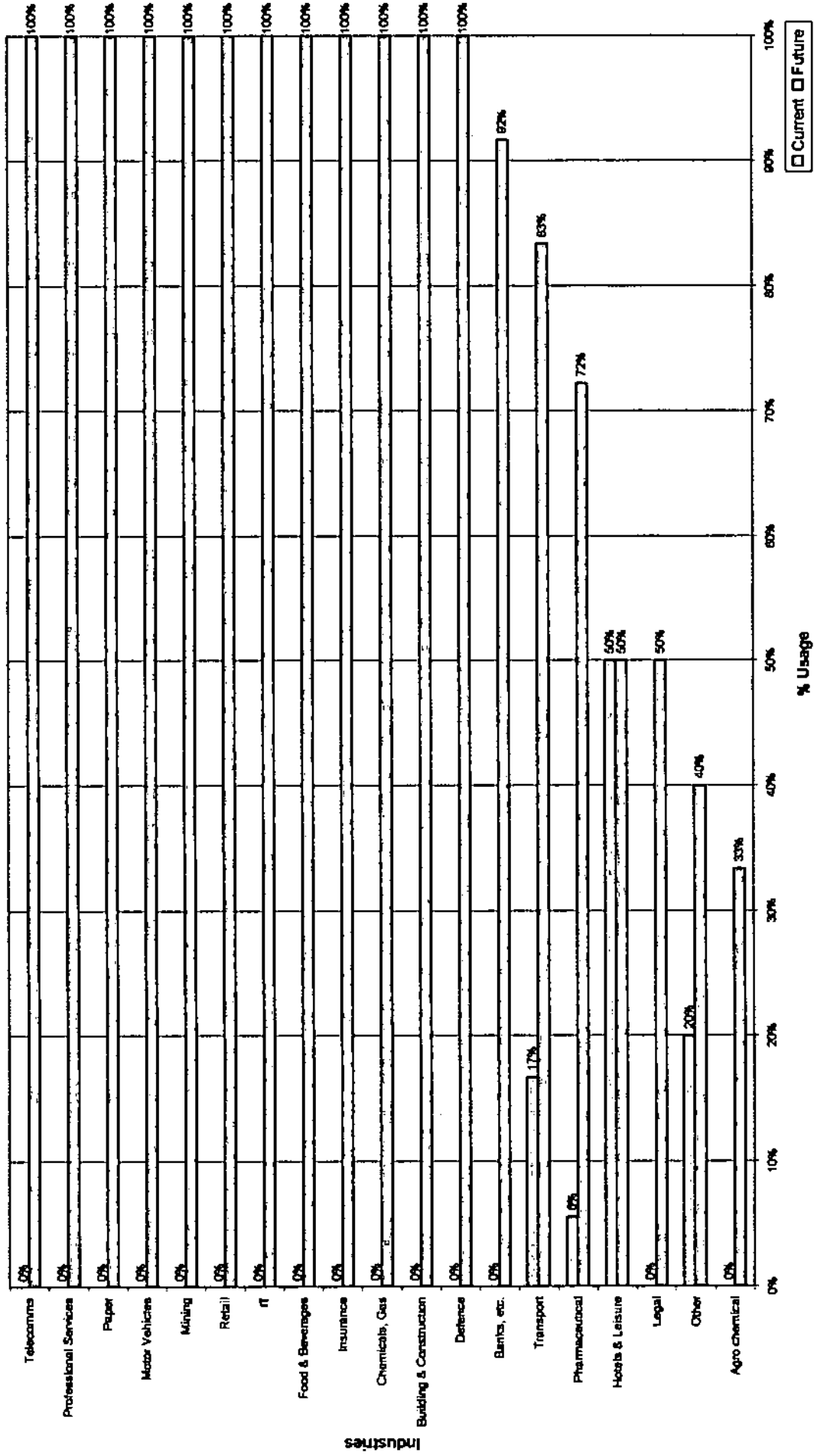
DBMS usage of different databases



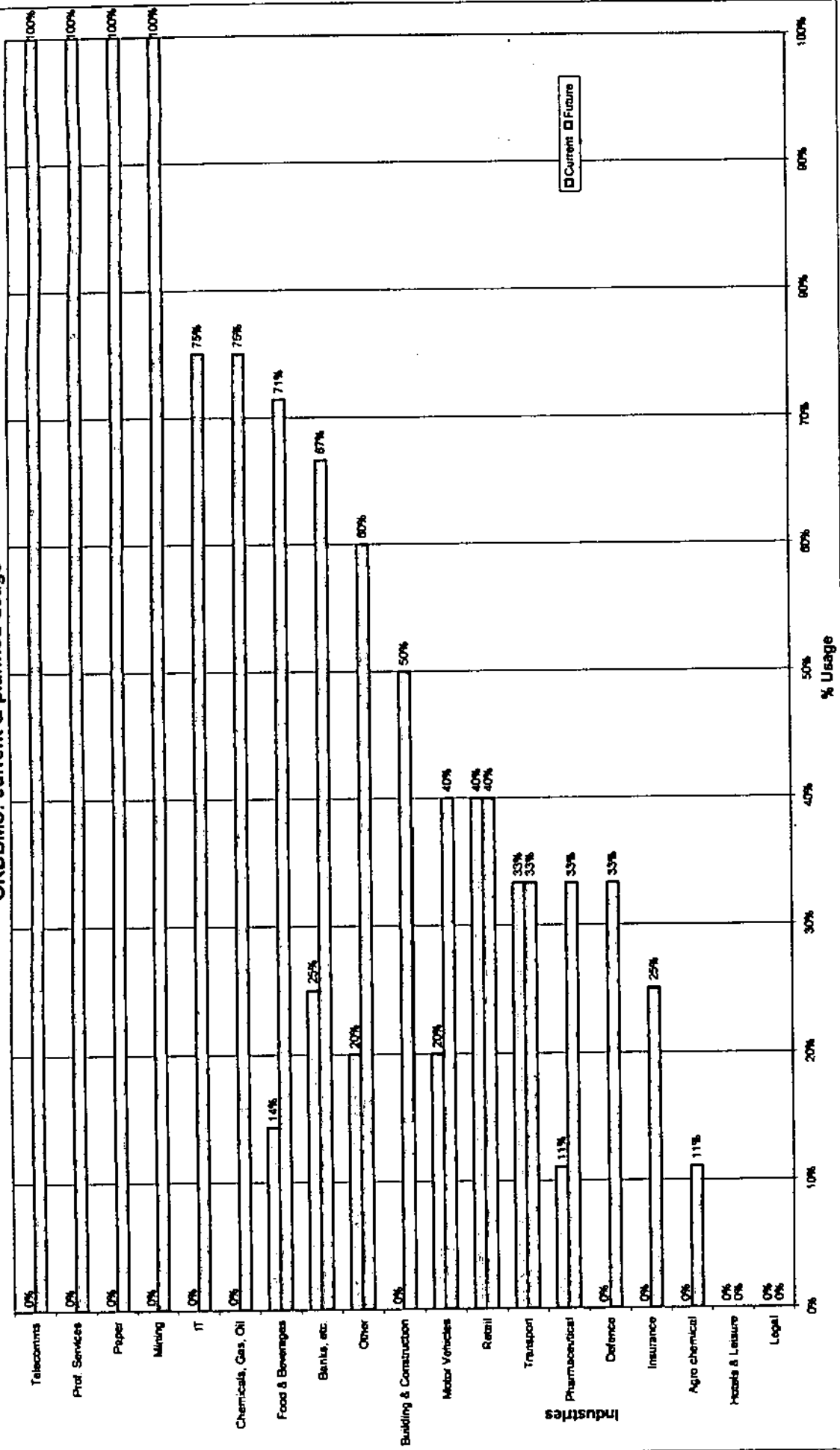
Desktop databases: current & planned usage



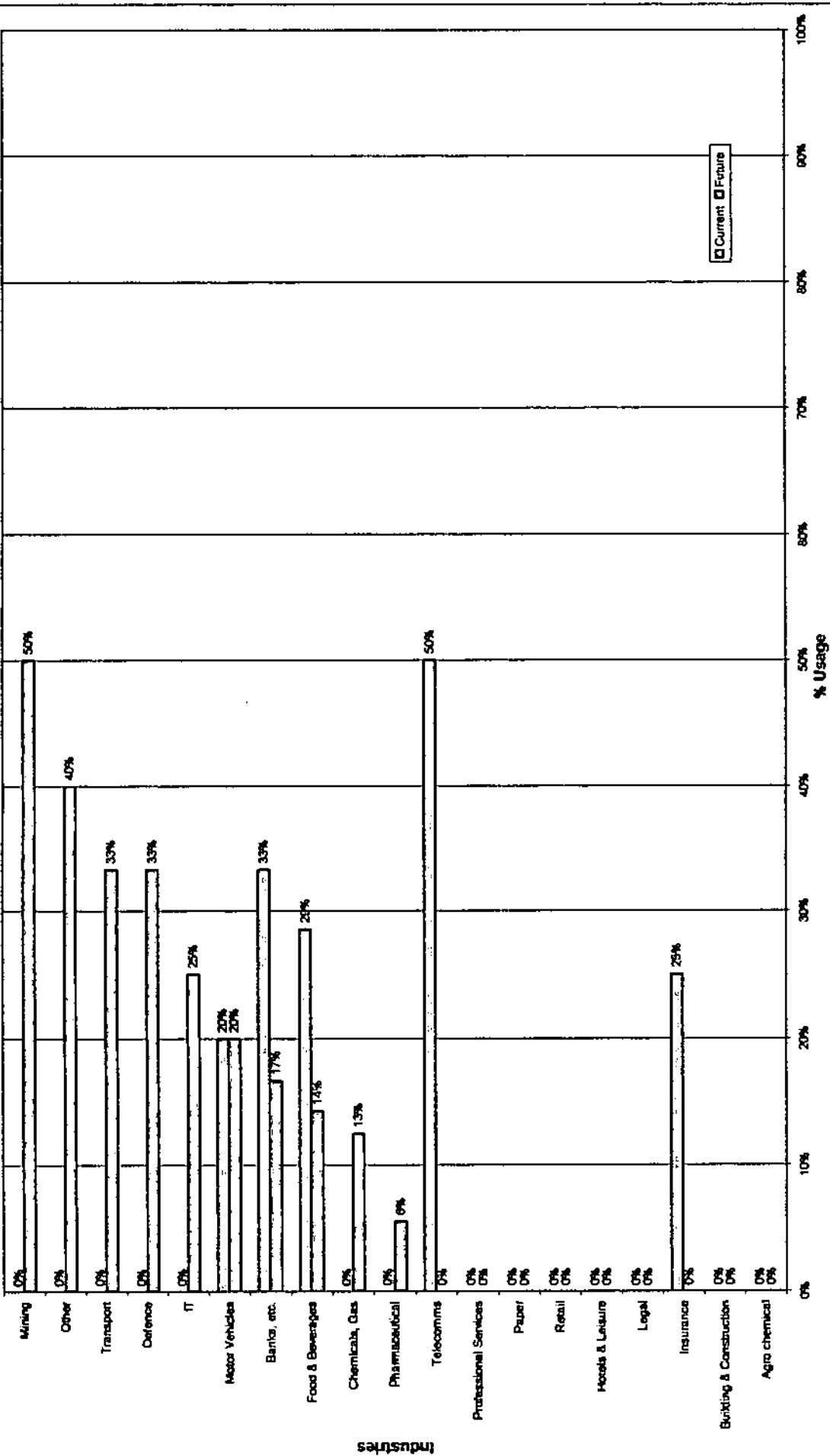
Enterprise DBMS: current & planned usage



ORDBMS: current & planned usage

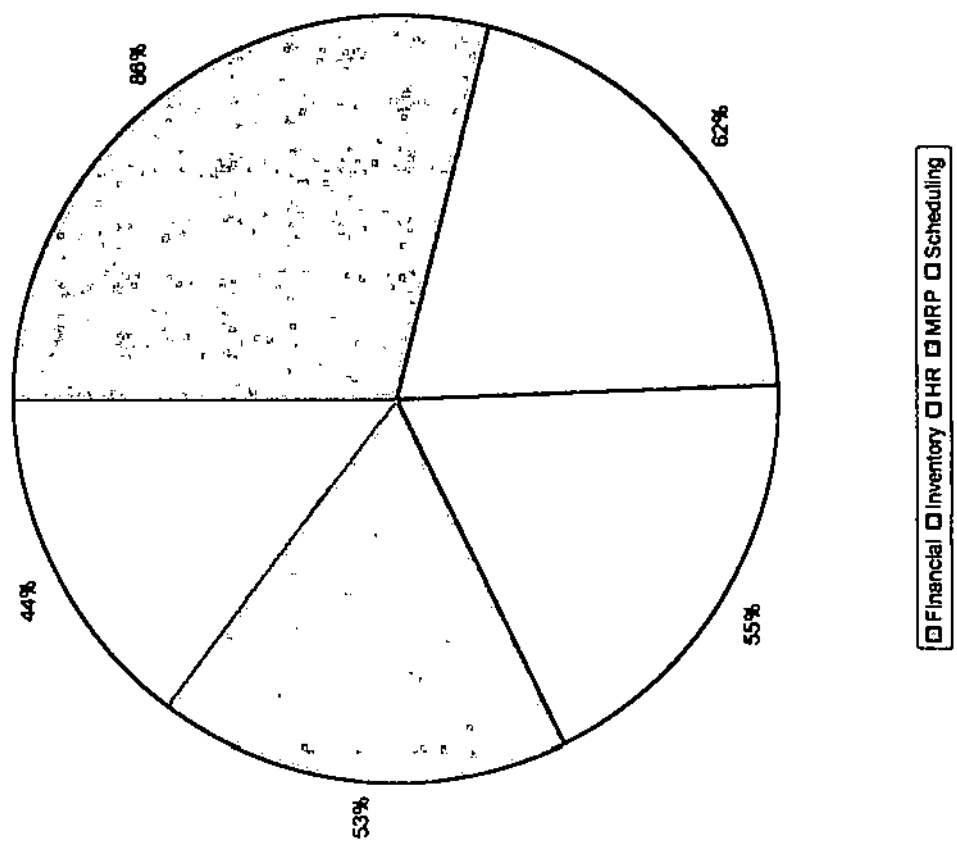


OODBMS: current and planned usage

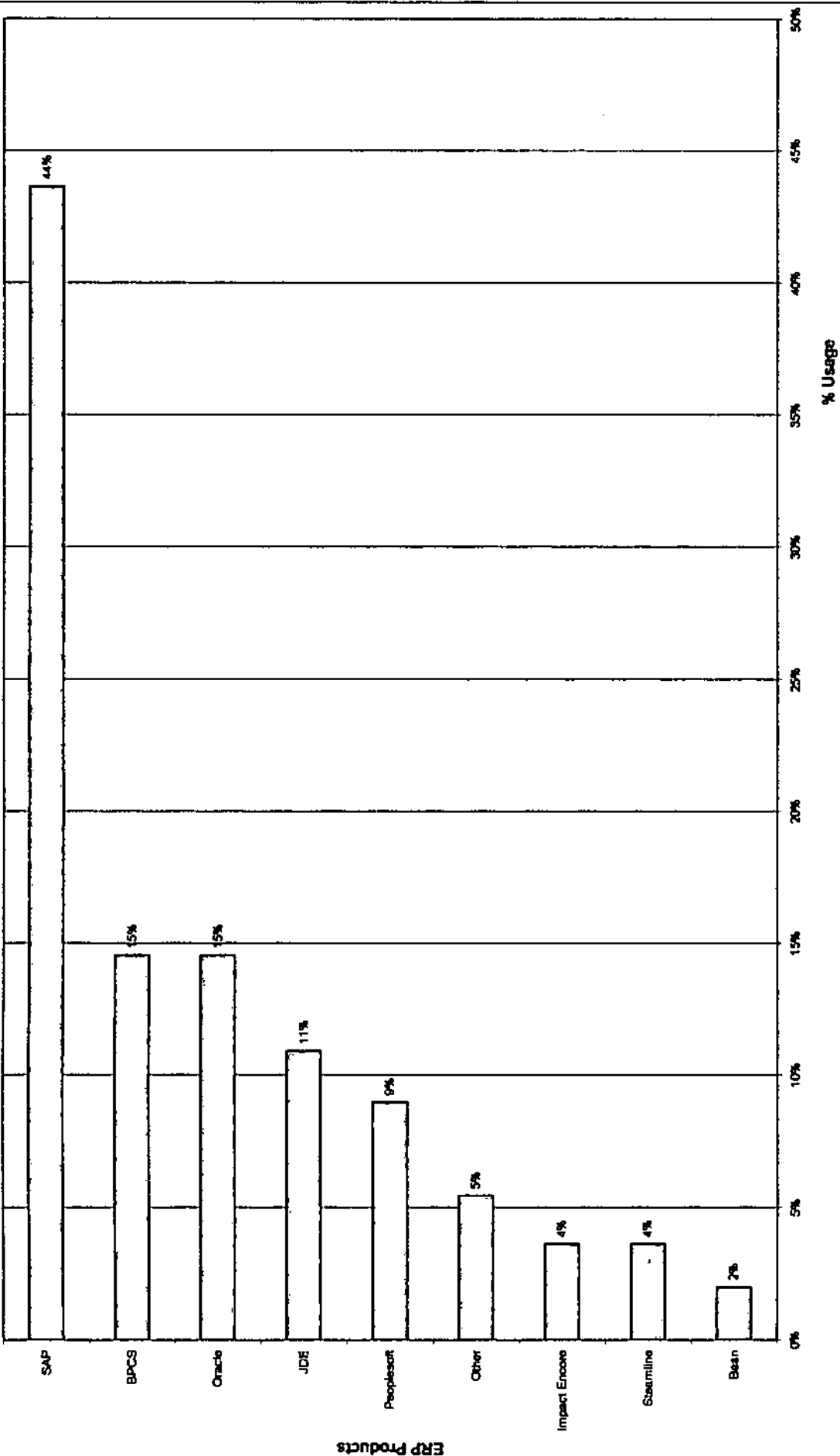


Graph 18

Major ERP modules used /planned in SA Business

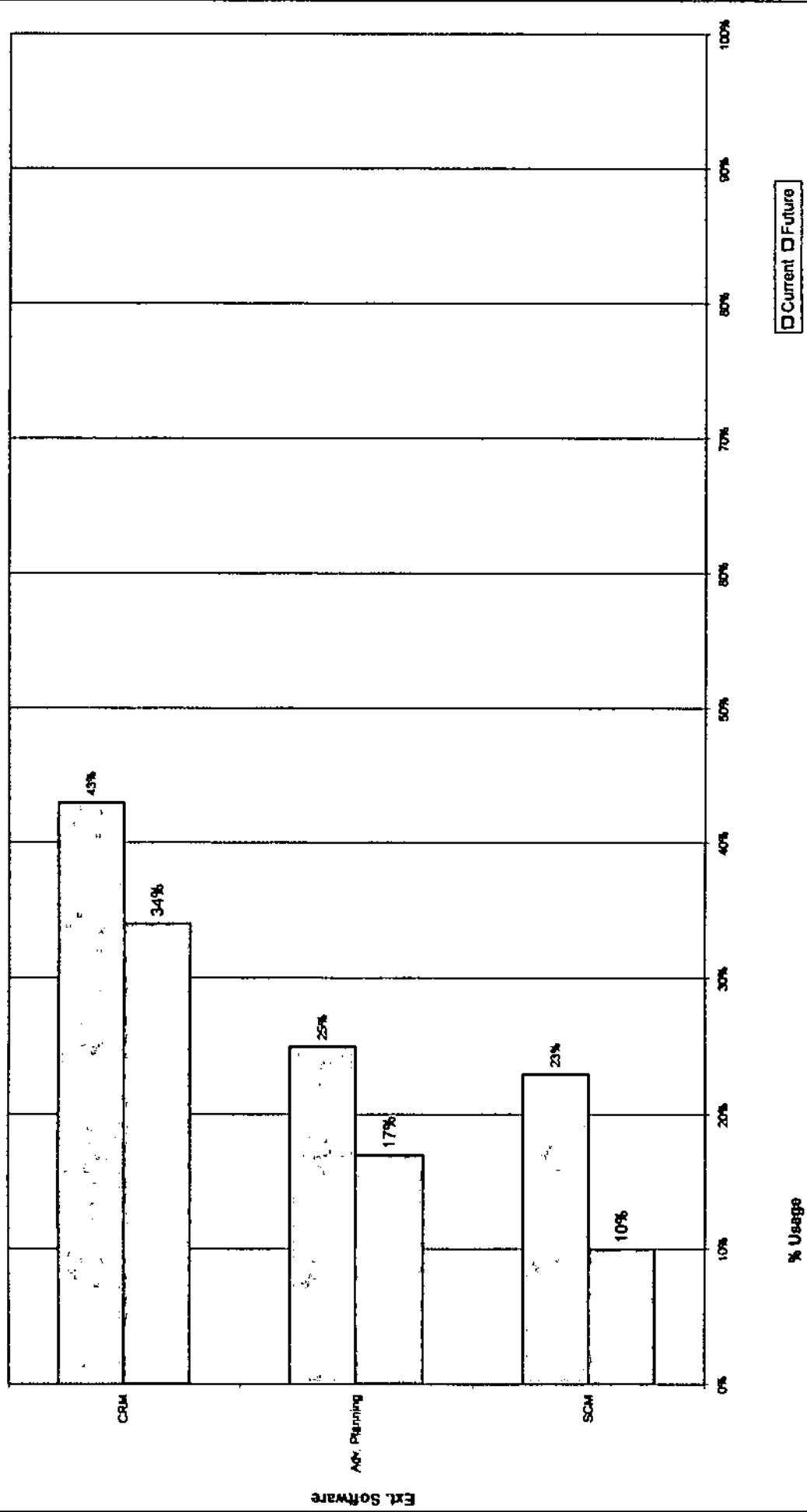


ERP products used by SA business



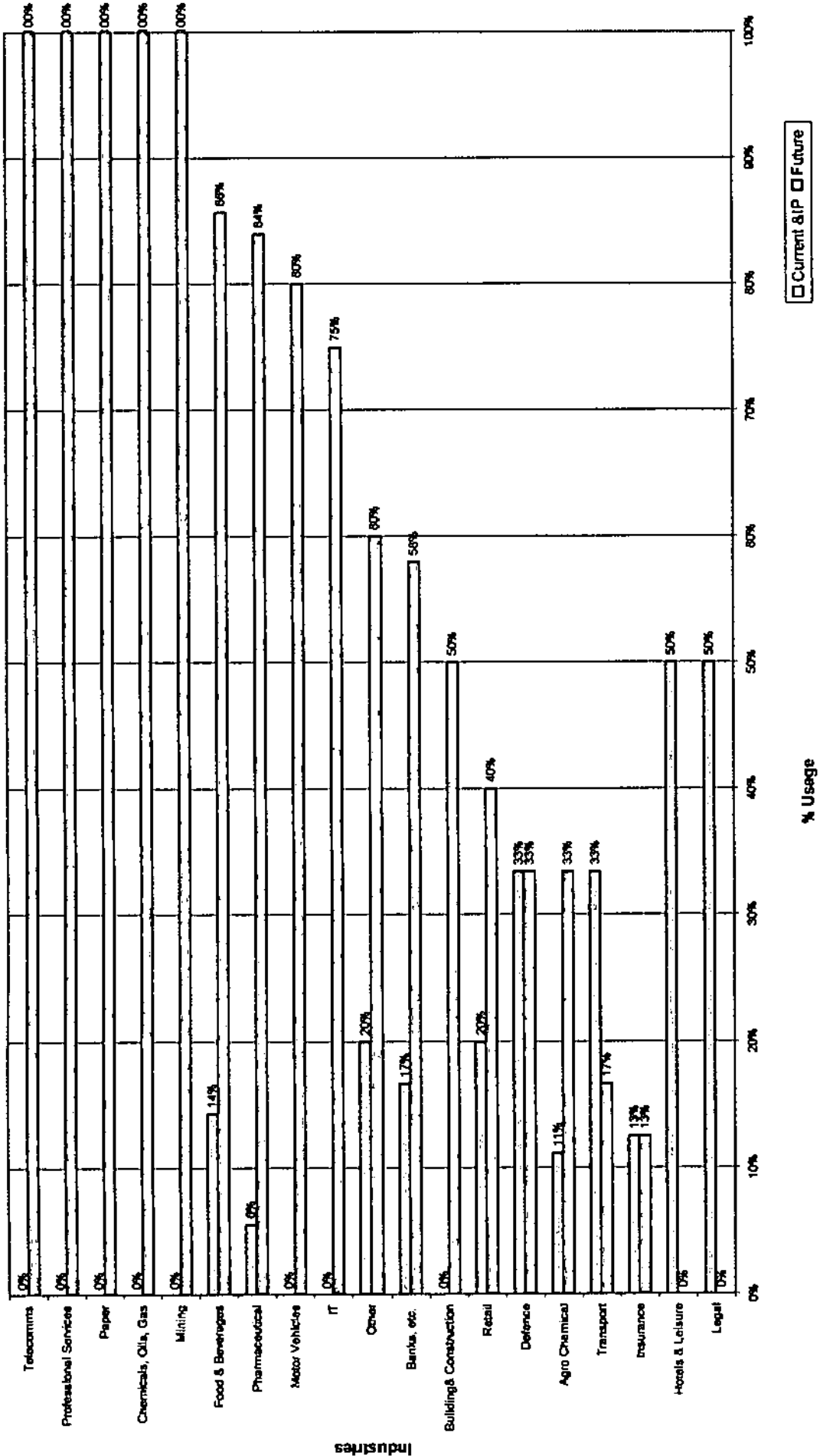
Graph 20

ERP extension software: current & planned usage

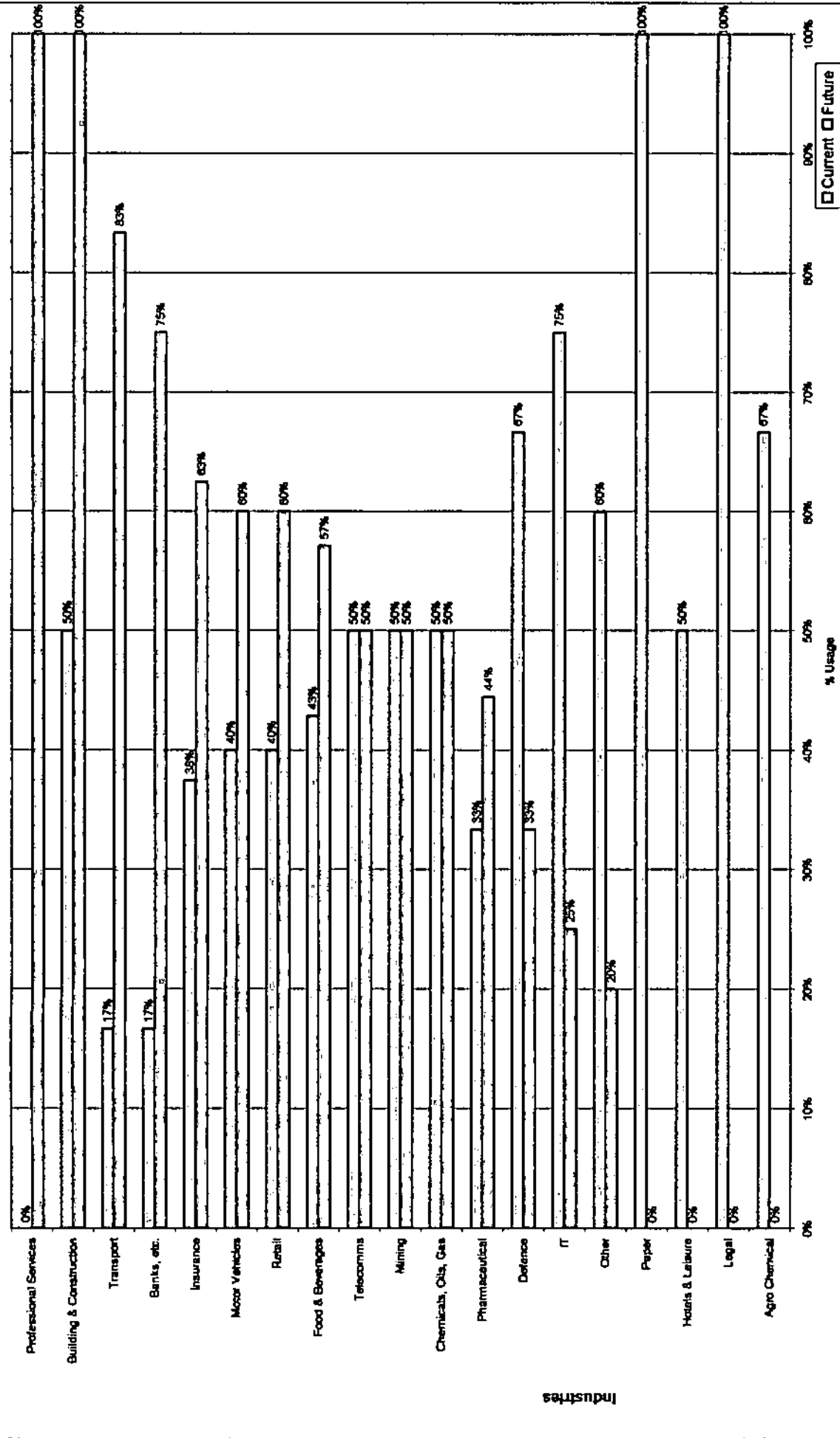


Graph 21

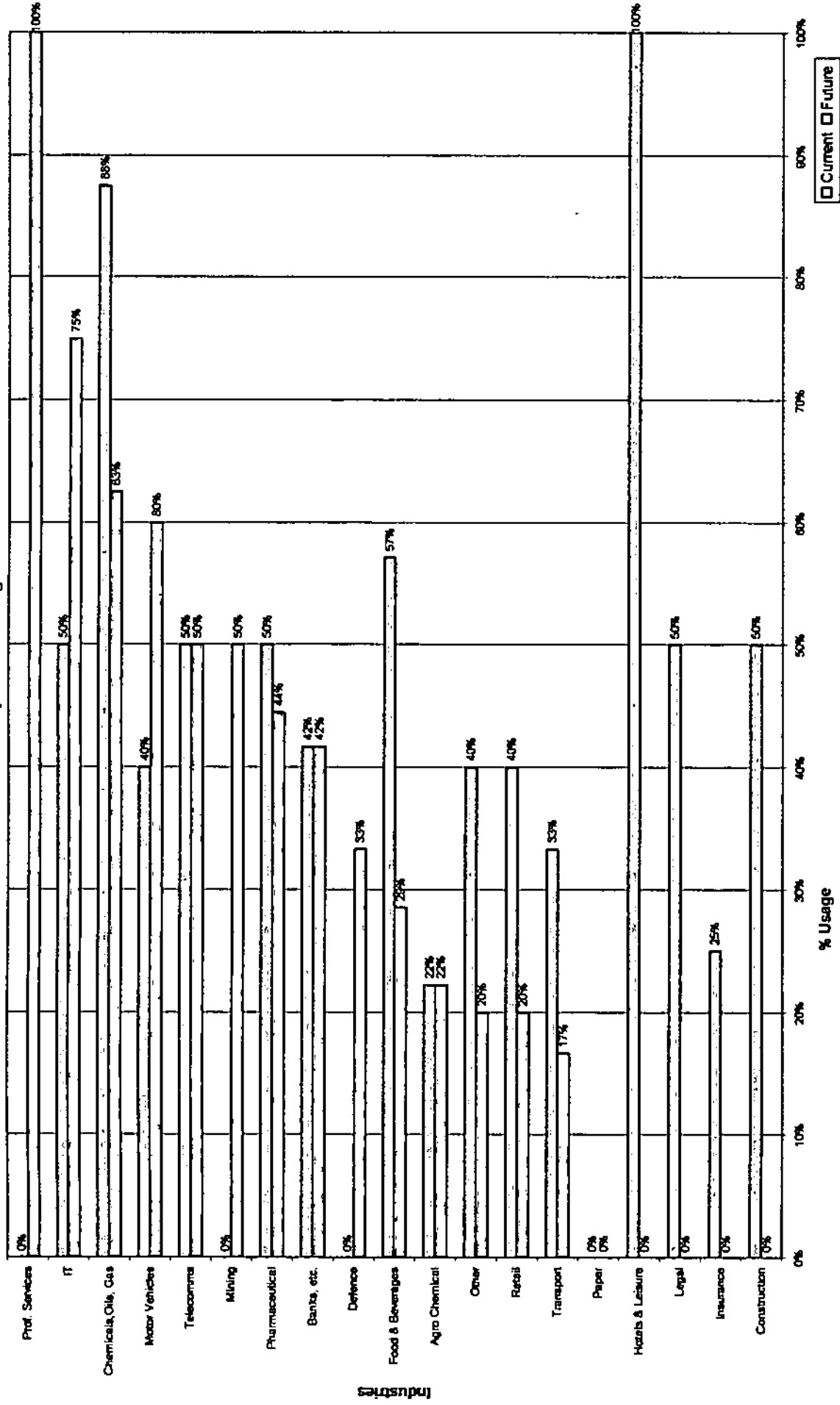
Traditional ERP: current, in-process & planned usage



EDI/e-commerce: current & planned usage

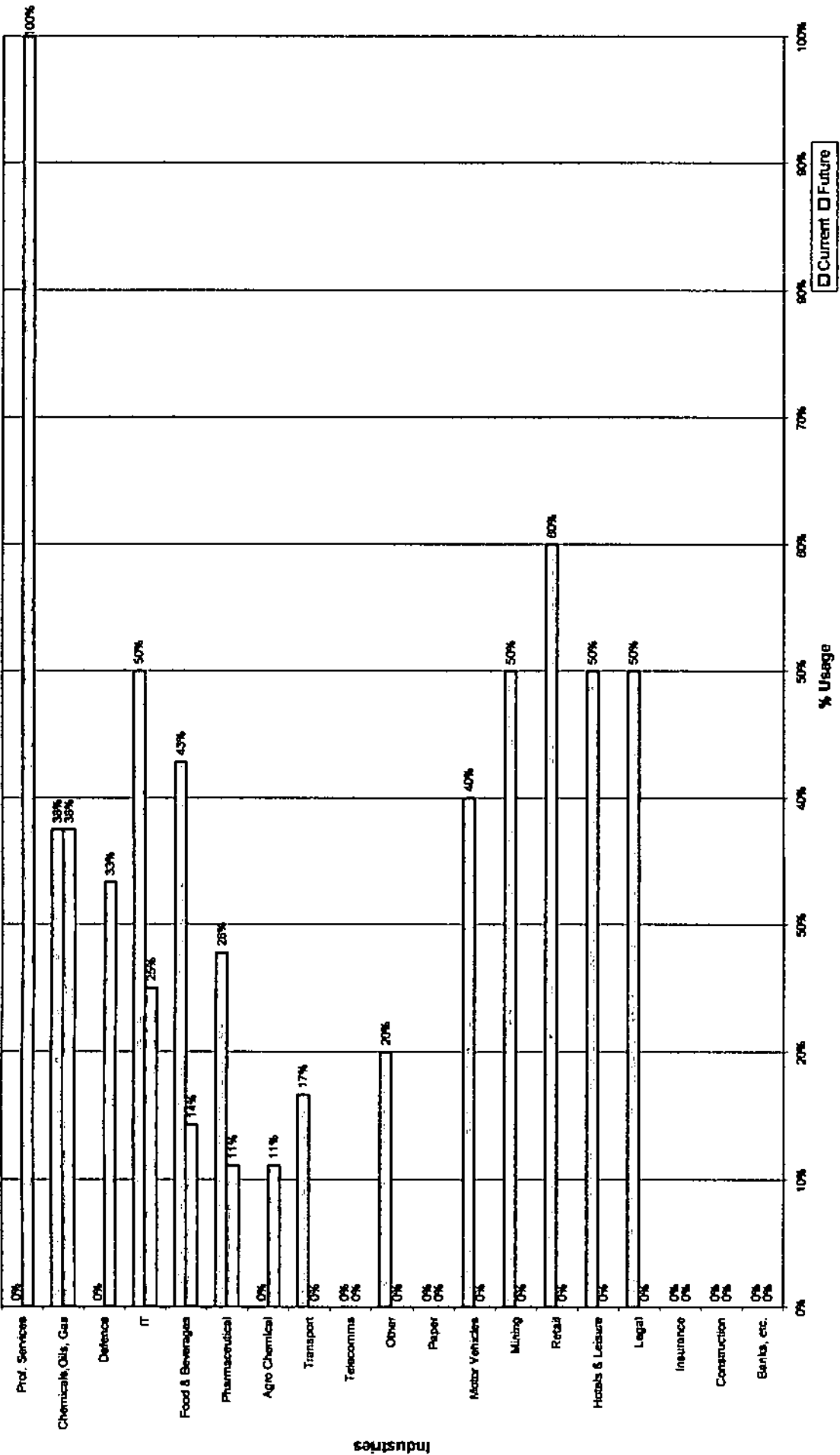


CRM: current & planned usage



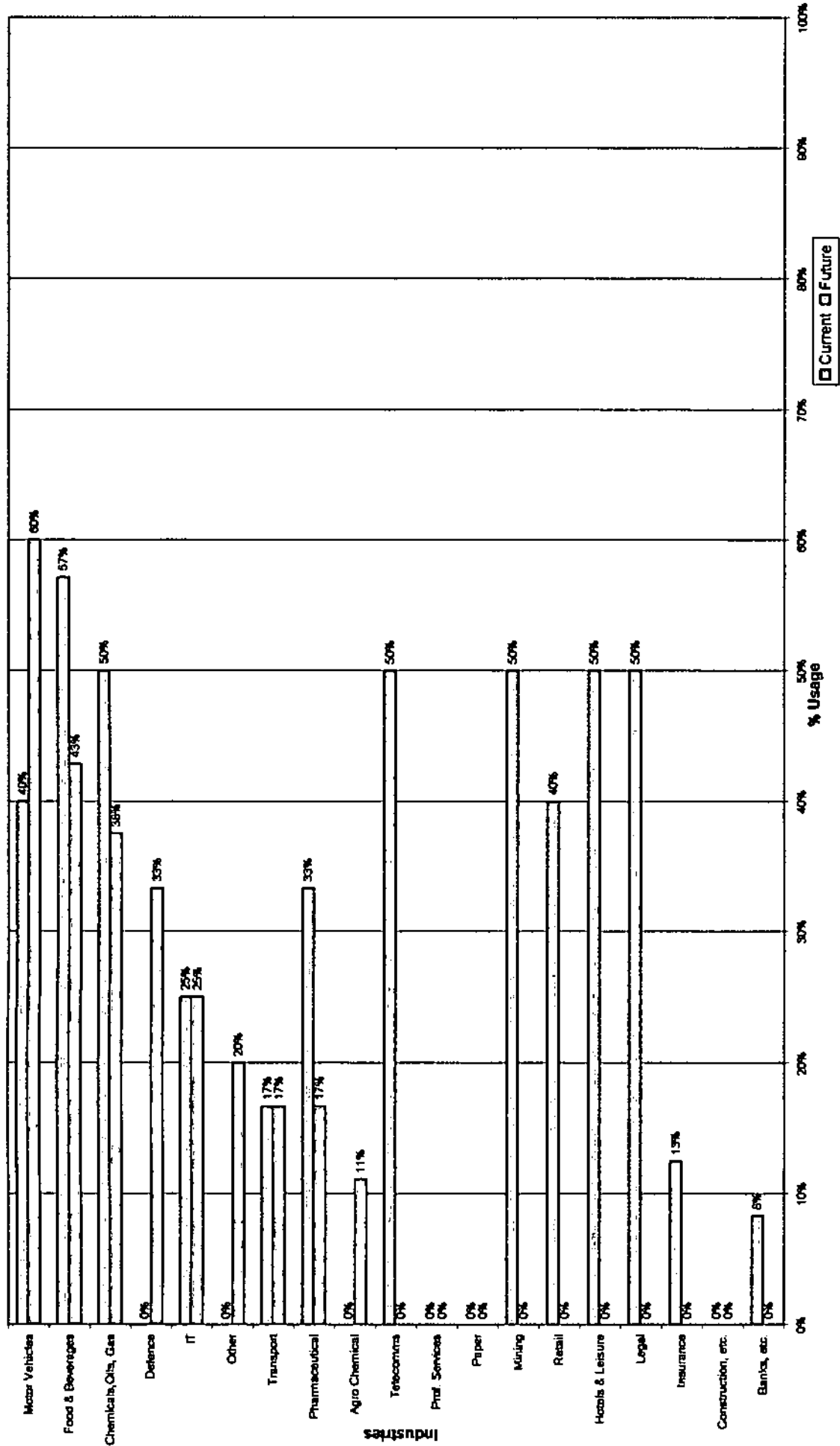
Graph 24

SCM: current & planned usage

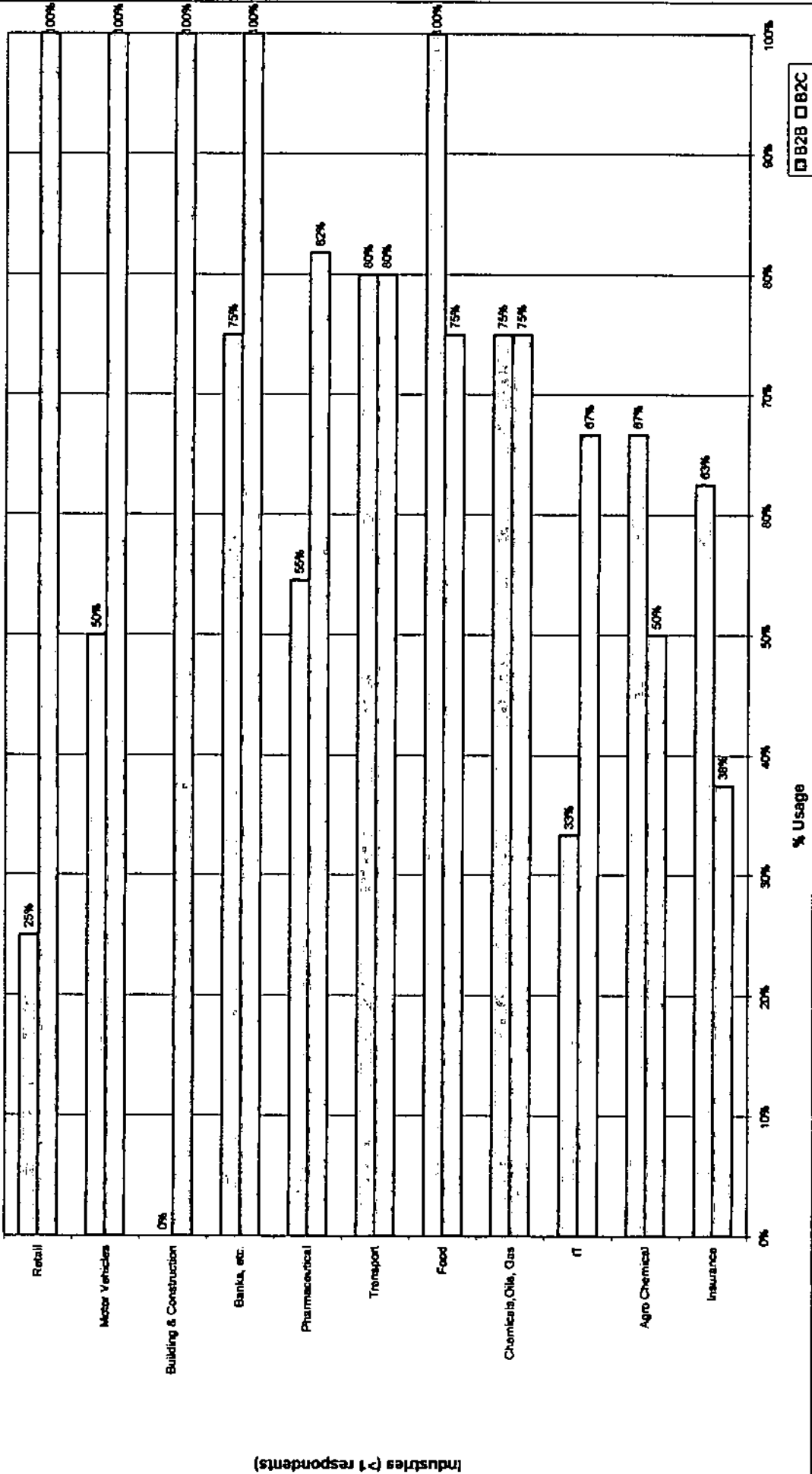


Graph 25

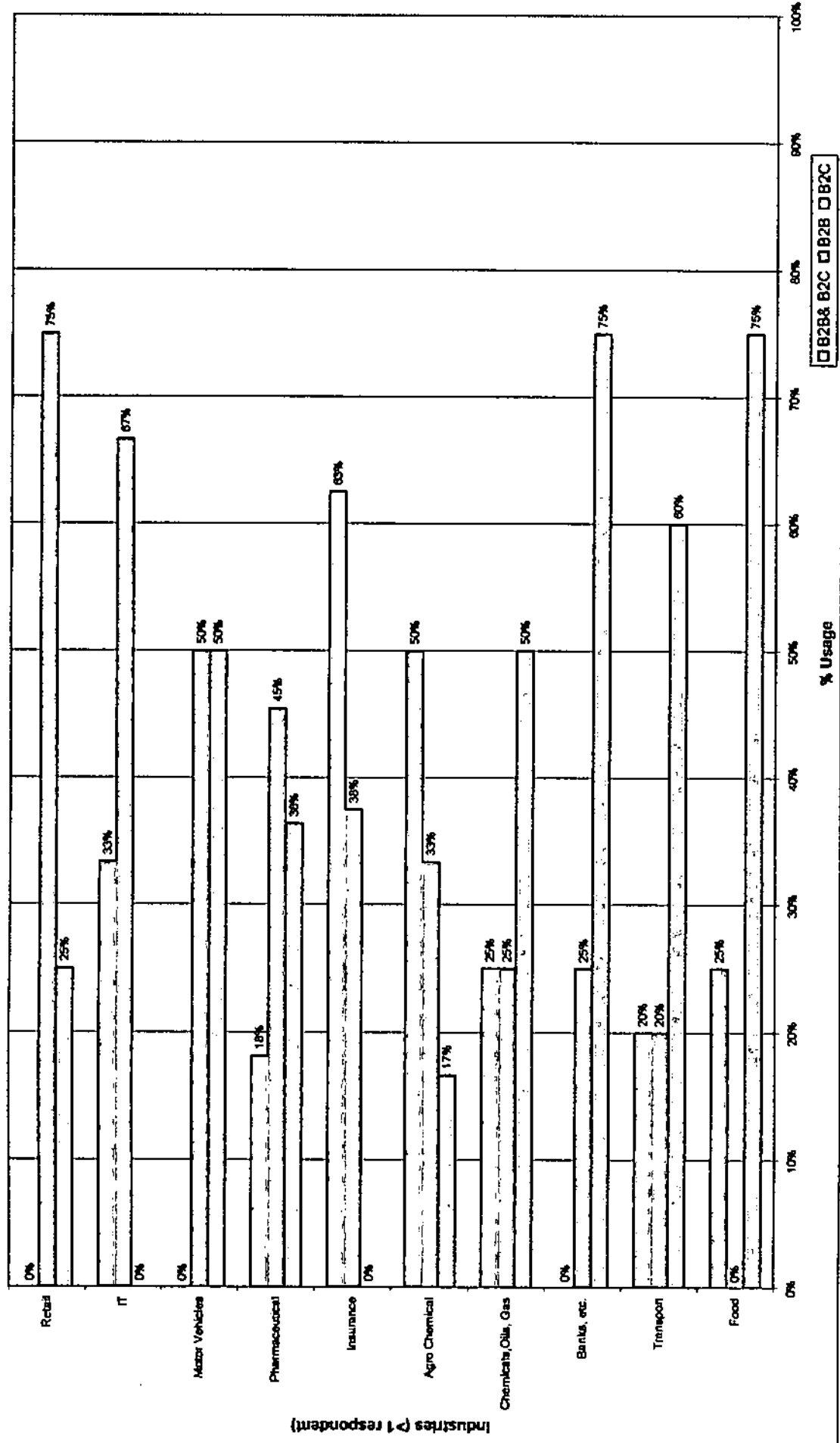
Advance planning software: current & planned usage



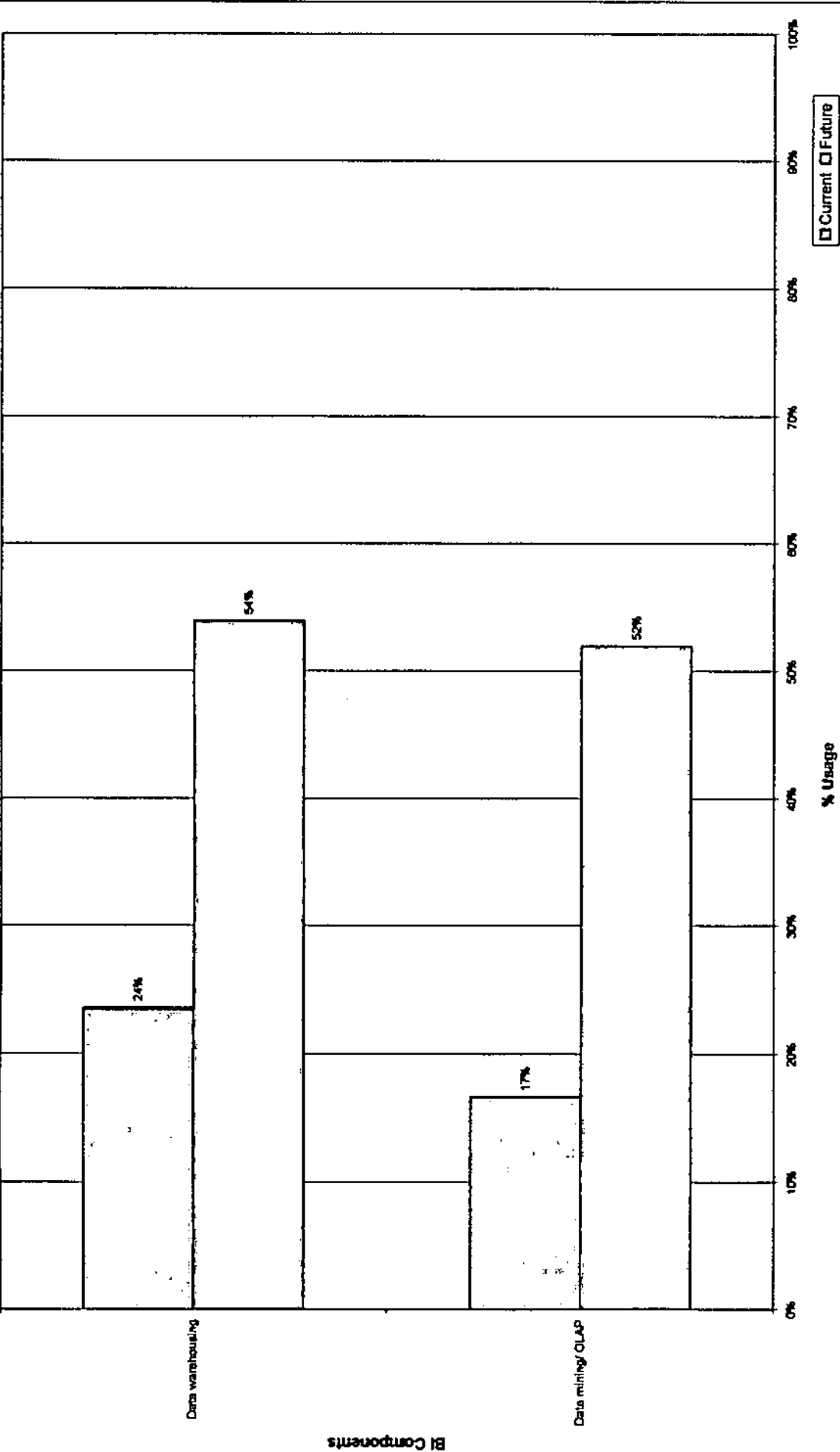
B2B & B2C e-commerce: current & planned usage



E-commerce: current & planned usage

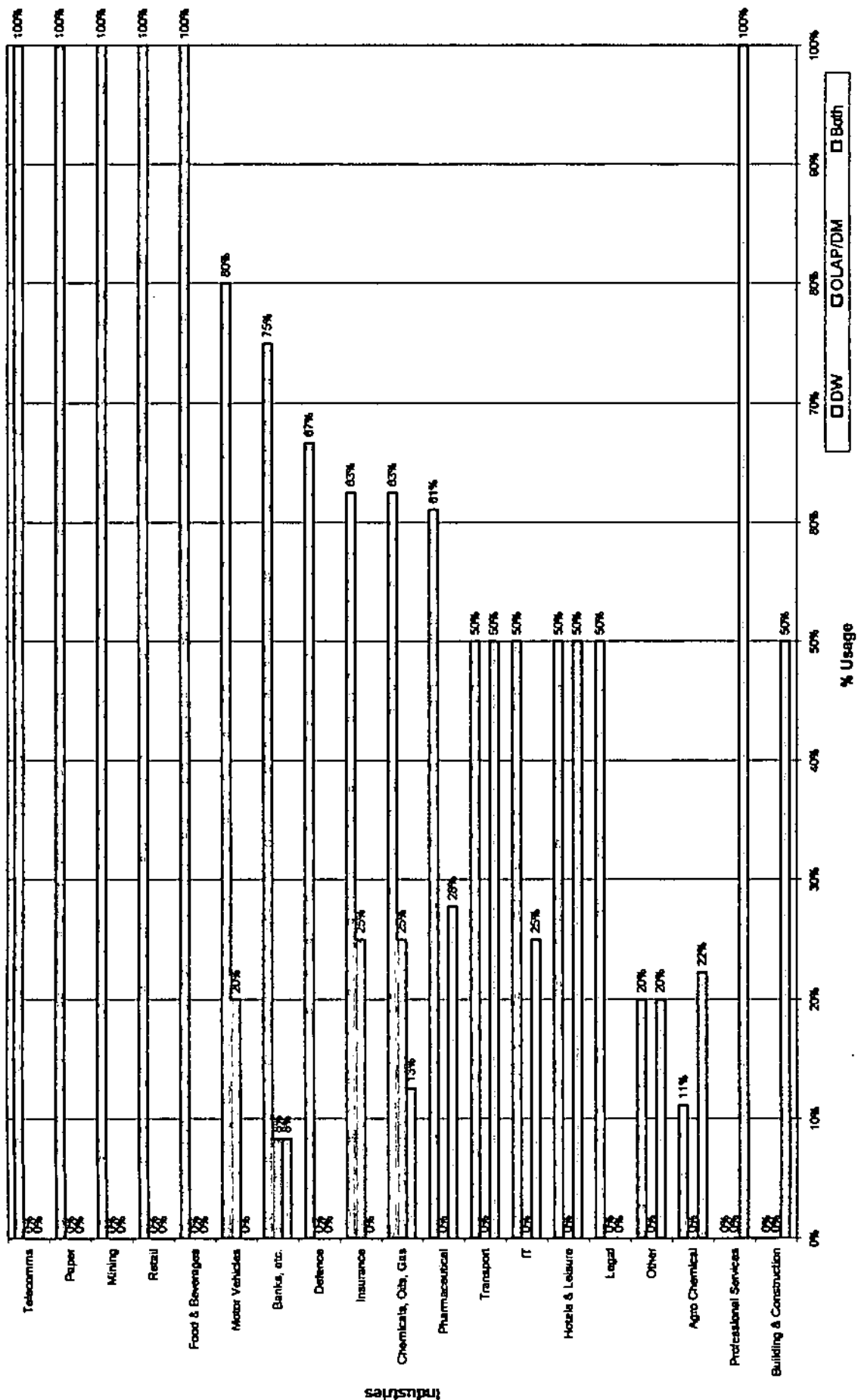


Two major BI groups: current & planned usage

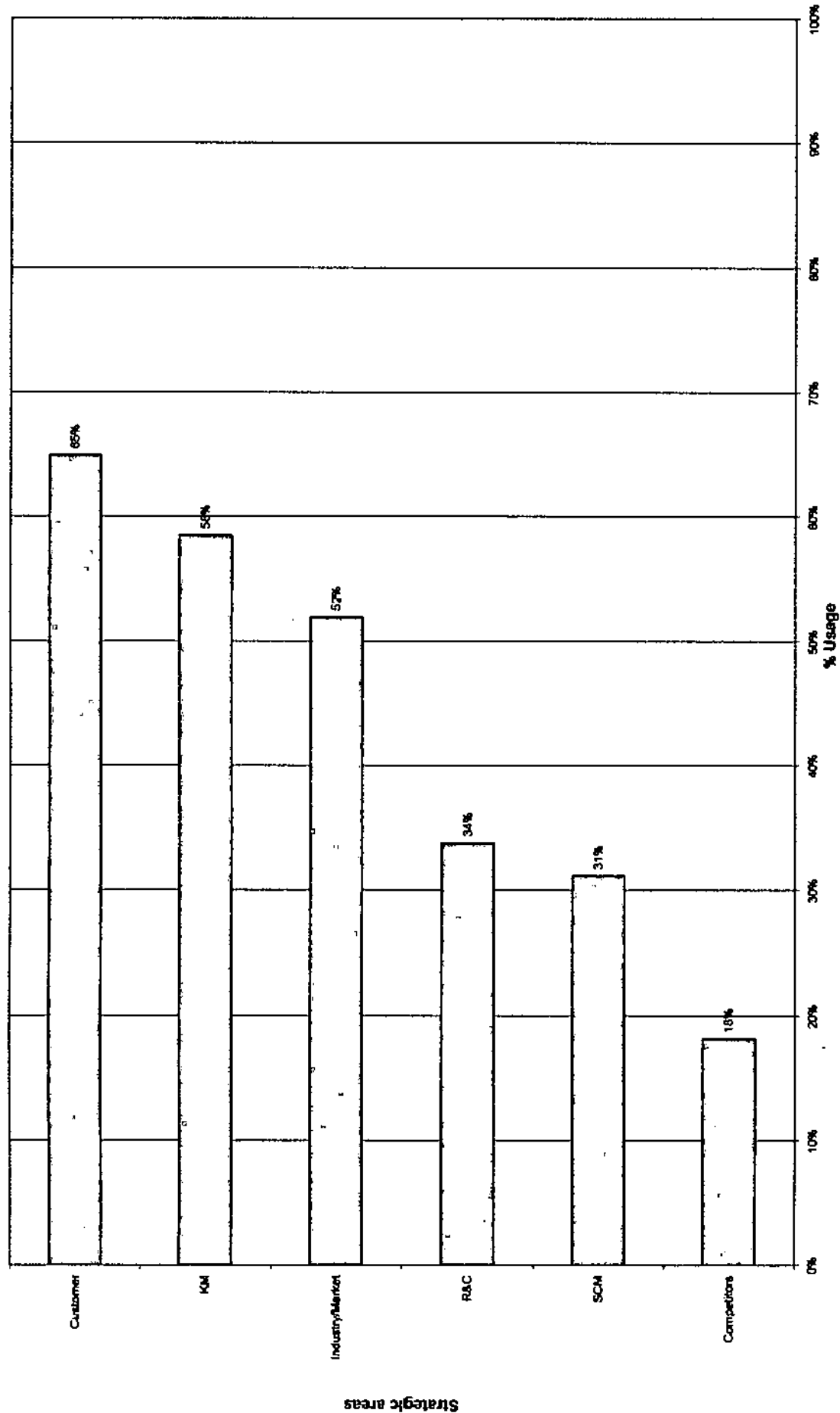


Graph 29

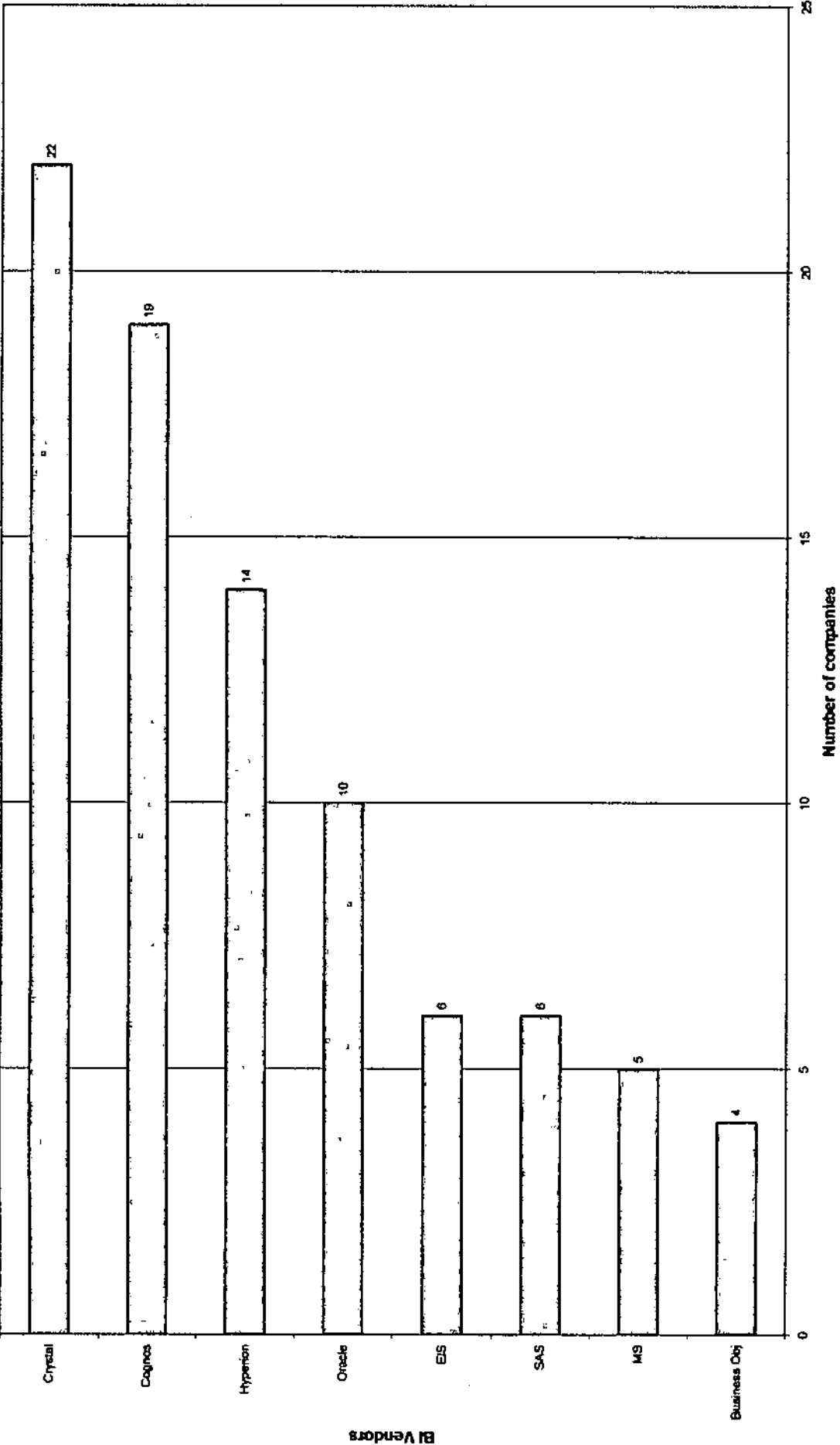
BI tools current & planned usage



Strategic analysis with BI: current & planned usage

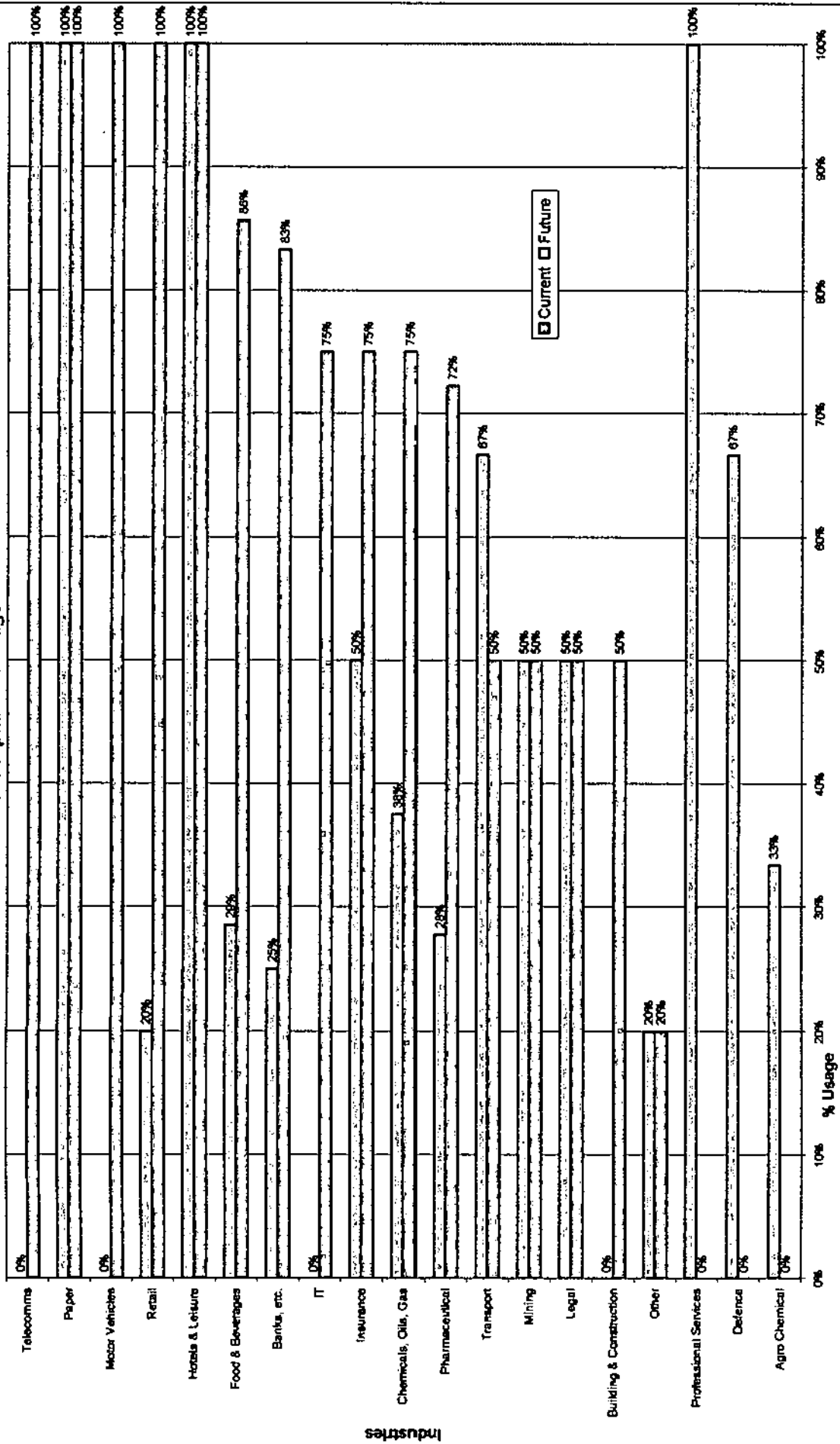


BI Vendor products: current & planned usage

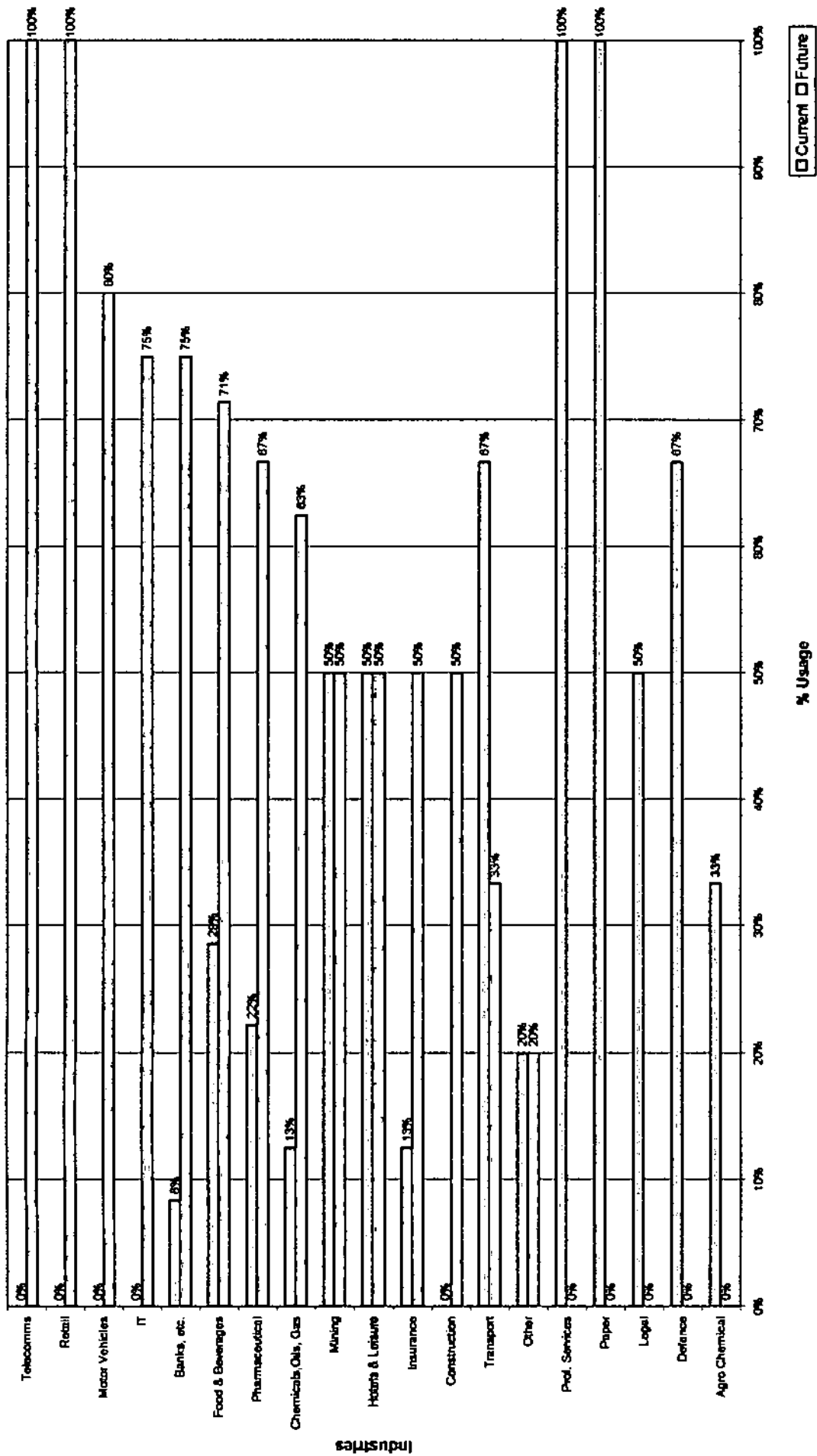


Graph 32

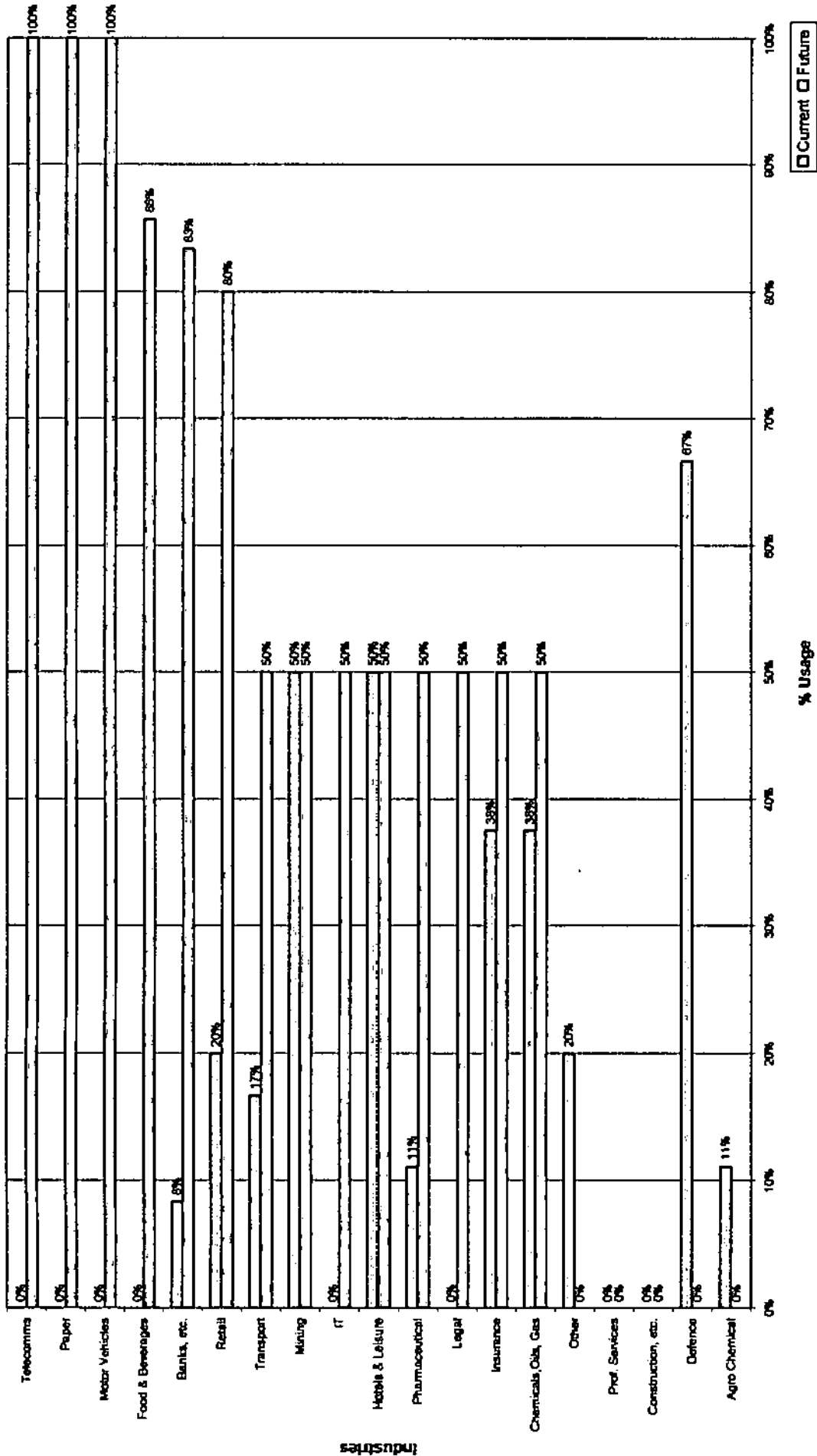
BI: current & planned usage



Data warehousing: current & planned usage

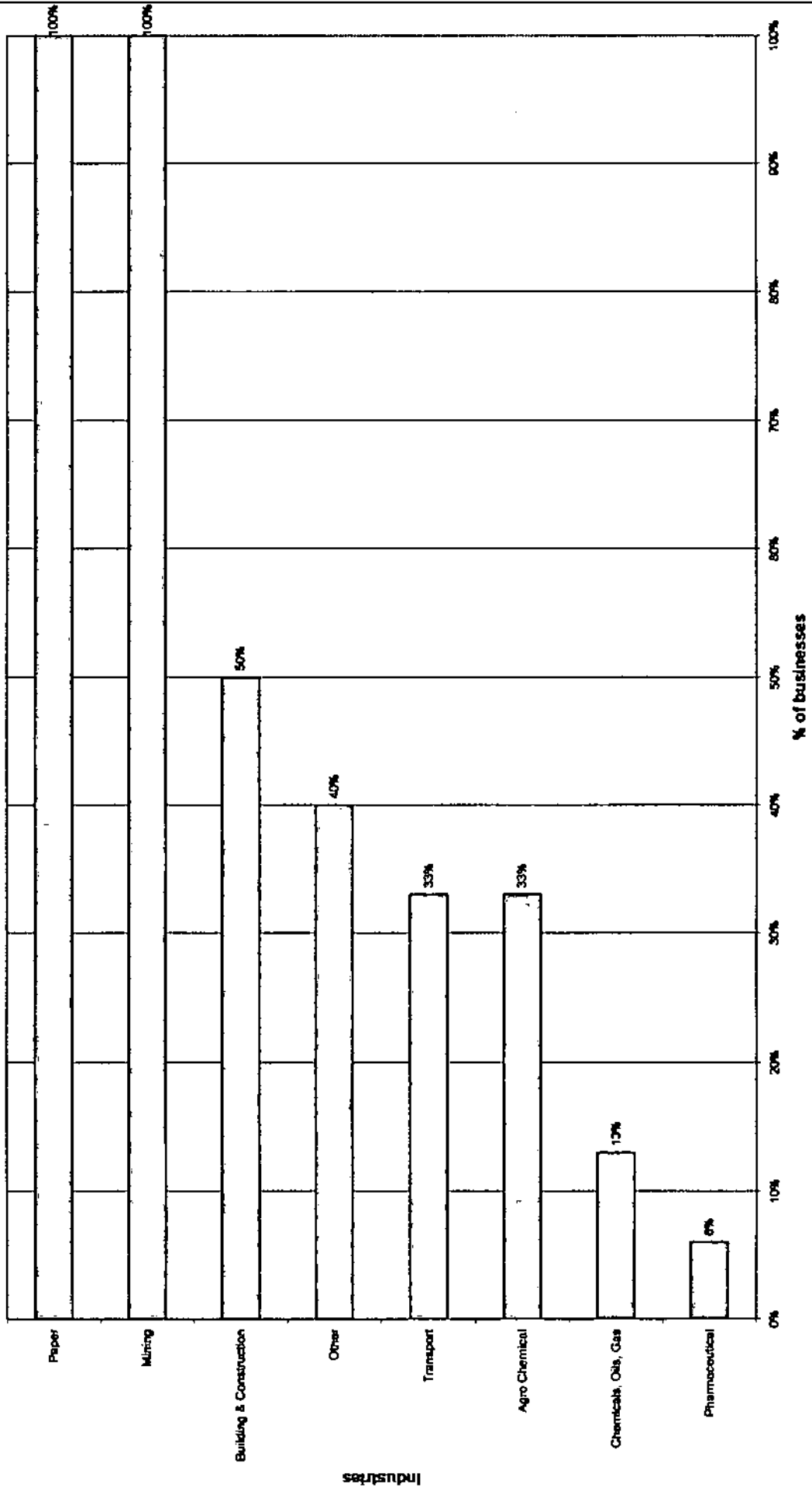


OLAP & Data mining: current & planned usage



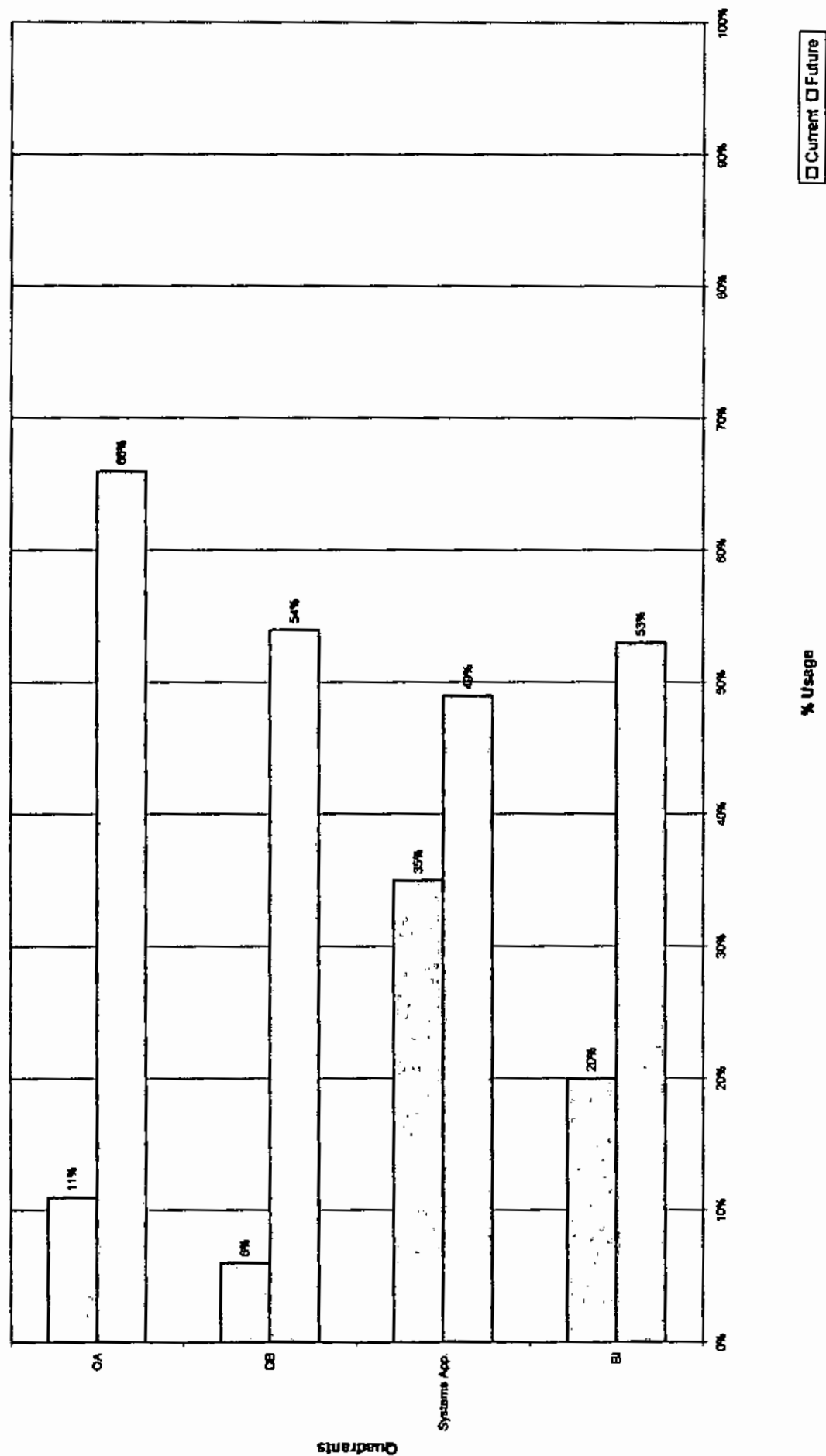
Graph 35

Top management: IT not a strategic tool



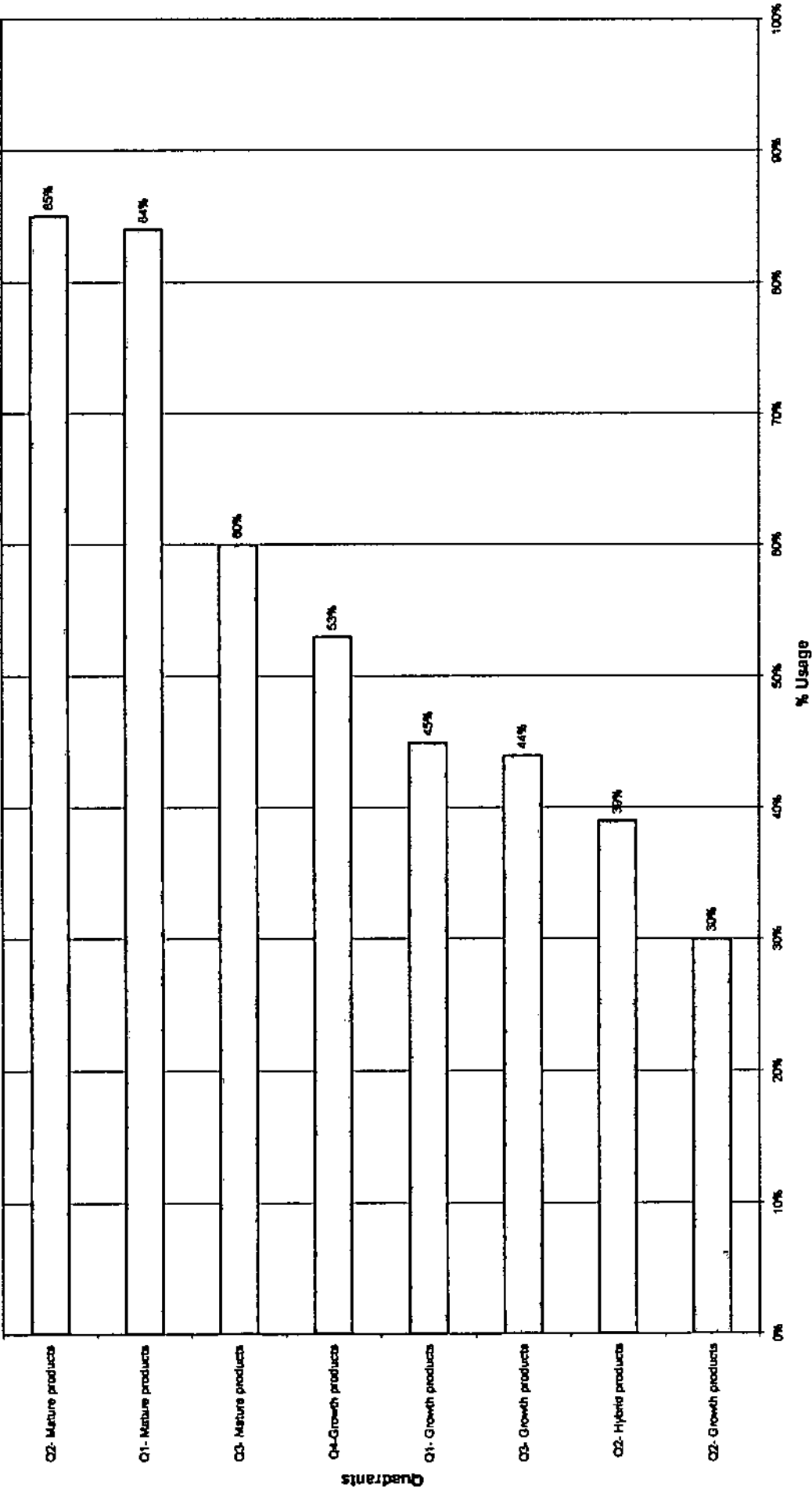
Graph 36

4 Quadrants: current & planned usage

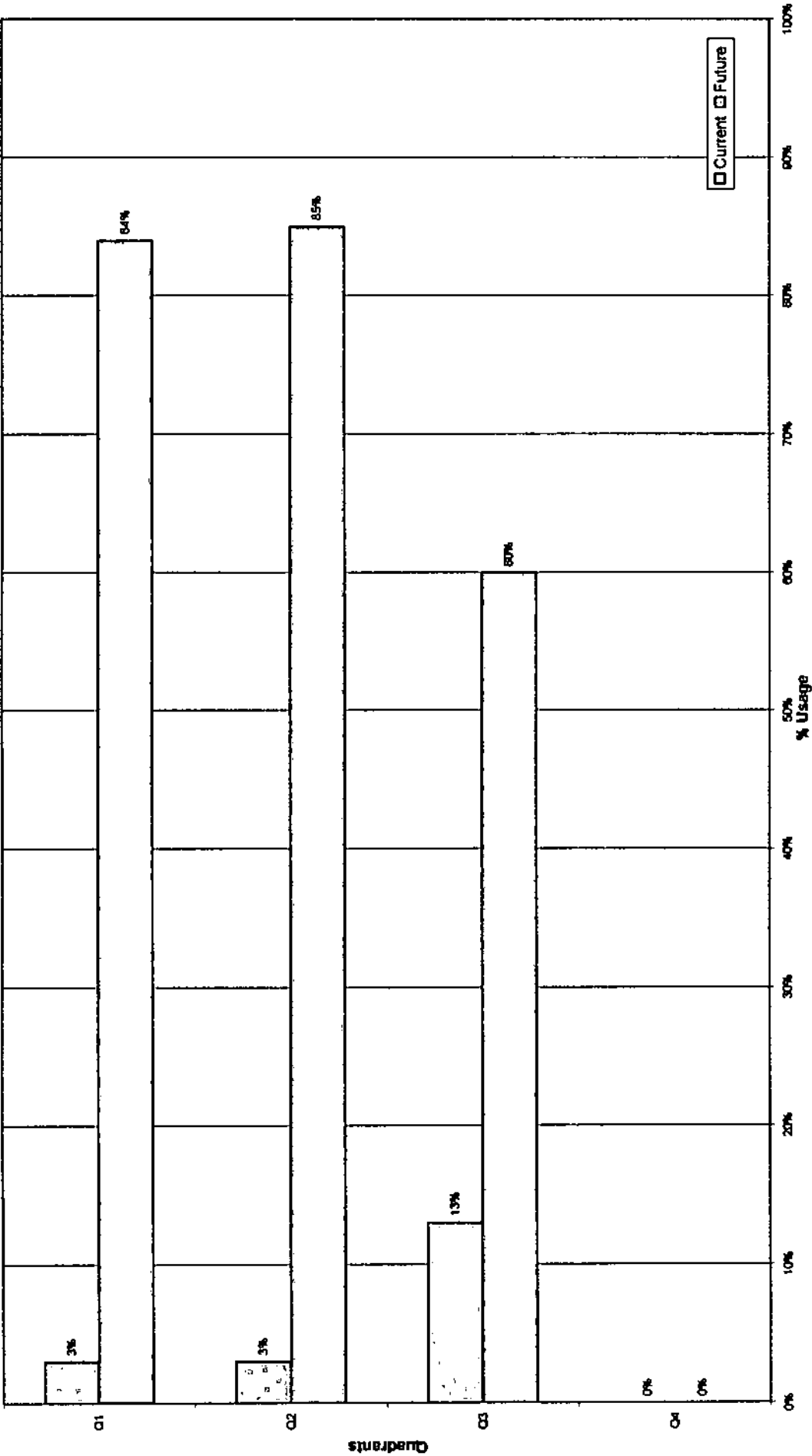


Graph 37

Analysis of 4 quadrants: current usage

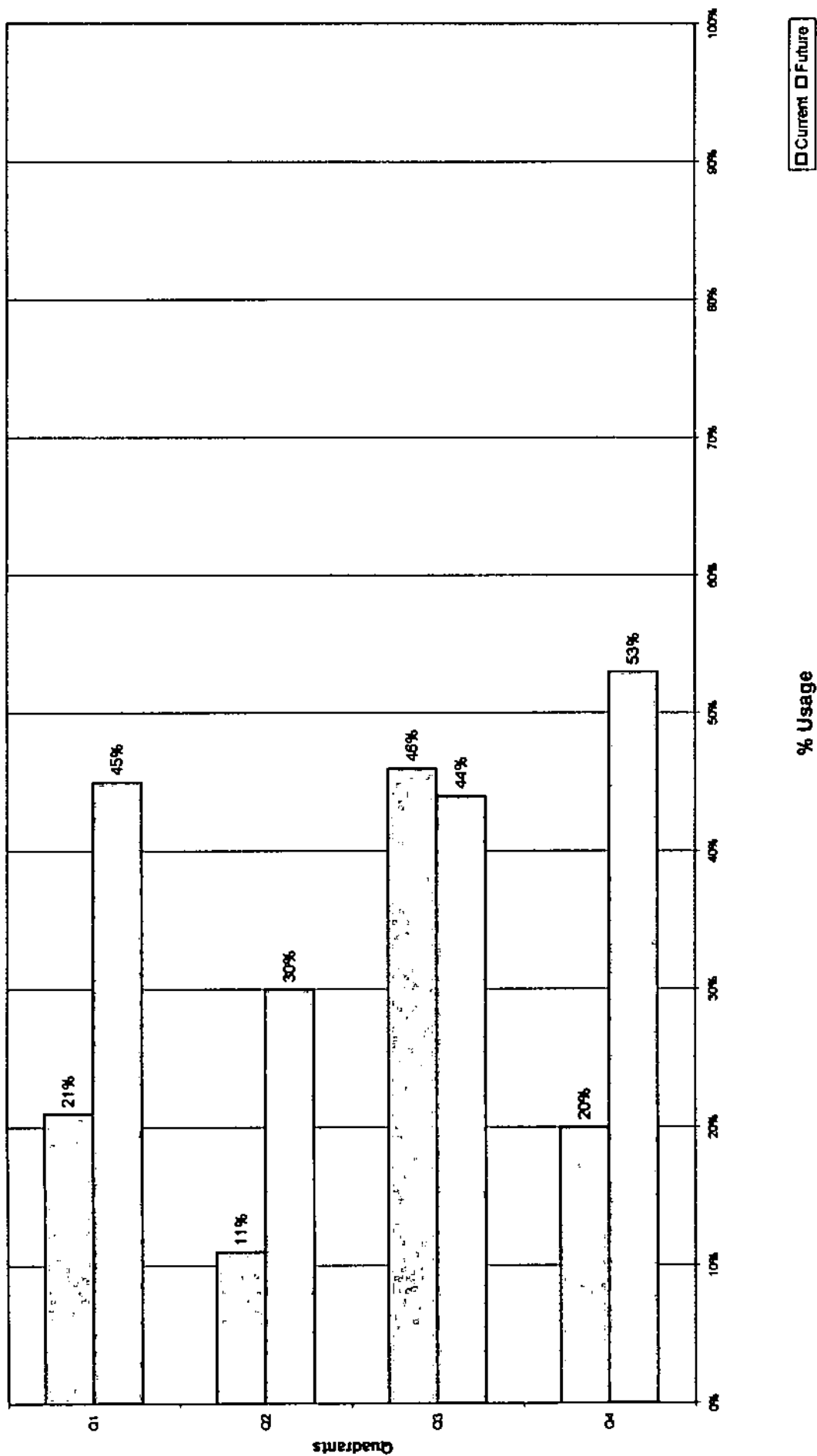


Analysis of quadrants: mature products: current & planned usage

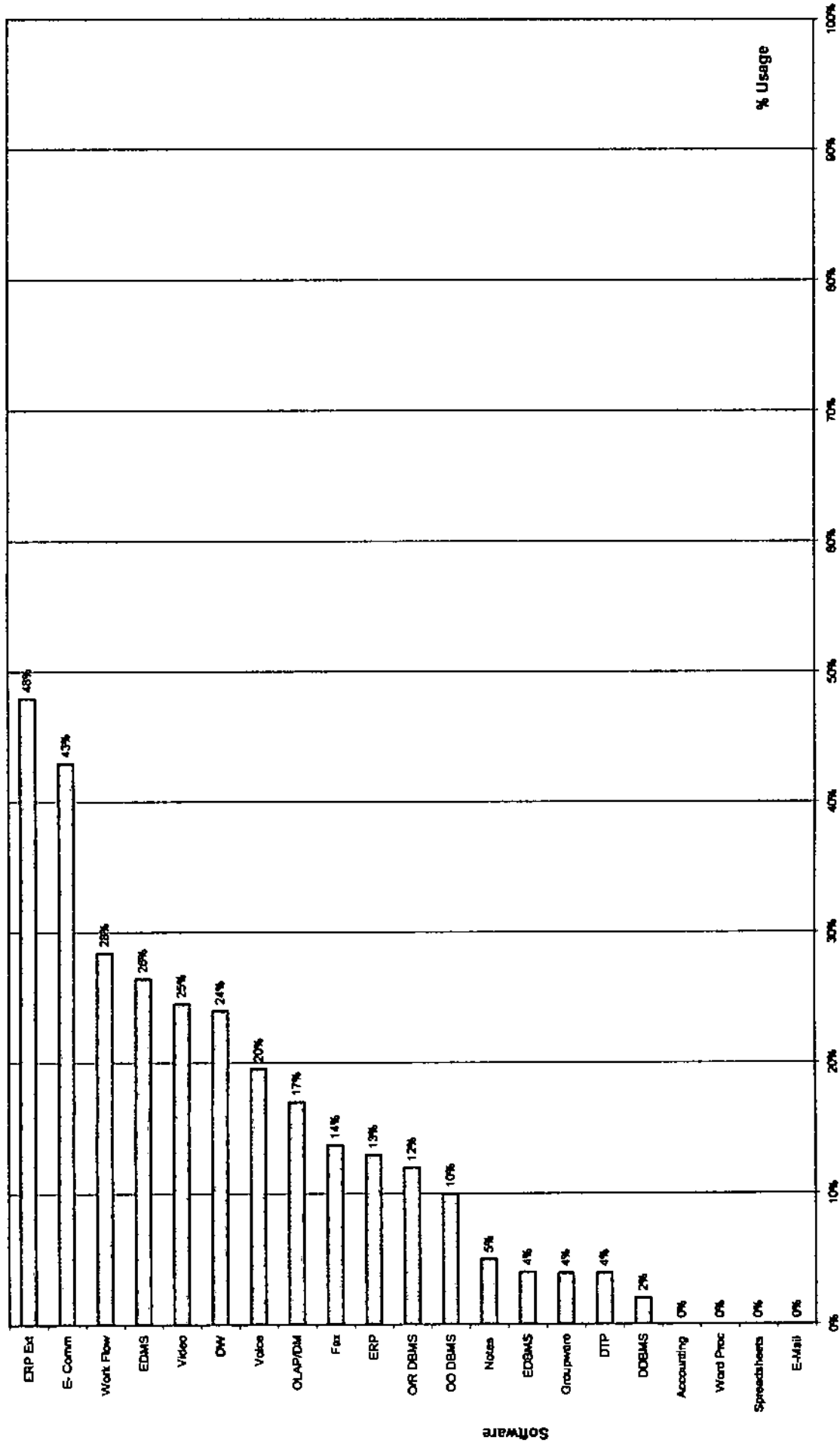


Graph 39

Analysis of quadrants: growth products: current & planned usage



Future implementation of software



APPENDICES

QUESTIONNAIRE

Survey of the current and prospective usage of Software in South African Business.

Office Automation Software

Do you use the following Office Automation Software in your organisation?

Currently

Planned for
the Future

General Accounting Packages (eg Accpac, Brilliant)

Yes | No

Yes | No

Electronic mail (eg Microsoft Exchange, Domino Mail Server, Groupwise, Pegasus.)

Yes | No

Yes | No

Spreadsheets (eg Microsoft Excel, Lotus 1-2-3)

Yes | No

Yes | No

Word processing (eg Microsoft Word, WordPerfect)

Yes | No

Yes | No

Electronic Facsimile Transmission (eg RightFax, Winfax)

Yes | No

Yes | No

Desktop Publishing (eg Corel Print Office 2000, Microsoft Publisher 2000)

Yes | No

Yes | No

Video Conferencing (eg products from Polycom, VTEL, VCON)

Yes | No

Yes | No

Voice recognition (eg IBM (ViaVoice), Dragon Systems (Naturally Speaking))

Yes | No

Yes | No

Workflow systems (eg Open Image, Keyflow (KeyFile), Visual Workflow (FileNet))

Yes | No

Yes | No

Electronic Document Management Systems (eg DocuShare (Xerox), IDM (FileNet), VistaPlus (Quest), DocsFusion (PC Docs/Fulcrum) etc)

Yes | No

Yes | No

GroupWare (eg Microsoft Exchange; Lotus Notes/Domino)

Yes | No

Yes | No

If your organisation is using GroupWare please indicate for what purpose it is used.

E-mail

Group Information
sharing

Document Management

Other? Please Specify.

Work Flow

Project Management

Discussion Forums

Database Applications

Do you use database application software in your organisation?

Currently

Planned for
the Future

Desktop Databases (eg MS Access, Approach (Lotus SmartSuite), Paradox , Filemaker Pro, Alpha Five)

Yes | No

Yes | No

Enterprise Database Management Software packages (eg Microsoft SQL Server, Oracle, IBM DB2, Sybase, Informix)

Yes | No

Yes | No

Object/ Relational Database Management Systems (eg Oracle 8, Informix Universal Server, IBM DB2/6000 Common Server)

Yes | No

Yes | No

Object-Oriented Database Management Systems (eg Jasmine (Computer Associates), ObjectStore (Object Design), Versant ODBMS)

Yes | No

Yes | No

Do you use Lotus Notes?

Yes | No

Yes | No

Appendix 1

If your organisation is using database software, please indicate how the databases are used below.

Individual users only	By most employees in a department	By more than one department
One central Enterprise Database	More than one Enterprise wide database	Other?

Systems Applications / Enterprise Resource Planning Systems (ERP)

Do you use an Enterprise Resource Planning (ERP) system in your organisation?

Please choose the most appropriate one.

Used currently	In Process of implementing	Planned for the future	None of these
----------------	----------------------------	------------------------	---------------

Please specify which ERP systems you are using, are in the process of implementing or intend to use? (eg SAP, Oracle, Peoplesoft, Baan, JD Edwards, Streamline.)

If you are using (or in process of implementing) any ERP system as indicated above, please specify which modules.

Financial	Human Resources	Inventory Control	
Material and Resource Planning	Production Scheduling	Other? Please Specify	

Do you use or intend to use Enterprise Extension software? Please mark below with a "C" for current use and "F" for intended future use.

(Software that improves existing ERP modules and connects the business with the outside world via e-commerce)

<u>Customer Relationship Management</u>		<u>Advanced Planning</u>	
Customer information/trends		Manufacturing Execution System (MES)	
Sales Force Automation		Product Data Management (PDM)	
Front ends - deal with customers		Dynamic Performance Monitor (DPM)	
Product configuration engine			
<u>Supply Chain Management</u>			
Component and Supplier Management (CSM)			
Schedule Reconciliation			

Other ERP Extension Software? Please specify.

Appendix 1

Do you use Electronic Data Interchange (EDI) / Web-based commerce?

Currently

Planned for the Future

Yes No

Yes No

If yes, please list the business process it is applied to or going to be applied to in your business.

If you do not foresee your organisation using Web-based commerce, please give your opinion on why not.

Business Intelligence/ Data Warehousing, Mining and On-line Analytical Processing (OLAP).

(Business Intelligence systems, as we see them, is software that can provide quick and accurate answers to managers' questions about the status of the business, business and economic trends, and the potential impact of changes in strategy and in the environment.)

Do you use the following Business Intelligence Software in your organisation?

Currently

Planned for the Future

Data warehousing

(eg Oracle, Informix (Extended Parallel Server), Microsoft SQL server)

Yes No

Yes No

Data mining and OLAP

Please specify below which product you are using or intend to use?

Yes No

Yes No

(eg Cognos (Powerplay Enterprise server), Hyperion (Essbase) Seagate (Crystal reports) SAS Collaborative Server, Microsoft OLAP tool, Oracle (Darwin enhanced), IBM (Intelligent Miner)

If yes on any of the above software, please indicate the purpose this software is used for or will be used for in your business?

Customer behaviour Analysis

Industry/Market Analysis

Knowledge Management

Other

Competitor behaviour Analysis

Supply chain management

Resources and capabilities analysis

If your business is not using or does not intend to use Business Intelligence Software, please give your opinion on why not?

Appendix 1

Please rank the five most important strategic areas in your business that you would like to see in Business Intelligence software. ("1" most important, then "2" etc.)

Customer Analysis		Industry/Market Analysis		Knowledge Management/ Information sharing		Other	
Competitor Analysis		Supply chain management		Analysis of Resources and capabilities			

Do you believe that Top Management perceives Information Technology as a strategic tool in your business?

Yes	No
-----	----

Please indicate your industry? _____

Please indicate the approximate number of employees in your organisation

1-100	101-200	201- 300	More than 300
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Please indicate your approximate annual turnover (This is used for classification of business size.)

Up to R4 million	R11- R20 million	R31- R40 million	More than R50 million
R4-R10 million	R21- R30 million	R41- R50 million	

If you wish to receive a copy of the final research findings, please provide the following Information.

Name: _____

E- mail address: _____

[illegible]

[illegible]

Name	Name	ERP Modules				CRM				Other CRM comp				Details/ERP				Rate								
		Fin	Inv	HR	Scanned	O	C	P	C	P	C	P	C	P	C	P	Net	C	P	Net	Out	Comp	Ind	SPW	DA	RAC
SAP ERP/CRM	Company 1																									
	Company 2																									
	Company 3																									
	Company 4																									
	Company 5																									
Oracle ERP/CRM	Company 6																									
	Company 7																									
	Company 8																									
	Company 9																									
	Company 10																									
Microsoft Dynamics ERP/CRM	Company 11																									
	Company 12																									
	Company 13																									
	Company 14																									
	Company 15																									
SAP ERP/CRM	Company 16																									
	Company 17																									
	Company 18																									
	Company 19																									
	Company 20																									
Oracle ERP/CRM	Company 21																									
	Company 22																									
	Company 23																									
	Company 24																									
	Company 25																									
Microsoft Dynamics ERP/CRM	Company 26																									
	Company 27																									
	Company 28																									
	Company 29																									
	Company 30																									
SAP ERP/CRM	Company 31																									
	Company 32																									
	Company 33																									
	Company 34																									
	Company 35																									
Oracle ERP/CRM	Company 36																									
	Company 37																									
	Company 38																									
	Company 39																									
	Company 40																									
SAP ERP/CRM	Company 41																									
	Company 42																									
	Company 43																									
	Company 44																									
	Company 45																									
Oracle ERP/CRM	Company 46																									
	Company 47																									
	Company 48																									
	Company 49																									
	Company 50																									
SAP ERP/CRM	Company 51																									
	Company 52																									
	Company 53																									
	Company 54																									
	Company 55																									

[illegible]

FREQUENCY TABLE FOR THE RATINGS OF STRATEGIC AREAS

		CUS	COMP	IND	SPM	KM	R&C	FIN/RISK
N	Valid	80	64	69	62	72	71	84
	Missing	4	20	15	22	12	13	0
Mean		2.17	4.05	2.7	3.52	2.56	3.68	
Std. Deviation		1.31	1.56	1.43	1.67	1.54	1.37	
Percentiles	25	1	3	2	2	1	3	
	50	2	4	2	3	2	4	
	75	3	5	4	5	3.75	5	

Appendix 4

LIST OF INDUSTRY NAMES WITH THEIR ABBREVIATIONS AS USED IN THIS DISSERTATION

	Abbreviations
Agro Chemical/Animal Health	Agro Chemical
Arms and Ammunition	Defence
Banks/Building Societies and Financial Institutions	Banks, etc.
Building & Construction	Construction, etc.
Chemicals, Oils, Gas	Chemicals, Oils, Gas
Communication Equipment	Communication Eq.
Food & Beverages	Food
Hotels & Leisure	Hotels & Leisure
Information Technology	IT
Insurance	Insurance
Legal Services	Legal
Mining	Mining
Motor Vehicle Manufacturers & Supplies	Motor Vehicles
Paper	Paper
Pharmaceutical	Pharmaceutical
Professional Services	Prof. Services
Retail	Retail
Telecommunications	Telecomms
Transport	Transport
Security, Printing, Bearings, Laboratories & Research Institutions	Other