The extent, issues and trends of enterprise resource planning system usage in South Africa

by

B. Worst

DISSERTATION

submitted as part fulfilment
of the requirements for the degree

MAGISTER COMMERCII

in

BUSINESS MANAGEMENT

in the

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

at the

RAND AFRIKAANS UNIVERSITY

STUDY LEADER: C.H. VAN SCHALKWYK
APRIL 1997

I, Barend Worst, declare herewith that this research study is a product of my own labours.

Signed at MIDRAND **on this** 13TH **day of** AUGUST **1997.**

Signature B. Worst

Commisionar of Oaths 0460490' COCAIN K MOTSAI
ROBERT MOTSAI
CST
MIDRAND SAPS
312-3056/7

SUID-AFRIKAANSE POLISIEDIENS
AREA NOORD-RAND
1997 -08- 13
MIDRAND
AREA NORTH RAND
SOUTH AFRICAN POLICE SERVICE

Table of Contents

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1
INTRODUCTION TO THE STUDY **PAGE**

1.1 Introduction 1

1.2 Problem Definition 2

1.3 Objectives 2

1.4 Scope 3

1.5 Demarcation of Research 4

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction 5

2.2 The evolution of Business Systems and Applications 5

2.3 The Information Pyramid 12

2.4 Systems Integration 14

2.5 Functional Coverage 16
2.5.1 Functional Areas of the Manufacturing Enterprise 18
2.5.2 Common Support Services 19
2.5.3 Architecture Elements 20

2.6 Benefits Achieved in Perspective 22
2.6.1 Hill's Speciality Pet Foods 24

2.6.2 Elkem Metals Co. 25
2.6.3 EJ Brach Corporation 25
2.6.4 Quaker Chemical 26
2.6.5 Bama Pie, Inc. 27
2.6.6 The Bottom Line 28
2.6.7 Leveraging the Investment 29
2.6.7.1 Custom fit versus No-code-modification 30
2.6.7.2 Training 31

2.7 Current Trends in Enterprise Resource Planning Systems 32

2.8 Conclusion 34

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Outline of Methodology 36

3.2 Population 37

3.3 The Sample 37

3.4 Data Collection 38

3.5 The Questionnaire 38

3.6 Data Analysis 40

CHAPTER 4
RESEARCH RESULTS

4.1 Analysis of Responses Received 41

4.2. Respondent Profiles 41
4.2.1 Number of Employees 41
4.2.2 Average number of Sites 42
4.2.3 Nature of Business 43

4.3 Status of Current Systems Employed 44
4.3.1 Effectiveness of current systems per functional area 44

4.3.2 Integration rating between different functional areas 46
4.3.3 Types of Systems used in different functional areas 48

4.4 Future plans of Respondents 51
4.4.1 Views on competitive advantage 51
4.4.2 Planned renewals/Extensions in next five years 53

4.5 Support of Current Systems 55
4.5.1 Sources of Support 55
4.5.2 Types of support 56

4.6 Benefits realised from Information Technology 58

CHAPTER 5
INTERPRETATION AND CONCLUSION

5.1 Interpretation of Results 60
5.1.1 The extent of Enterprise Resource Planning system usage 60
5.1.2 Functional Coverage and Trends 61
5.1.3 Support Levels 62
5.1.4 Benefits Realised 63

5.2 Conclusion 63
5.2.1 Highlights of Study 63

BIBLIOGRAPHY 65

APPENDICES

A QUESTIONNAIRE 70

LIST OF TABLES

2.1	Functional Areas and Business Processes	18
2.2	The Four Controllable Aspects to Manufacturing	28
3.1	Relationship between Objectives, Propositions and Questions	39
4.1	Types and Systems Used in Different Functional Areas	49
4.2	Renewal/Extension Plans for Next Five Years	53

LIST OF FIGURES

2.1	Evolution of Business Systems	7
2.2	Applications Evolution	9
2.3	Traditional Application Development Approach	10
2.4	The Information Pyramid	13
2.5	The Manufacturing Enterprise	17
4.1	Number of Employees	42
4.2	Average Number and Type of Site	43
4.3	Nature of Business	44
4.4	Effectiveness of Current Systems Per Functional Area	46

LIST OF FIGURES (Continued)

4.5	Functional Integration Effectiveness	47
4.6	Effectiveness of Functions and Integration to other System Functions	48
4.7	Types of Systems Used in Different Functional Areas	51
4.8	Functional Ration of Competitive Advantage Possibilities	52
4.9	Renewal/Extension Plans for Next Five Years	54
4.10	Support Sources Available	56
4.11	Types of Support Available	57
4.12	Benefits Realised	59

The Extent, Issues and Trends of Enterprise Resource Planning System Usage in South Africa

Chapter 1

1.1. Introduction

The advent of the computer has lead to tremendous changes in the way that business is conducted throughout the world, to such an extent that the world is referred to as the "Global Village".

With more and more international markets opening up every day, the South African business has to ensure that it is fighting fit to not only be competitive in this global marketplace, but also to be able to ward off competitors on home turf.

Information systems have gained recognition as tomorrow's competitive weapon, which allows the business enterprise to function and compete in an ever changing and complex environment.

The evolution of information systems and their use, have thus far focused on automation of individual business processes. This has however lead to spot solutions, with limited impact on the bottom line. It has been realised that long term benefit can only be gained by integrating the information flow across the whole enterprise.

This is achieved through the concept of Enterprise Resource Planning (ERP) systems, where the whole enterprise across multiple sites are linked together with information technology, to enable the different functional units to work as a team towards a common goal.

1.2. Problem Definition

The concept is not new, but there are certain factors that complicated the application of this concept in actual practise:

The rapid advances in technology, engineering and business processes, have left today's enterprise with a multitude of different computer applications to choose from. This puzzle consists of many variables, including : hardware, application software, operating systems, data bases and networks.

An indication of the complexity of offerings available in the market today is reflected by a survey conducted by Paras on Process MRP Systems (Paras, 1992:7-28).

The research problem is therefore to investigate the extent of usage of Enterprise Resource Planning (ERP) Systems in South Africa.

1.3. Objectives

The research project has the following objectives:

- To determine the extent of Enterprise Resource Planning (ERP) System usage in South African Industrial companies.

- To determine the different functional areas that ERP functionality is applied to in these companies, as well as trends in this area.

- To determine levels of support currently available to the South African Enterprise Resource Planning (ERP) System user

- To determine the benefits realised out of implementing Enterprise Resource Planning (ERP) functionality.

1.4. Scope

This research explores the extent to which Enterprise Resource Planning (ERP) functionality are being used in South Africa.

As these systems are mainly used in Industrial companies, this research is limited to Industrial companies within South Africa. Companies in both the discrete and process environments are included in the study.

Due to the cost of implementing such systems, these companies tend to be companies with more than 100 employees, although relevant companies with fewer employees have been included. The larger majority of the companies operate in a distributed environment, with sites spread throughout South Africa, and in neighbouring and overseas countries.

Due to the exploratory nature of the research problem, and the limited full enterprise wide use of Enterprise Resource Planning (ERP) Systems in South Africa, the scope will be wide, with the intent of this study to gain a broad perspective of the topic.

1.5. Demarcation of the research

This chapter outlines the background to the research. It also covers the research problem, and the objectives to be achieved by the project. The scope and limits of the research project is discussed.

Chapter Two includes a discussion of related literature on the topic. The related research propositions that was developed is stated and discussed.

Chapter Three includes a detailed discussion on the research methodology used. The relationships between the problem stated, the research objectives and the propositions is discussed. The questionnaire used will be explained, as well as the relationships between the questions and the research propositions.

Chapter Four comprises of a full analysis of the research results. This includes a discussion on the findings of the research, as well as the results of the findings as compared against the propositions.

A review of the results against stated objectives and a final conclusion is included in Chapter 5.

Chapter 2

Literature Review

2.1 Introduction

It would be improper to investigate the research problem, without first looking at the history, status, and future trends of Enterprise Resource Planning (ERP) usage within the Industrial Enterprise.

The use of computers as tool within the Industrial Enterprise has been in a constant state of evolution for the last 30 years.

In the book Computer Integrated Manufacture by Ingersoll Engineers, Mortimer (1985:13) states that effective long-term integration of the manufacturing environment is certainly not possible without the use of computers.

2.2 The evolution of Business Systems and Applications

During the seventies, the concept of Islands of Automation came into being **(See Figure 2.1).** This concept increased productivity by grouping the value adding functions within the company into separate islands of automation.

Many enterprises took advantage of automation through implementation of information technology tool such as: (International Business Machines1990:16)

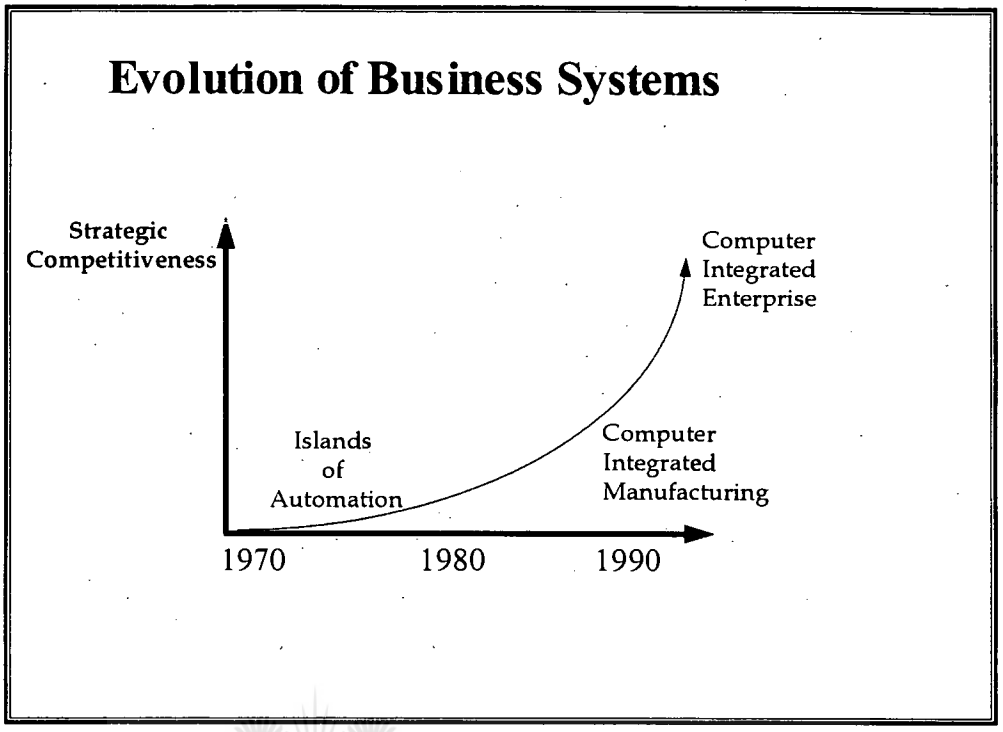
- Computer-aided design
- Computer aided manufacturing processes
- Material resources planning tools
- Instrumentation systems
- Administrative and decision support tools.

During the mid-eighties these thoughts and practices evolved into the Computer Integrated Manufacturing (CIM). Mortimer (1985:13) describes Computer Integrated Manufacturing (CIM) as the overall business philosophy that forces out unnecessary waste by reducing complexity and cost whilst improving quality in order to be much more competitive.

With the new century looming, and with international competition escalating to new levels with advances in communication, transportation and business processes, this integrated manufacturing will have to be practised across an enterprise. This enterprise will consist of distributed manufacturing and distribution sites, all linked together to add value to the customer independent of distance.

Figure 2.1

Evolution of Business Systems



Source : Marcam (1994:6)

What will the state of the art manufacturing firm look like in the year 2000? Advanced Manufacturing Research (AMR) (1994:1) believes that if you look at the promise of the technology becoming available, and the capabilities of solutions that leverage this technology, it is not a stretch to envision a future characterised by the following:

- An almost invisible computer/network infrastructure supporting appropriate manual and automatic data collection into a comprehensive company model.

- Everything is interconnected. No user, including model developer/maintainers, know or care whether the infrastructure is open or proprietary, mainframe or distributed workstation based, owned or leased. To the user, the systems are invisible, maintained by specialists, and hardly thought of except when they fail to do what is expected.

- There is no Information System (IS) department between the users and the company model, which means that there are no "applications" or on-site application developers. In this way computers will become universal tools.

- There is little traditional hierarchical management structure because the infrastructure allows everyone to know what is on the plan and what is in need of attention. Resources will in this model become self allocating.

- The company model, which reflects the actual organisation and operation, is continually challenged, simplified, and streamlined. Except for a few business/modelling experts, the users continually improve the model.

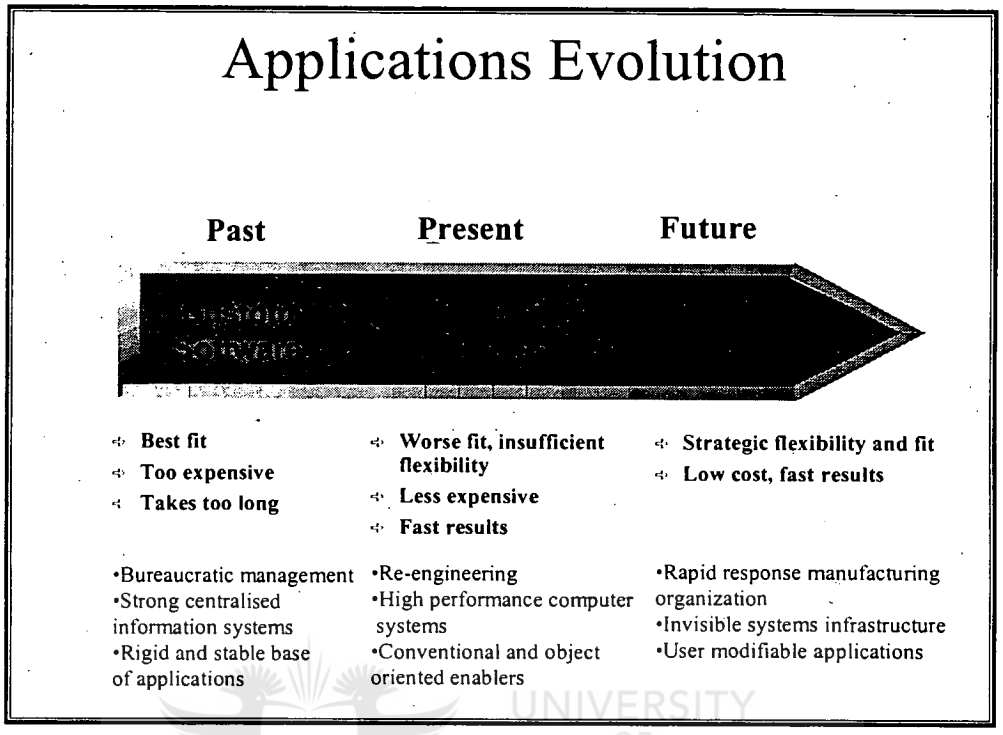
- A new kind of enabled technology, operating on top of the invisible computer/network infrastructure, empowers users to make changes as required.

Along with business system evolution, the development of applications have also gone through rapid change. These change went hand in hand with changes in processes and policies used to manage them.

This history (**See Figure 2.2**) started with companies writing their own applications, through the current trend of using standard packaged software, toward tomorrow's promise of component assembly in a perfect best of breed world.

Figure 2.2

Applications evolution



Source : Adapted from Connor,S. (1994: 20) and Advanced Manufacturing Research (AMR) (1994: 3)

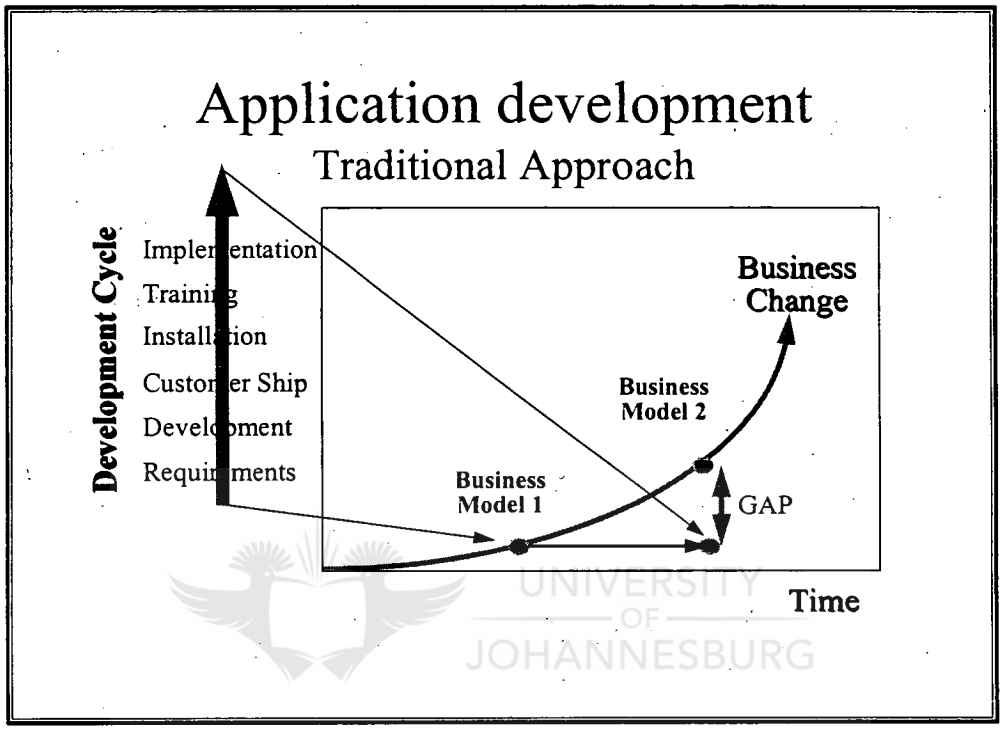
During the first era, companies developed their own applications by using an internal Information Systems (IS) department. These applications were developed to a set specification. The development and implementation period tended to be long and costly. The implemented application offered a very good fit, but tended to be rigid and costly to maintain.

According to Connor (1994:25) this approach fell out of favour due to the fact that this approach assumes that the information needs of the business remains constant over time. What happens in reality is that the business model is changing, while the application is being developed and implemented to set specifications. When the system is then

launched, it is already outdated. From there on, the information system department is trying to continually catch up to the changes happening in the business. (See Figure 2.3)

Figure 2.3

Traditional Application development approach



Source : Connor (1994:25)

Currently most industrial companies looking for effective Information Systems, are opting for standard packages. These packages are pre-designed and built, to suit most of the information needs of today's company.

The advantage associated with these solutions are faster implementation, and lower overall cost, maintenance included. Another advantage is that the suppliers of these products, regularly add new extended functionality, in the form of release updates.

As these solutions have not been custom developed, most companies will have to either adapt their business practices, through business process re-engineering, or customise the application. The disadvantage of modifying the source code of a standard application, is that this modifications needed to be re-tested with every release update applied.

According to Advanced Manufacturing Research (AMR), this led to the move towards a second paradigm for application development based on object-oriented (OO) analysis, design, and programming. (1994:4) Although it is not yet fully defined, fundamental characteristics include:

- non-procedural development
- a message passing inter-module interface, and
- comparatively easy application modification on the fly

In their report "manufacturing 2000" (1994:6) Advanced Manufacturing Research (AMR) refer to application packages of the future as being customisable libraries of object-oriented functionality.

This technology allows applications to be built, and adapted to the changing business needs, as they arise. These changes will be made by the user, thus resulting in a user driven business application, and not an application with computer technicians separating the system from the user.

These changes will be transacted more rapidly than ever before, as the underlying technology will now support it.

As the system may now consist of several different applications driving the needs of the business in a truly best-of-breed environment, the user will be working with an invisible system infrastructure.

Cornell (1983:147) states that there is an increasing emphasis on Information Systems Technology alternatives in order to optimise the operating environment. This, coupled with the increasing confidence on the part of the users that they are qualified to take on more responsibility for the management of systems projects.

Dailey (1996:1) is of the opinion that new emerging technologies such as object orientation and the internet will enable users who are increasingly customer focussed to look beyond the enterprise and into the value network to meet very tough customer demands.

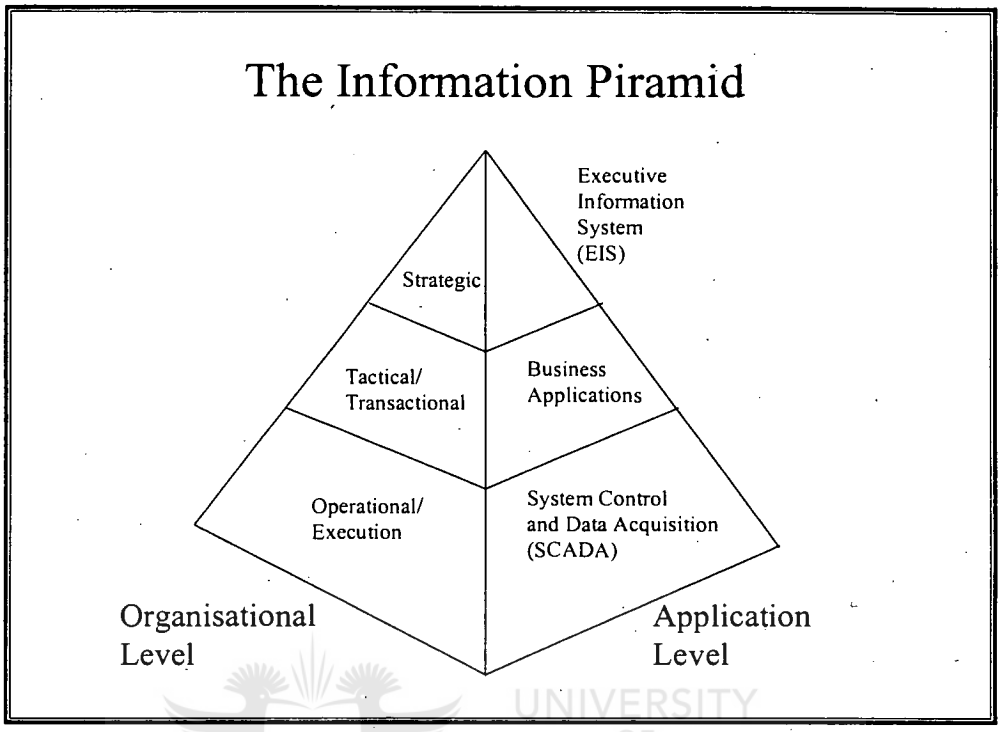
2.3 The Information Pyramid

According to Cornell to justify the existence of any system, there must be an effective co-ordination between the functional requirements and the system objectives. A well defined systems environment that is understood by the organisation promotes a better working relationship among the business functions, the system developers and the end users. This must begin at the strategic level and be driven down to the different operational levels. The degree of harmony will become critical to the successful enterprise in the future. (1983:145)

There are three major levels within an organisation in which systems address business requirements. These are depicted in Figure 2.4.

Figure 2.4

The Information Pyramid



Source: Adapted from Cornell T.R. (1983:146)

Executive management tends to focus on the strategic level which encompass such systems as simulation models, projections, etc. They primarily support the planning process requirements of the organisation.

The tactical level , traditionally has been the focus of most system activities. This level provides the information necessary to run the organisation and can be equated to such applications as:

- inventory management
- production scheduling
- sales and distribution management

- plant maintenance management
- payroll,

The operational or execution level, encompass the operational and process control portions of the enterprise.

2.4 Systems Integration

According to Cornell (1983:146) traditionally, systems integration has been addressed in an unstructured, unorganised manner resulting primarily from executive mandates which forced user management to work with other organisations through a Management Information System (MIS) function. The Manufacturing Information System organisation is usually limited in both resource and charter.

Cornell states that there are many factors which forced the swing away from the centralised computing environments of the late 70's, to the decentralised empowered computing environments of today. Amongst these are:

- the low cost, high powered personal computer boom
- user insurrection emerged due to over control of data processing resources
- the marketing of packaged software applications
- emergence of decision support software
- multi-functional workstations, which allows for multiple activities to be performed at the same time

- the rising importance of Flexible Manufacturing Systems (FMS) in order to change the dimension of a facility to meet market demands quickly and efficiently.

All these factors emphasise the need for proper integration between different functions and business operations.

Sullivan (1982) says that at least six basic varieties of integration are discernible :

- Horizontal - Across business functions, such as accounting, marketing and manufacturing.

- Vertical - Across levels of control, such as from operational levels to management control and planning.

- Temporal - Through time series, such as from one period or year to another.

- Longitudinal - From one business unit or product line to another.

- Physical - Among physical locations, such as branches, production facilities or distribution centres.

- Gateway - Between the enterprise and the outside world, such as other companies, customers, suppliers, and the government.

Advanced Manufacturing Research's vision is full integration from the customer to the production line. They reveal however, that the current infrastructure, organisational and technical, will not support this kind of seamless integration. That is, classical computer

applications, development, budgeting, deployment techniques and philosophies are irreconcilable with these manufacturing goals. (1994:2)

In their book "Implementing CIM - Computer Integrated Manufacturing" Kochan and Cowan states that today, it is information and efficient integration of information technology into application systems which is of greatest economic relevance. The strategy for the automated flow of information is, therefore, of vital significance. (1986:113)

Sadowski (1984:4) states that although the need for such integrated systems has been clearly defined, there still are significant barriers to their successful development and implementation. There is a distinct lack of executive leadership which has the foresight to look beyond a Computer Integrated Manufacturing System (CIMS) as a purely technical challenge and view it as the management challenge that it really is.

2.5 Functional Coverage

A review of Enterprise Resource Planning (ERP) systems will not be complete without an investigation into the functional scope of such systems.

There are many different ways of classifying the functional areas that make up an Enterprise wide manufacturing system. For the purpose of this review it was decided to use only one view, to illustrate the scope of functionality expected from an Enterprise Resource Planning (ERP) system.

International Business Machines (IBM) (1990:17) devided it up as follows : **(See Figure 2.5)**

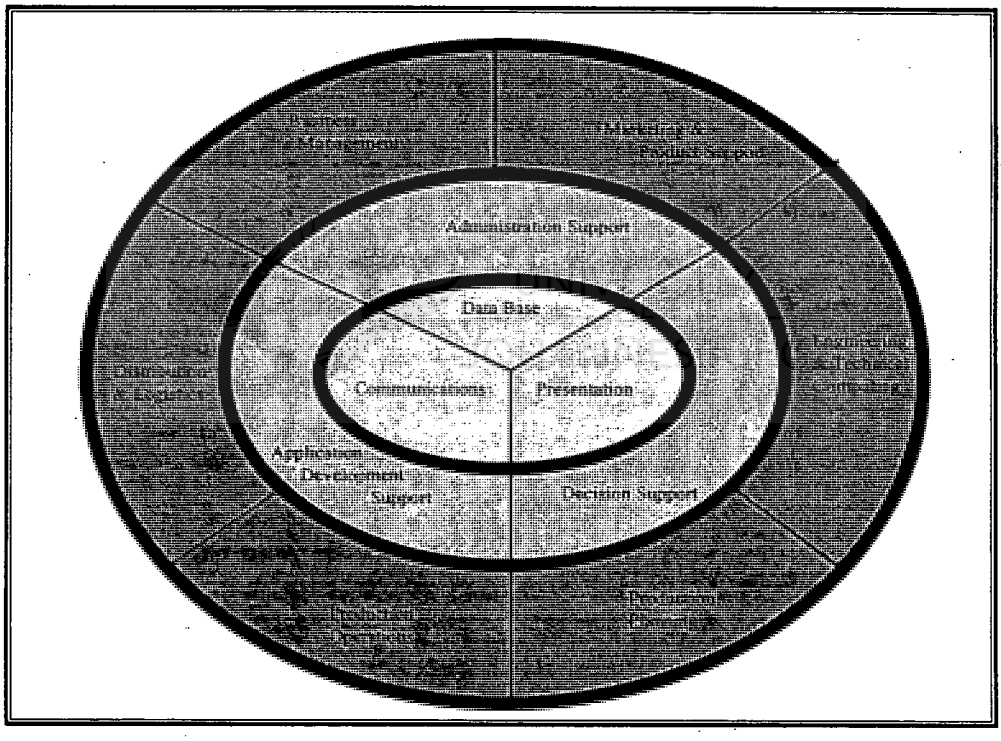
- The outer layer represents the functional business processes of the enterprise. International Business Machines (IBM) seperated them into six groups.

- The middle layer defines the common support services that supports the business processes of the company.

- The core represents the architecture that supports the information needs of the enterprise.

Figure 2.5

The Manufacturing Enterprise



Source : International Business Machines (IBM) (1990:17)

2.5.1 Functional Areas of a Manufacturing Enterprise

According to International Business Machines (IBM) (1990:19-63) the Functional layer of the Enterprise can be devided into six functional areas. These six areas then represent the business processes performed within the Industrial Enterprise.

Table 2.1 represent the business processes found within each of these functional areas.

Table 2.1

Functional Areas & Business Processes

Functional Area	Business Processes
Marketing and Product Support	Marketing Customer Order Servicing
Engineering and Technical Computing	Research Product Development Process Development Facilities Engineering Engineering Release Control Engineering Management
Production Planning	Master Production Planning Material and Resource Planning Procurement Plan Release
Production Operations	Production Management Material Receiving Storage Production Process

	Quality Test and Inspection Material Transfer Product Shipping Plant Maintenance Plant Site Services
Distribution and Logistics	Physical Distribution Planning Physical Distribution Operations
Business Management	Financial Planning and Management Accounts Payable Billing and Accounts Receivable Cost Accounting Enterprise Planning and Business Management Enterprise Services

Source International Business Machines (IBM) 1990:19-93

2.5.2 Common Support Services

Common support functions link the business processes of the enterprise to the architecture of the system. **(See Figure 2.5)**. According to International Business machines (IBM) (1990:96) these functions may be devided into three individual areas:

- *Administrative Support* provides general business or office support. This includes functions as diverse as creating documents, scheduling meetings and tracking finances.

- *Decision Support* clarifies and presents critical information to decision makers. These include employees from top management down the chain to the end-users of the system.

- *Application Development Support* creates the applications necessary to keep all aspects of the enterprise functioning smoothly and efficiently.

2.5.3 Architecture Elements

The architecture acts as the foundation of the system. This Information System Structure allows Industrial Enterprises to integrate business processes and supporting functions into one cohesive network.

The information environment of an industrial enterprise is subject to frequent changes in system configuration and technologies. According to International Business machines (IBM) (1990:102) the right architecture can offer a flexible structure that enables the enterprise to react to these changes. This structure relies on a number of modular elements that allow information systems to grow more easily with the enterprise's changing needs. **(See Figure 2.5)**

Communications

The delivery of enterprise data to people, systems and devices is a critical aspect of the architecture. This is because today's industrial environment brings together a wide range of computer systems, technologies, operating systems and applications. This range makes it increasingly difficult for people and machines to communicate with each other - especially when they describe and format data differently.

Data Management

This includes how data is defined, how different data elements are related, where data is stored and who has access to that data. Data management is particularly critical in today's industrial environment, since there are so many different data bases, formats, and storage and access techniques.

Presentation

Because today's industrial enterprise contains such a wide array of devices and information needs, it must have a consistent way to distribute and present information to people at terminals or workstations, machine tools, automated guided vehicles, etc. The range of this information covers everything from simple messages between people to large data arrays for engineering design applications.

In today's environment, presentation occurs on displays that utilise different technologies. Some are non-programmable terminals, some are programmable workstations and are uniquely implemented for each application. As a result, the same information is often treated differently by individual applications.

Utilising these building blocks, an architecture can provide a consistent base for integrating the enterprise's product, process and business data. It can define the structure of the hardware, software and services required to support the enterprise's complex requirements. And it can translate this data into a form that can be effectively used by the enterprise.

2.6 Benefits Achieved in Perspective

> "THIS IS A MAN AGE. THE MACHINES ARE SIMPLY TOOLS WHICH MAN HAS DEVISED TO HELP HIM DO A BETTER JOB."
>
> Thomas J Watson
> International Business Machines(IBM)

Since the advent of the computer, man has tried to find ways of employing it as a tool in his business environment. This has however lead to mixed results. There are numerous examples of great successes, but there is just as many scary tales of system implementations that failed with huge financial impacts on the companies involved.

In his paper "The Economics of Computer Integrated Manufacturing", Jack Meredith states that although some of these systems are extremely expensive, not all are, and quite a few are less expensive than other common alternatives(1984:42). The benefits of these systems are many. They are more productive than manual or simple stand-alone machines, offer more consistent and higher levels of quality, exhibit shorter product lead times and manufacturing cycle times, require less space, minimise inventory levels, need less management attention, are after, yield more flexibility, reduce scrap, and so on. In terms of the marketplace, these systems offer advantage against foreign competitors who hold the strong loyalty of their workers - they minimise the need for extensive workforce management co-operation.

Yet, in the face of the overwhelming competitive environment, and the numerous clear benefits these systems can bring to the firms, there is a tremendous reluctance on the part

of many companies to move in the direction of automation. This is due, in large part, to the extremely sizeable investment required by a firm with a minimal, or total, lack of experience with such systems. It literally becomes, for many such companies, a game of "you bet your company".

This lack of experience impacts the firm in two ways. Firstly, top management is often totally unacquainted with such systems and must rely on the expertise of their manufacturing executive. However, the executive has often been out of touch with the details of the shop floor for many years, and particularly is not up to date on new technology.

Additionally, most of these executives have rarely been consulted in advance about manufacturing strategy, usually being simply handed the task of implementing a preconceived manufacturing strategy. To initiate such a change in manufacturing would normally be done under rare circumstances, and then only if the manager was perfectly confident in the outcome. Thus, the manufacturing manager is typically no more anxious to try these new technologies, perhaps even less so, than the top executives.

In lieu of guidelines for investing in these manufacturing systems, executives opt for standard financial measures that have been used relatively successfully for single machines and other stand-alone equipment in the past: Return on Investment (ROI), Payback, Internal Rate of Return (IRR), etc. Although it is arguable whether these are appropriate guidelines, the problem encountered when these measures are used for complete manufacturing systems is that they fail to take the natural synergy of the systems into account.

2.6.1 Hill's Speciality Pet Foods

Hill's, a unit of Colgate-Palmolive, is a leader in the $1 - billion - plus US speciality pet foods business. After completing their $ 80 million production facility in Richmond, IN, fully automated mechanically and electronically, they produced 280 million LB of dog food in their first year of production.(Sperber : 1992:25)

According to Larry Wagner, Vice President of global business systems at Colgate - Polmolive, "Every time we build a major new facility, we see it as a opportunity to learn, bring in the latest technology, and put the appropriate management philosophy in place."

Marc Swartz, Facility Director at Richmond, summed up the company's battle cry "Informate before you automate!". Swartz, sees this philosophy as the cornerstone of their success.

"I can't honestly tell you that one software package is better than the others. The real benefits of any of these packages lie in how they are used. A system will only do what you tell it to," Swartz explained. This message was visible throughout the whole project.

As early as 1988, a top management steering committee set down two guiding principles for the Richmond project:

1.) Decisions are made by those who are affected by them, and

2.) Information must flow first to those who need it for decision making purposes.

2.6.2 Elkem Metals Co.

Other success stories include Elkem Metals Co., in Alloy, W.Va.. This company cut emergency and unplanned maintenance man-hours by 66% within 18 months after implementing a maintenance management system. Also, furnace uptime and production were increased significantly. The plant converts quartzite into high quality silicon and ferrosilicon used in steel, iron, aluminium, chemicals and electronics.

In this plant, management recognised the need for improved maintenance performance, and established a long term goal: to bring plant assets up to a acceptable level, maintain this level and extend the life cycle of plant assets.

The project was completed on time and within budget and had a payback period of just 14 months. Capabilities of the system as supplied, proved to be satisfactory, and no program changes have been necessary. Elkerm's Alloy plant has a gain-sharing program with it's employees. This year the maintenance operation is expected to make a significant contribution to the program. (Papamarcos:1991:36)

2.6.3 E.J. Brach Corporation

The E.J. Brach Corp. makes more than 1.2 million pounds of candy each day and produces more than 300 varieties, including hard candies, toffees, jellies, caramels, chocolate and speciality items for the United States market.

"We are probably one of the most competitive industries in the world," states Brach Vice President of Information Services James Wood. "Our competition is anything the consumer will buy, and I've got to equip the manufacturing and marketing people with the tools they need to compete. Information System identified data as one of the bottlenecks in meeting competitive challenges. " (Kelly:1991:2)

Brach implemented an enterprise wide system, using a team of manufacturing employees, and some consultancy for special tasks such as systems integration.

The system has reduced the need for raw materials inventory by more than 30 percent and packaging inventory by more than 30 percent. Further advantages were gained from the integration of the different data sources into one real-time data base.

2.6.4 Quaker Chemical

This medium - sized plant in Uithoorn, the Netherlands, manufactures venerable grease and cooling products, hydraulic fluids and rust preventing products for the steel industry and defoamers for the paper - and - pulp industry.

Manufacturing functions were tracked on stand - alone databases on Personal Computers that did not communicate with one another. Duplicate and triplicate information and multiple errors resulted from rekeying data. Quaker needed an integrated system that centrally maintained all data.

The firm decided to take a structural approach to changing its information management. Until then, management did not have any formal guidelines for its information policy because it did not have sufficient control over the information policy, the information plan and its execution. The information manager felt the best way to develop a well-organised information management policy was to get management's approval and acceptance.

With the help of a Dutch consulting firm, Quaker set up a project team, and chose an application after two months of evaluation.

The integrated system eliminated stand-alone workstations running isolated tasks and replaced them with a structured, automated approach to planning. The implementation of this software, supervised by the consulting firm, was completed in 10 months. The software proved helpful in qualifying for ISO 9001 certification, a world-wide quality standard.

Results were gained in the areas of logistics, on-time delivery, planning, quality control and more accurate production tracking. Additionally, credit memos were cut down to 5% of previous levels. (Vos:1992:4)

2.6.5 Bama Pie, Inc.

In price-competitive industries, many companies do not have the luxury of increasing prices to expand revenues or boost profits. Instead, they must focus on cutting costs through elimination of manufacturing waste and inefficiency. Bama Pie, Inc. of Tulsa, Okla. falls into this category.

Bama manufactures pies and biscuits sold by McDonald's Corp. fast-food franchises throughout the world, as well as other retail foods that are distributed through grocery stores in the United States. In this market new products debuts weekly, shelf space represents a vicious battleground, and profit margins are regularly shaved in recurring price wars.

In mid-1989 , Bama management decided that the company must be able to respond more quickly to changes in raw goods - specifically, the daily fluctuations in the price of staples - as well as more accurately monitor inventory and sales of finished products.

"We realised that our reaction time to changes in the cost of raw goods was critical but we were not able to control, due to lack of information," says Charles Green, Bama's Information System Manager. (Laplante:1990:4)

After implementing an Enterprise Resource Planning (ERP) Solution, Bama gained control over the information they needed to run the business. Bama was now able to bid for better raw material prices, with all necessary information at hand.

Accurate costing information also allowed them to avoid unprofitable agreements, and another immediate benefit was found in improved inventory accuracy.

2.6.6 The Bottom Line

Through the above mentioned examples, it can be seen that real benefits can be achieved by utilising an Enterprise Resource Planning (ERP) system in the Industrial Enterprise.

According to Marcam Corporation (1993:1), one of the largest Industrial Application Vendors in the world, there are only four aspects to manufacturing that can be controlled. These are Time, Quality, Cost and Capital. By controlling them positively with the effective use of Enterprise Resource Planning (ERP) systems, profitability can be increased. **(See Table 2.2)**

Table 2.2

The Four Controllable Aspects to Manufacturing

Controllable Aspect	Possible Approach
Time	**Manufacture/distribute the product** • Just In Time (JIT) • Time Based Competitive Strategies

	• Shorten the supply chain • Quick Response
Quality	**Make the product with fewer defects** • Total Quality Management (TQM) • Continuous Improvement
Cost	**Make the product for a lower cost** • Activity Based Costing (ABC) • Product Life Cycle Management
Capital	**Turnover capital more quickly** • Increase Inventory Turnover

Source : Marcam (1993:1)

The way in which these aspects are managed, or controlled using Enterprise Resource Planning (ERP) applications will depend on the enterprise, and the industry in which it is competing.

2.6.7 Leveraging the Investment

Ferreira and Treacy (1988:14) states that in justifying automation systems, companies have to determine whether the resulting benefits are in fact due to the system itself or, perhaps, to changes because of the system.

Currie found in his research into the strategic management of Advanced Manufacturing Techniques, that problems were often found where companies relied too much on vendor "hype" (e.g. promises of large cost savings) to justify the purchase. (1994:81)

According to Musser (1993:32) there are many traps to look out for in the search for the perfect system:

High-calibre manufacturing systems promise improved return-on-investment through tighter inventory control, improved product quality and better customer service. To achieve these benefits, decision-makers must look beyond the system's basic features and functions.

Among the more critical decision criteria: does the software accurately reflect the way you do business? Is there a focus on the special requirements of your manufacturing environment - be it batch or continuous-flow processing, high-volume repetitive or make-to-order discrete? Or does the application vendor take a one-size-fits-all approach?

Moreover, in addition to ensuring that the software has the capabilities to meet your business needs today, you must also be sure that it will continue to meet those needs in the future.

These are just some of the questions that needs to be answered, before the enterprise invest in an Enterprise Resource Planning (ERP) system.

2.6.7.1 Custom Fit versus No-code-modification

Application software selection is a comprehensive process. With careful analysis, however, the user can find the appropriate system, one that addresses most of the business needs. While the goal of the application supplier is to provide the most complete application possible, there will be requirements unique to the manufacturer's operations. How the 10-20 percent of the company specific requirements are addressed, has significant bottom-line impact.

Is it possible to have the best of both worlds, to customise a manufacturing system and still take advantage of future releases?

Musser (1993:34) suggests that there is a middle ground, a cost-effective and efficient alternative to the "custom versus no-code-modification" trade-off. With the right software tools, you can make operation-specific enhancements without modifying the application source code.

This allows the user to achieve a custom fit to his business - without sacrificing the investment in the software used to manage the enterprise.

2.6.7.2 Training

> "In the long run what may be important is the texture of the system. By texture we mean the quality the system has to evoke in users and participants, a feeling that the system increases the kinship between men."
>
> Theodor Sterling

There are several examples of companies that implemented a system only to find it poorly utilised, ineffective, and the target of complaints from throughout the organisation.

According to Walsh (1994:14) the purpose of a Enterprise Resource Planning system is "business improvement". As with any new tool, the system will have an impact on established practices and procedures. It will change the way people carry out their day-to-day activities.

A well designed training program contributes to implementation success by ensuring that the new system does, in fact, streamline your business. It prepares people to use the system more efficiently and confidently when it finally goes "on-line".

Different people require different training according to the role that each plays in the implementation process. Inadequate or poorly timed training often undermines the success of the implementation, especially when users do not understand the impact the new system will have on their job responsibilities. Consequences include feelings of inadequacy, indifference, or apprehension that may undermine the system's productivity and cost-saving benefits.

Kochan and Cohen (1986:119) states that if a major change such as system implementation is to have any chance of success, it must have complete workforce support. The greater the involvement and contribution from the lower levels, the better the chance of a smooth running project.

2.7 Current Trends in Enterprise Resource Planning (ERP) systems

The Gartner Group, is a Massachusetts, US, based information technology industry consultancy group. During their 1996 European Symposium, they had the following long term vision on Enterprise Resource Planning (ERP) systems. (Gartner:1996:9)

> "People used to be locked in by hardware,
> Now they are locked in by applications'
> This is just as bad, but harder to get out of.."

Gartner Group
1996 European Symposium

For the long term future Gartner sees frameworks arise in which customers can plug components. There will only be a few framework vendors, and many component vendors. These frameworks will however be vendor specific and component vendors will sell components for a specific framework.

According to Gartner people see more and more high risk involved with "big bang" implementation approaches.

Companies also tend to now focus on system decisions round their core business, and realise bigger returns because of that decision. Gartner expects all current Enterprise Resource Planning offerings to evolve drastically in the future. All this new generation technology is very new, and a lot will still change. They see the traditional client-server Enterprise Resource Planning market slowing down somewhat by 1998. The total number of Enterprise Resource Planning systems sold last year was 4000 new sites on a installed base of 67 000 sites. This show less than 8% replacement last year.

Gartner also sees vendors realising that they cannot provide all functionality required by the broad marketplace. To overcome this hurdle, they see vendors partnering with market leaders to be able to offer certain functionality.

Gartner also sees companies using different applications from different vendors to put together their Enterprise Resource Planning system. Finally, the technology is moving in a direction where this best-of-breed environment seems to be a reality.

Dailey (1996:3) describes the future vision as "Extended ERP", and describe it as customer focused, dynamically balanced value network through asset optimization and real time transaction processing. He breaks down the focus into four areas:

- Better, faster, cheaper
- Externalizing the enterprise data model
- Getting better data from trading partners and suppliers, and

- Distinguishing between competitive requirements and areas of competitive differentiation - going beyong "best practices".

2.8 Conclusion

According to Gartner Group Europe (Dailey,1996:2) the vision for manufacturing business systems continues to change.

In the late 1980s, the Enterprise Resource Planning (ERP) vision broke out of the transaction centricity and reactive nature of earlier manufacturing business system philosophies, and focused on proactively using information to dynamically balance and optimise financial, manufacturing and distribution resources.

With Enterprise Resource Planning (ERP), we also saw a move away from inventory focus to a service focus, as the market experienced and continues to feel the immense pressures of mass customisation, global competition and time to market.

The result is that the vision of Enterprise Resource Planning (ERP) is evolving to reach beyond the enterprise. "Extended" Enterprise Resource Planning (ERP) is an interenterprise vision that includes the balancing and optimisation of not just the enterprise, but the value network, or the entire set of supply and demand business processes that drive the enterprise's delivery of goods and services.

This vision requires dramatically new technologies to enable the functionality to achieve the required results.

During the next five years, vendors and users alike will struggle to achieve extended Enterprise Resource Planning (ERP) as the new technology skill shortage, the demands of year 2000 compliance, increased IT outsourcing and vendor shakeout will result in painfull rather than smooth evolution.

Chapter 3

Research Methodology

3.1 Outline of Methodology

The research was conducted using a survey to collect data. The survey was in the form of a questionnaire.

The objectives of the study were investigated in the literature review. This review yielded certain propositions, which could then be tested against the initial objectives, by means of the questionnaire.

It has to be remembered that the collected data only reflects the personal views of the person answering the questionnaire, therefore no individual responses were highlighted, but the results of the data analysis were treated as a whole.

The analysis was conducted using basic frequency tables and descriptive statistics to obtain information that could be tested against the propositions.

The information gathered for each question was then tested against the particular proposition from which it was formulated. A decision was then made as to whether the information supported the proposition or not.

Following these steps, a conclusion was drawn, in which the findings were related to the initial research objectives.

3.2 The Population

The focus of this study was to investigate the extent and usage of Enterprise Resource Planning (ERP) systems in South African industrial companies. This excluded several sectors of the South African economy from this study. This was decided, as Enterprise Resource Planning (ERP) systems are designed to support the industrial enterprise. Although several companies outside of the industrial sector uses portions of Enterprise Resource Planning (ERP) systems, this is not done extensively enough to warrant inclusion in this study.

The population was gathered from a list of the top 600 companies in South Africa. This list was then filtered to only include industrial companies. The population size was reduced to 489 companies. This group of companies represented a broad cross section of the industrial sector within South Africa.

3.3 The Sample

The population of 489 companies were then submitted to an accuracy test to verify the names and addresses of the targeted participants in the study.

Care was taken to identify a person who either have responsibility for the usage of Enterprise Resource Planning (ERP) systems within the company, or someone who could accurately answer the questionnaire.

The list was also scrutenised to select only one target participant per company. When more than one site per company were included, the most relevant site was selected. In most cases this included the head office of the company.

The resulting list included 258 targeted participants. Questionnaires were mailed to this list. This mailing resulted in 46 useable responses being received. Three responses

were received too late to be included in the study. Two responses were unuseable, as one was submitted without any response, and the other did not have enough data filled in to warrant it's inclusion in the study.

3.4 Data Collection

A covering letter was addressed to the head of the computer department, information technology (IT) department or data processing (DP) department, depending on the particular company.

This letter asked the targeted participant to complete the questionnaire and to mail it back in a return envelope which was included with the questionnaire. The letter also outlined the reasons for doing the study, and provided information about the degree for which the study was being undertaken, as well as the study leader's name.

The questionnaire asked direct questions regarding the current use and benefits generated by the use of those Enterprise Resource Planning (ERP) systems in a particular company. It also asked for an indication as to how this usage will change in the future, and how these changes will correlate with their views on the competitive advantage of their companies.

A mailed questionnaire was used, as this was deemed the most appropriate method of gathering data from a large number of geographically spread out companies. It also allowed participants to complete the questionnaire at their leasure.

3.5 The Questionnaire

The questionnaire was devided into three basic sections. The first section determined the current status and usage of Enterprise Resource Planning (ERP) systems in the industrial sector. It also explored the planned extension, modification or replacement

of those systems. This planned spending on information technology was then evaluated in terms of fit to the competitive areas in the business.

The second section looked at the support infrastructure employed by the different companies. This not only delved into technical support, but also tested general availability of other types of consulting relevant to the proper use of Enterprise Resource Planning (ERP) systems in the typical industrial company.

The last section explored the perceived benefits realised by industrial companies by implementing Enterprise Resource Planning (ERP) systems.

The following table sets out the research objectives, the propositions realised from the literature review and the applicable questions used to research each subject.

TABLE 3.1

Relationship between Objectives, Propositions and Questions

RESEARCH OBJECTIVE	PROPOSITION	QUESTION
To determine the extent of Enterprise Resource Planning System usage in SA industrial companies	Companies will be using wide spread of different packaged and in-house developed software, most will be moving towards fully integrated Enterprise Resource Planning systems	1 2 3 4 5 6 7 8
To determine the different functional area's coverage, and the trends in functional coverage	Big spread of functional solutions, mainly served will be financial, production and Sales and distribution functions	4 5 6 8
To determine levels of support	Own first line support, moving	6

available to industrial companies	towards outsourcing support	8 9 10
To determine benefits realised from using information technology in the business	localised benefits, mainly in terms of cost reduction	4 5 6 7 8

3.6 Data Analysis

The data received back was fed into Microsoft Excel 5.0 spreadsheets to do the analysis.

Data was sorted, summarised and eventually graphically represented in the form of graphs, and charts.

These graphically represented results were directly imported into the research results displayed in Chapter 4. This chapter was generated on the Microsoft Word 6.0 word processing package. The direct electronic importing of the results eliminated the possibility of errors through manual data transportation.

Chapter 4

Research Results

4.1 Analysis of Responses received

Of the total of 258 questionnaires mailed to prospective participants, 52 were received back. These included 6 which could not be used due to reasons such as not being filled in, or not being complete. This left 46 questionnaires which could be considered useable, these were all used in compiling this report.

The questionnaires were mailed on the 21 December 1996, and the last response were received on 11 February 1997. Thereafter no further responses were accepted.

4.2 Respondent Profiles

4.2.1 Number of employees

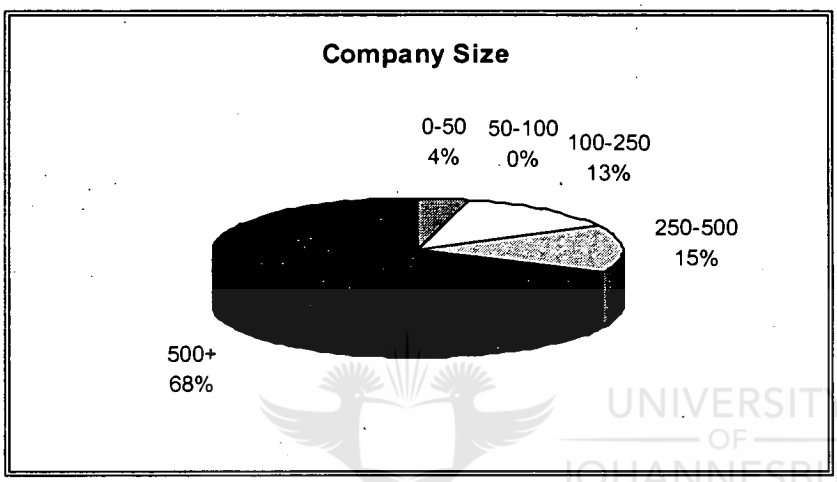
This study was aimed at the larger industrial company, specifically those with more than 500 employees. As can be seen in Figure 4.1, 68% of the respondents employed more then 500 employees.

The companies employing between 250 and 500 employees made up 15 % of the respondents. 13 % of respondents employed between 100 and 250 employees.

Although no companies replied in the 50 to 100 employee bracket, 4 % of respondents had less than 50 employees. These companies were included, as they turned out to be small discrete manufacturing companies. If the study was to consider the usage of Enterprise Resource Planning (ERP) systems throughout the industrial sector, these responses were also valid.

FIGURE 4.1

Number of employees



4.2.2 Average Number of Sites

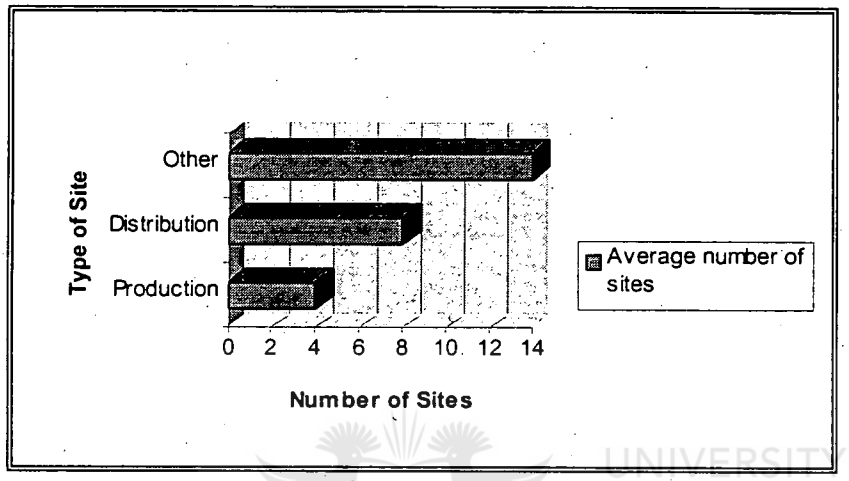
The second question explored the type and number of sites from which these industrial companies were conducting their business.

The respondents averaged four different manufacturing sites, and on average used eight distribution sites. In most cases, this was due to the fact that it is cheaper to manufacture products locally than to ship finished product over great distances. In a couple of instances, the manufacturing sites were situated at the source of raw material, these include mines and meat processing plants.

In nearly all cases (see Figure 4.2), the final goods were distributed through a network of distribution sites (8 average) and from there using third party distribution (14 average). Again this is mainly due to the widely decentralised markets for industrially produced products.

FIGURE 4.2

Average number and type of Site



4.2.3 Nature of Business

The majority of the respondents (60 %) came from the process manufacturing industries, these include chemical, pharmaceutical, building material and mining industries. These industries represent batch repetitive and continuous flow type manufacturing.

The discrete manufacturing companies made up a further 20 % of the respondents. These are mostly job shop and assembly type operations.

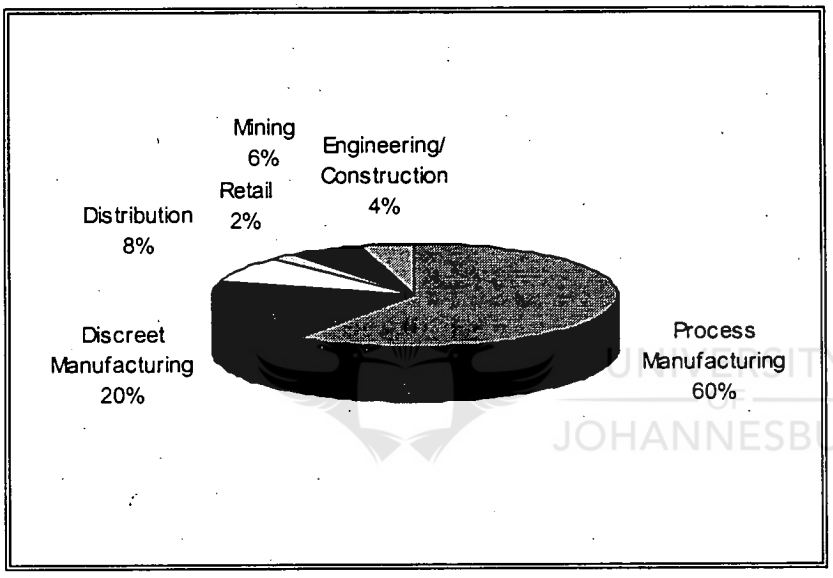
Companies specialising in distribution came in third with 8 % of respondents. Mining houses made up 6 % of respondents. The mining operations were mostly made up of

one or multiple mining operations, and in most cases had some surface located processing functions.

Engineering and construction companies made up 4 % of the responses. Retail companies filled the other 2 % of respondents.

FIGURE 4.3

Nature of Business



4.3 Status of Current Systems Employed

4.3.1 Effectiveness of Current Systems per Functional Area

In this section respondents were asked to evaluate the effectiveness of the systems currntly employed in the different functional; areas of their business.

The results were plotted against a rating from 0 to 4. The higher the rating, the better the perception of the functional effectiveness in a particular area of current systems. The results are displayed in Figure 4.4.

Financial applications were rated as the most effective, with an average rating of 2.61. These include functional areas such as Accounts Payable (Creditors book), Accounts Receivable (Debtors book) and Cash management. This was the first areas to be computerised in business applications, and is as such expected to be the leader in effectiveness.

Second, the Sales and Distribution applications with a rating of 2.24. It is interesting to note that these were the only two areas that scored a relative effectiveness of over 50 %.

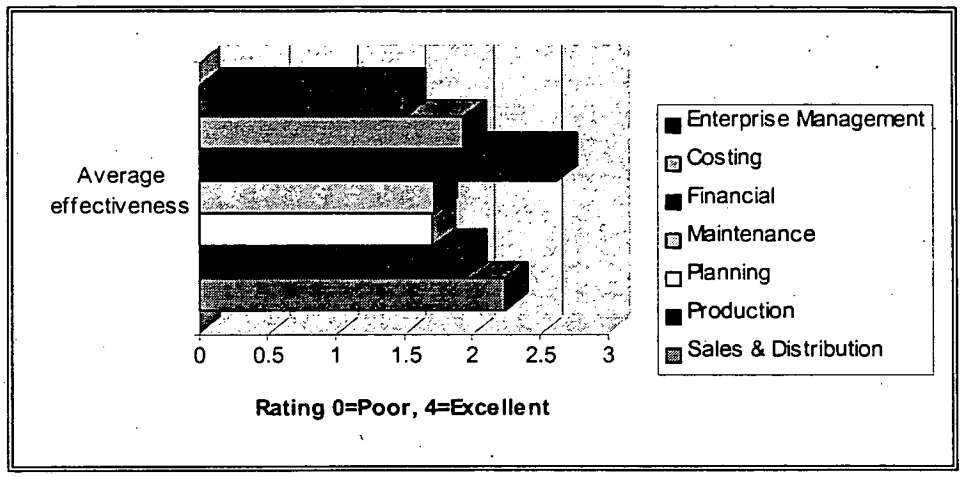
Joint third the Product Costing and Production management applications, both with ratings of 1.93.

Then Maintenance Management with 1.72 and Production planning with 1.7.

As expected the Enterprise Enabling functions scored an average of 1.5. This is due to the fact that this is one of the last areas to be targeted by software functionality. Only now with increased competitive pressures on a multi site company is the management of the complete enterprise becoming a critical issue.

FIGURE 4.4

Effectiveness of Current Systems per Functional Area



4.3.2 Integration Rating between different Functional Areas

This question was posed with the purpose of evaluating the integration of information flow between the different functional areas of systems currently employed by respondents. The results of this rating from 0 (Poor) to 4 (Excellent) are displayed in Figure 4.5.

Again the Financial system's integration to other systems rate at 2.52, followed closely by the Sales and Distribution systems at 2.24 and Costing systems at 2.02. Again it is only these three functional areas that are rated at over 50 % for their integration to the rest of systems employed.

Integration to Production and planning systems rate at 1.96 and 1.87 respectively.

An swop is that Enterprise Management systems are rated as better integrated (1.59) than Maintenance Management systems (1.48). This could be due to the fact that the

Maintenance functions in several companies are seen as loose standing support functions to the supply chain.

Note the similarities in shape of Figures 4.4 and 4.5. In figure 4.6 the graphs are superimposed to highlight these similarities.

Figure 4.5

Functional Integration Effectiveness

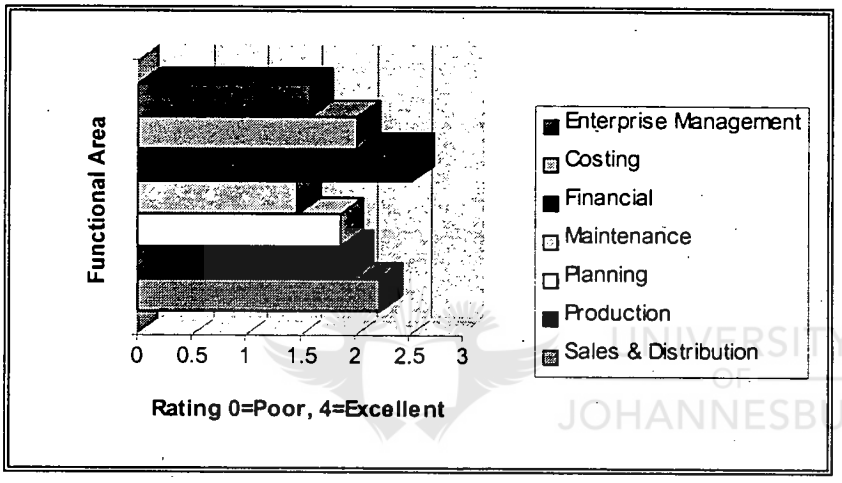
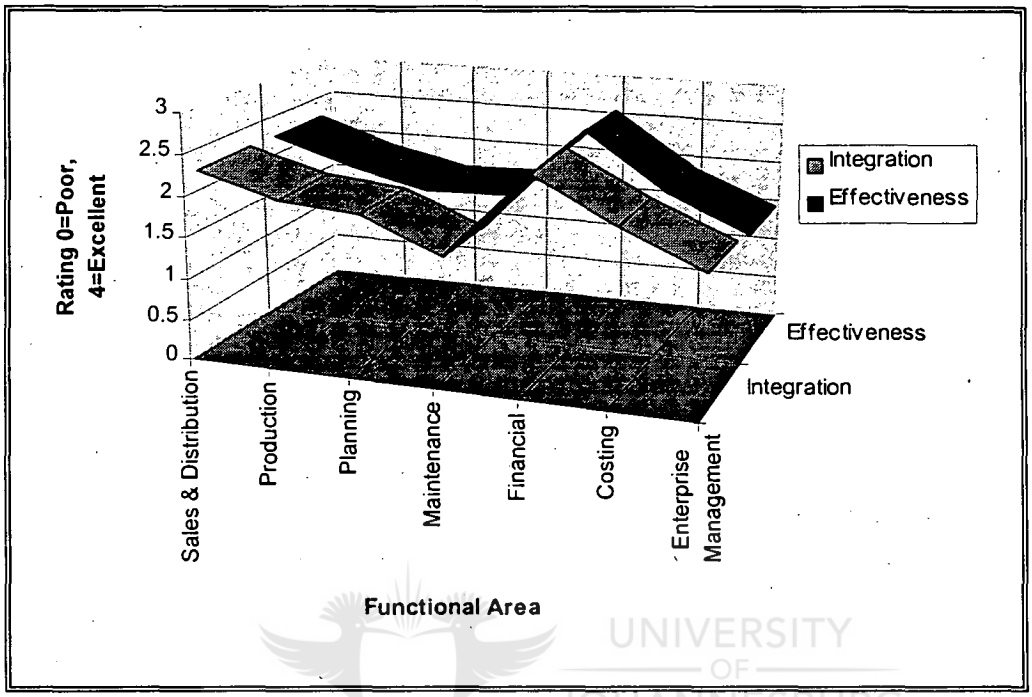


FIGURE 4.6

Effectiveness of Functions and Integration to other System Functions



4.3.3 Types of Systems used in different functional areas

This question was included in the questionnaire to determine the spread between manual systems, in-house developed systems, systems developed by outside contractors, spot solutions and integrated systems.

This was done by functional area, so that patterns could be identified.

Answers from respondents were split by percentage. Table 4.1 shows the result from that calculation.

TABLE 4.1

Types of systems used in different functional areas

	Sales& Distr	Production	Planning	Maintenance	Financials	Costing	Enterprise Management
Manual	10.87	23.91	26.09	47.83	0.00	8.70	50.00
In-house developed	30.43	23.91	23.91	6.52	13.04	36.96	15.22
Contract developed	10.87	15.22	15.22	4.35	10.87	6.52	10.87
Spot solution	4.35	8.70	6.52	26.09	23.91	15.22	4.35
Integrated System	43.48	28.26	28.26	15.22	52.17	32.61	19.57

If we look at the types of systems used for Sales and Distribution functions, it is clear that nearly half of the respondents use the sales functions linked to integrated systems. The benefits of an integrated system are apparent in this area, with information integration needed to several areas of the business, as example inventory management and accounts receivable.

More than a third of the respondents(30.43%), chose to develop their application in-house, to solve their customer service needs. Third most widely used is systems developed under contract (10,87%), and the same amount of respondents still handle this part of their business, by using nothing more than paper. A small amount (4.35%) used loose standing spot solutions.

The production and planning functions scored almost exactly the same, which points to the close relationship that these two functions have in most industrial companies.

In both cases, integrated systems are used most widely (28.26%) to manage and plan manufacturing activities. There is a almost even split between manual systems, production with 23.91% and planning with 26.09%, and in-house developed systems, both have a 23.91% distribution. It is disturbing that manufacturing, where most of

these industrial companies' competitive advantage reside, is being run using a manual sytem in nearly a quarter of the respondents.

A smaller percentage of companies (15.22% in both cases) have systems developed by contractors, and a small number (8.72% and 6.52% respectively) use spot solutions.

Maintenance management results showed nearly half (47.83%) of respondents, running their plant maintenance using manual systems. A further 26.09% use spot solutions, which shows a large number of dedicated unintegrated maintenance applications being marketed in South Africa. Integrated systems account for a mere 15.22%, and only a small number of companies use in-house developed (6.52%) and contractor developed systems (4.35%).

Note that none of the companies used manual means to handle their financial functions. More than half of the companies (52.17%) have their financial modules as part of an integrated system, a smaller number have spot financial solutions (23.91%), and some have in-house developed and contracted financials (13.04% and 10.87% respectively). This situation is due to the fact that the first computer applications were developed on the financial side, and naturally these applications are better developed and more freely available, and thus more widely used.

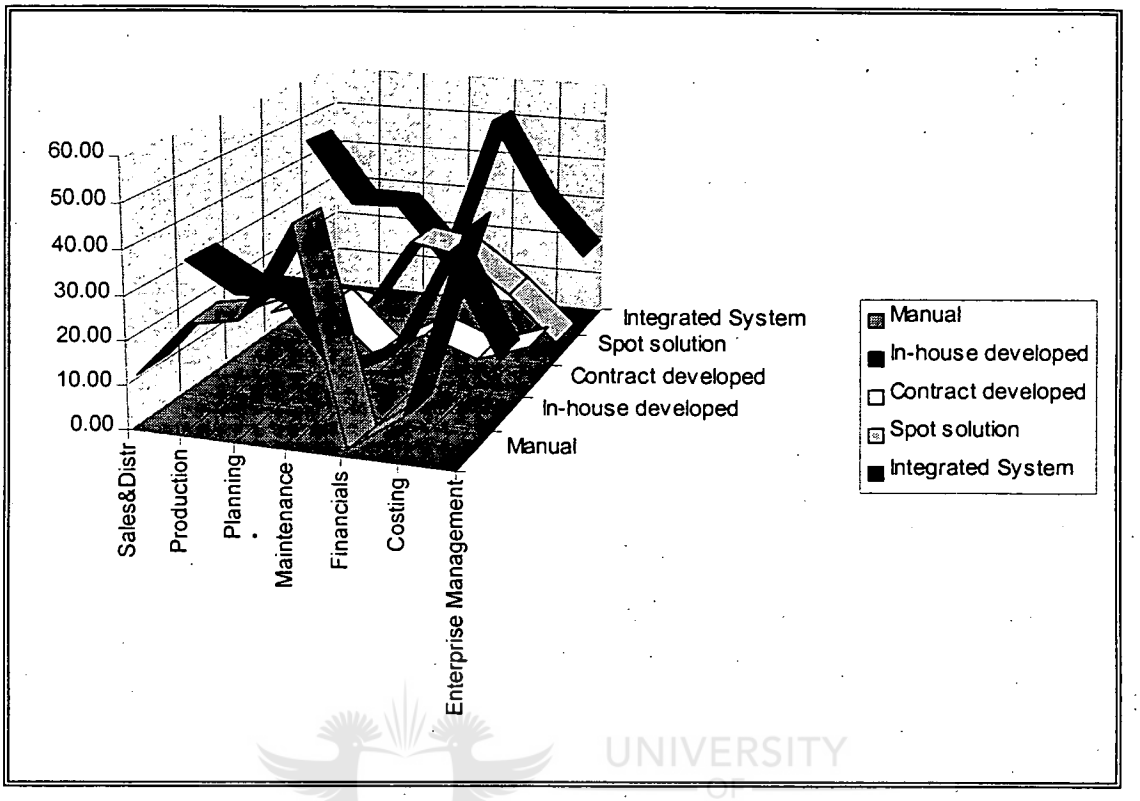
The costing function shows an anomaly, with the most systems (36.96%) being developed in-house. That is closely followed by integrated costing functionality (32.61%), and only a small number of respondents using anything else.

Most of the respondents (50%), integrate and coordinate the activities between their different sites, using nothing more than manual systems. There is an indication of a changing mindset, with 19.57% of respondents choosing to integrate this function with the rest of their functional areas. Some (15.22%) chose to develop their own systems to do this task for them, and 10.87% of the companies had software developed by contractors to fulfill this function.

The results are graphically shown in FIGURE 4.7 below.

FIGURE 4.7

Types of systems used in different functional areas



4.4 Future plans of Respondents

4.4.1 Views on Competitive Advantage

In this question, respondents were asked to indicate where they see the competitive advantage areas of their business. The question was included to gauge their perception of which areas they have to focus on as far as Information management is concerned, to be able to help their company gain competitive advantage.

The results of the analysis of the respondents' answers is illustrated in Figure 4.8.

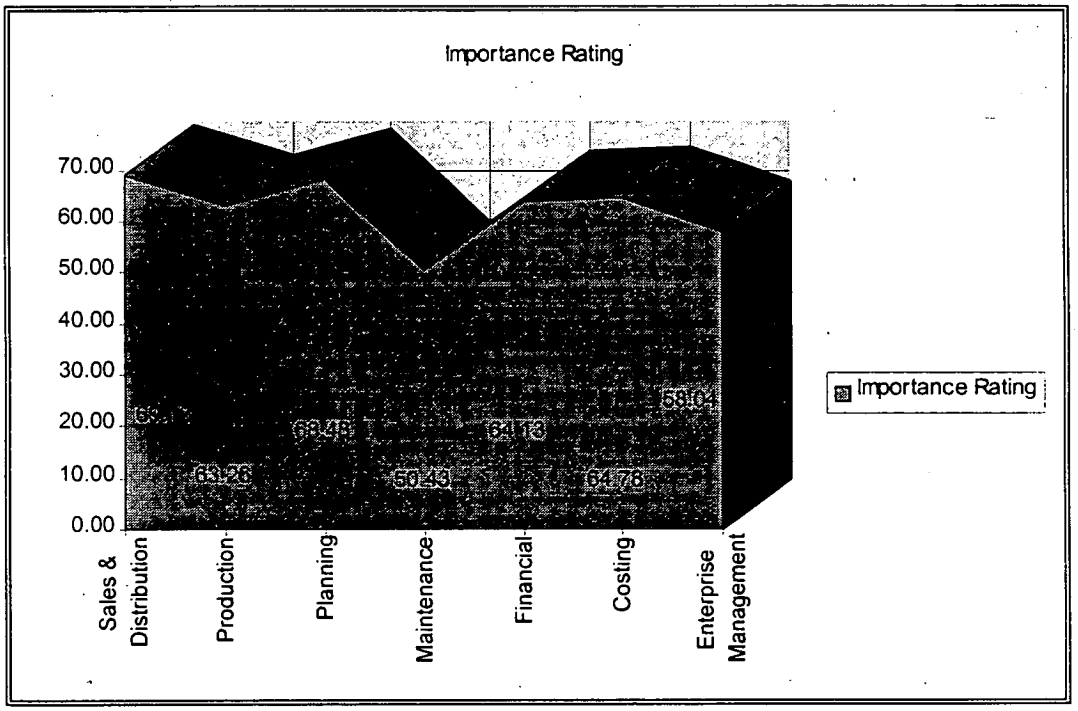
The sales and distribution function was seen as the most important functional area for the business to gain competitive advantage, with a score of 69.13 out of a possible 100. This was closely followed by the planning function , with a score of 68.48.

Then followed Costing, Financial and Production applications, with 64.78, 64.13 and 63.26. These were then followed by Enterprise Management (58.04) and Maintenance (50.43).

The average score was 62.61, which showed that all companies thought accurate information management to be essential for all parts of the business.

FIGURE 4.8

Functional Rating of Competitive Advantage Possibilities



4.4.2 Planned Renewals / Extensions in next Five Years

Respondents were asked to indicate the areas of their current information infrastructure on which they were going to spend resources over the next five year period. They were also asked to indicate whether those plans were for system modification, integration to other areas of the business, or to replace that particular function's application.

The results were analysed and tabulated, and can be viewed in Table 4.2.

Table 4.2

Renewal / Extension plans for next Five years

	Sales& Distribution	Production	Planning	Maintenance	Financials	Costing	Enterprise Management
No Plans	17.39	17.39	19.57	28.26	13.04	15.22	28.26
Modification	21.74	21.74	26.09	23.91	21.74	19.57	21.74
Integration	19.57	21.74	15.22	17.39	30.43	23.91	21.74
Replacement	41.30	39.13	39.13	30.43	34.78	41.30	28.26

In all functions of the Enterprise, respondents stated plans to replace the current functionality in the next five years, with the highest occurrence in the areas of Sales and Distribution, and Costing. This correlates exactly with the areas indicated as most important to gain competitive advantage, by means of proper information support. Across all functions, an avearage of 36.33% of companies are planning to replace functionality during the next five years.

The system modification / adaption functions were second most popular, averaging out in all the different functions at a score of 22.36 % of companies undertaking these functions. All functions were equally well represented in this area, with just production planning, getting more attention. It can be accepted that the year 2000 adaption has a substantial role to play in the money being spent in this area.

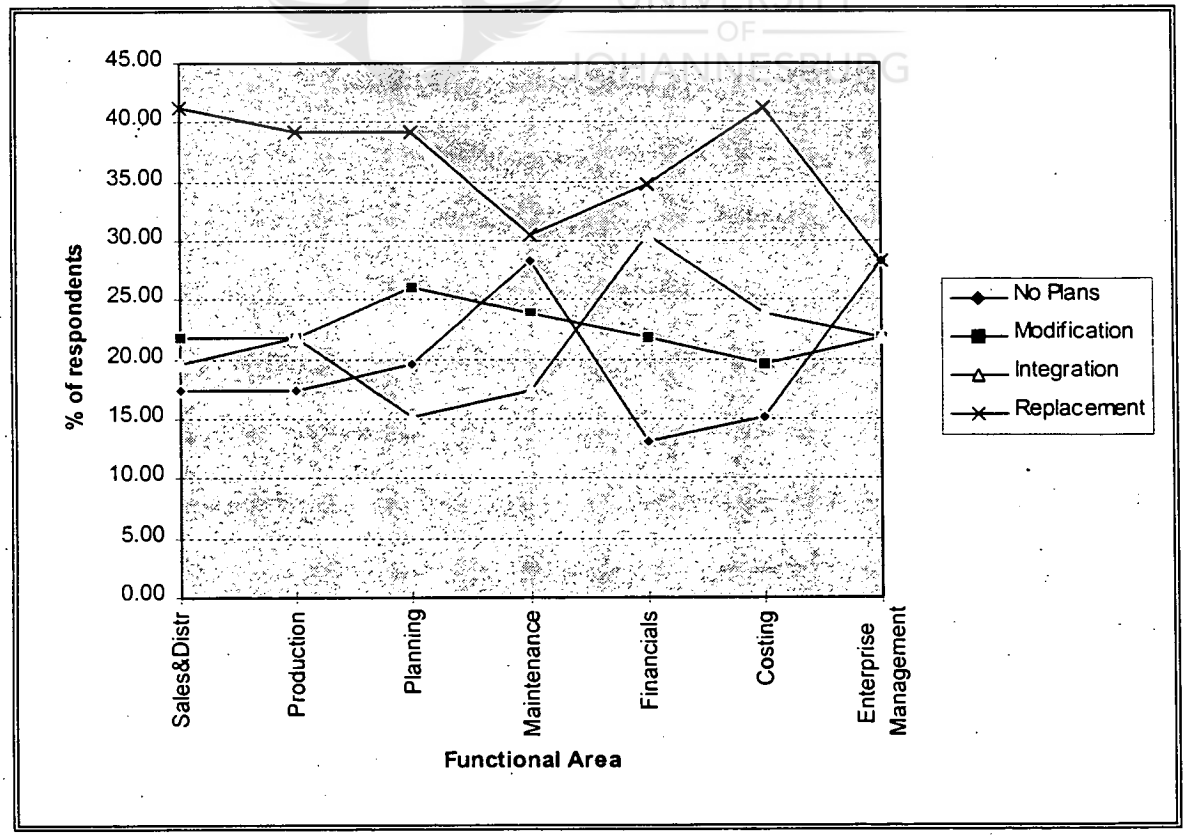
Integration activities took up third place, with a definite peak in the integration of financial functions to the rest of the information functions (30.43 %). Integration activities realised an average score of 21.43%.

The least number of companies are planning no investment at all. An average of 19.88 % of companies are not going to spend any money on their information management systems. The least amount of investment is made in the areas of Maintenance Management and Enterprise Management. (Both 28.26)

The results of this part of the questionnaire can be seen in Figure 4.9 below.

FIGURE 4.9

Renewal / Extension plans for next Five years



4.5 Support of Current Systems

4.5.1 Sources of Support

This part of the research tried to establish how and from where current Information Systems are supported. Respondents were asked to indicate if they receive their support from their own Information technology department, from their application vendor or, if they outsource their support activities. They could also indicate a combination of these.

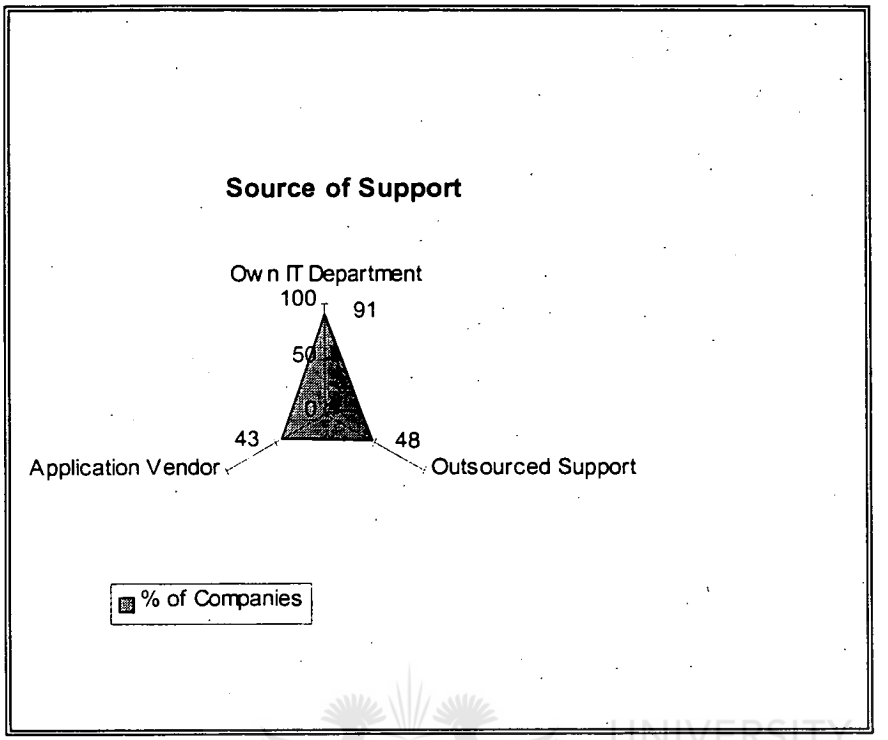
It showed that 91% of the respondents used their own Information Technology departments to support their application users.

43% of the respondents made use of their Application vendor's expertise in solving problems. Nearly half of the respondents (48%), have outsourced their support activities to third party support services.

These figures are graphically portrayed in Figure 4.10.

FIGURE 4.10

Support sources available



4.5.2 Types of Support

The support currently available to respondents were analysed, to establish the specific areas of support available to these companies. The areas investigated were:

- Application Training
- Implementation Support
- System Integration Support
- Business Consulting, and
- Modification Development Support.

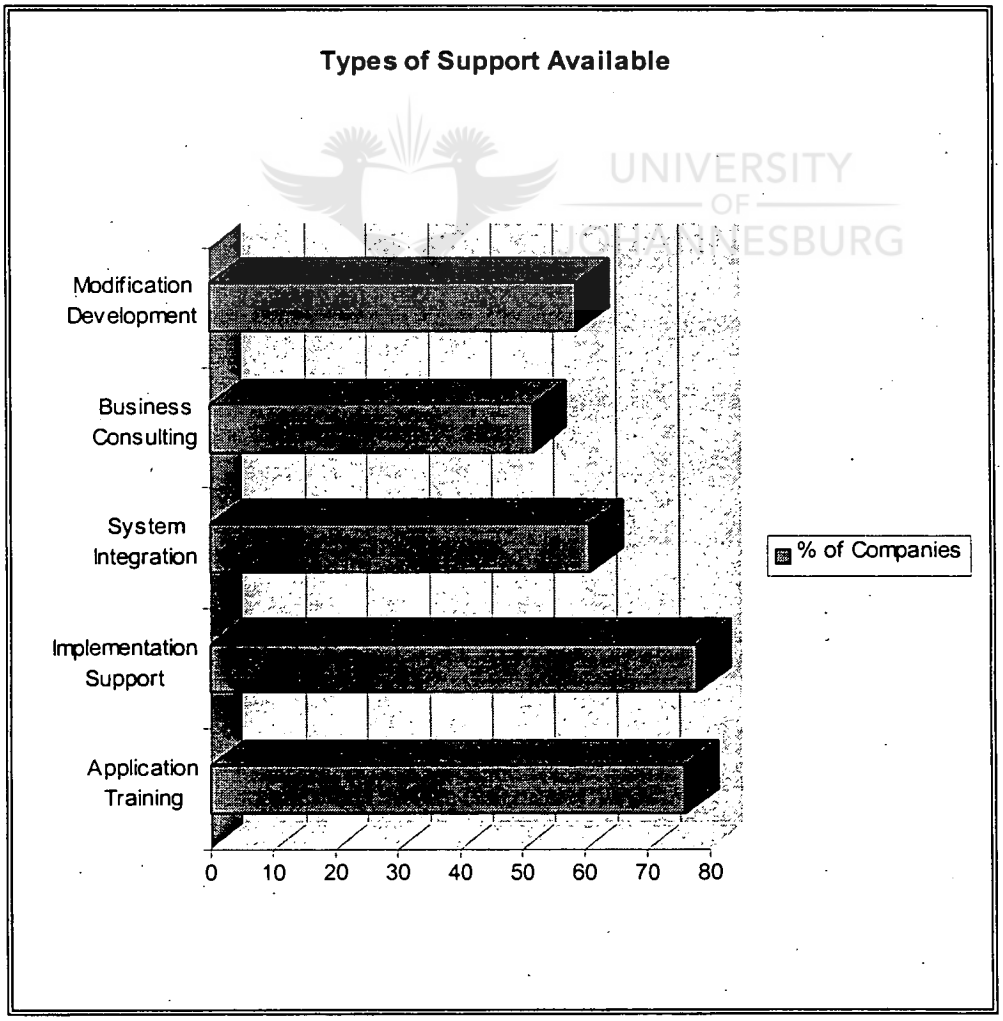
The responses showed high levels of support available to these companies, in all these levels. The ranking after the rating was:

- Implementation Support 78%
- Application Support 76%
- System Integration Support 61%
- Modification Development Support 59%
- Business Consulting 51%

The results are graphically shown in Figure 4.11.

FIGURE 4.11

Types of Support Available



4.6 Benefits realised from Information Technology.

The last question put to respondents, asked them to rate the benefits realised from their companies' use of Information Technology.

They had to give a rating from 1 (Low) to 5 (High), for the realised benefits in the following four areas:

- Time - Time involved in manufacturing and distribution of the products
- Quality - Make the product with fewer defects, less returns
- Cost - Make the product at lower cost
- Capital - Turn over capital more quickly.

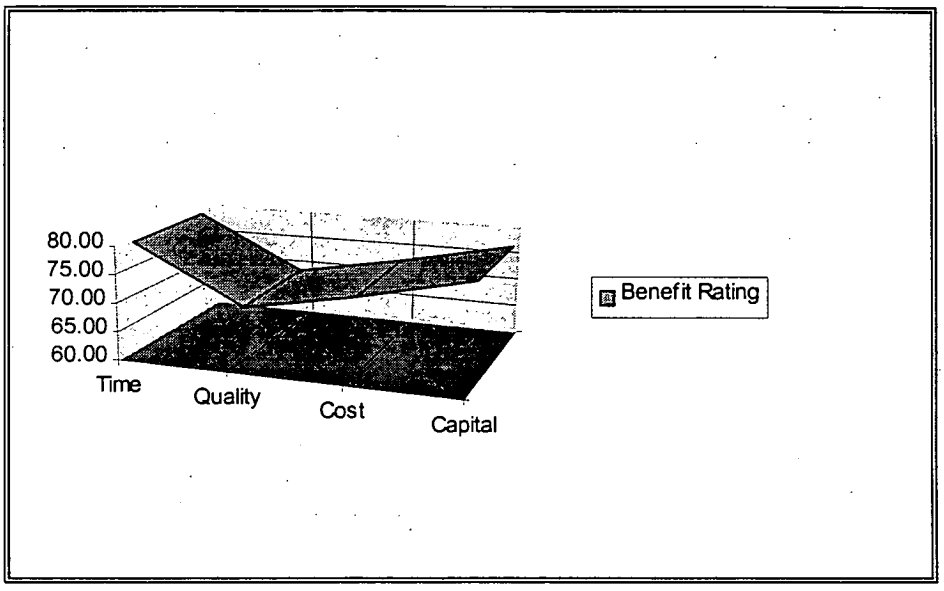
Results showed that the biggest benefit was gained in the area of time. The average score here was 3.17.

Capital turnover gains, scored second highest, with 3.11. Then came cost savings (2.93), and the least benefit was realised in the area of quality (2.78).

The average score across these four areas was exactly 3. Which means, that the average benefit realised by using Information Technology in the business, is rated as being average.

FIGURE 4.12

Benefits Realised



Chapter 5

Interpretation and Conclusion

5.1 Interpretation of the results

5.1.1. The extent of Enterprise Resource Planning (ERP) System usage

The study revealed that although manual "paper" systems are still found in certain functional areas of the business, mainly enterprise management and maintenance management, most companies are utilising computer systems to support their business activities.

There is a varied spread of In-house developed systems, systems developed under contract by third parties, and spot applications in use in the South African industrial sector. Spot solutions refer to specialist best-of-breed applications that are developed to support specialist functions pertaining to individual functions within the business. These may include functions such as sales forecasting, finite scheduling and telephone-sales management.

In-house developed systems were most widely used in the areas of sales & distribution, production management, production planning and costing systems.

Contract developed systems made up very small percentages of systems across all functional areas, and spot solutions were only notably evident in the areas of maintenance management and financial systems.

The results revealed a large number number of respondents that are already using fully integrated Enterprise Resource Planning (ERP) systems to manage and support their business activities. This is also supported by the relatively many companies (36.33 % average of companies) that plan the replacement of their applications during the next five years.

In the importance rating exercise, it was clear that all respondents see the effective information management within the different functional areas of their business as essential for gaining and maintaining competitive advantage in their market place.

The first proposition proved correct in that a wide spread of different types of software applications are being used. It is also correct in the sense that most respondents are moving towards more effective, better integrated solutions.

5.1.2 Functional coverage and trends

The question on effectiveness of current systems within the different functional areas of the business revealed some interesting facts.

Only financial and sales & distribution systems were rated as more than 50 % effective across all respondents. The other functional areas were rated as less effective, and enterprise management functions were rated only 37.5% effective.

Where respondents were asked to evaluate the integration between systems used for the different functions within the business, only three were rated as more than 50% effectively integrated. These were financial, sales and distribution and costing systems.

These two results could be the main reasons why there is such a heavy emphasis on system modification, system integration and application replacement on nearly all respondents' plans for the next five years. It is clear that current systems are perceived

as below acceptable standard, and that there is a realisation of the importance of integrated effective information management to support the business.

The second proposition was also correct in that a big selection of different types of applications are used to solve information needs in different functional areas of the business. Surprisingly, however, is that only the financial and sales and distribution areas are perceived as being more that 50% effective.

5.1.3. Support levels

Most companies (91%) utilised internal resources for application support. Although a relatively new concept in the information technology (IT) industry, are 48% of respondents also making use of third party support.

This is a clear indication that outsourcing services are delivering business benefit to companies, if such a large number of companies are making use of these services.

Nearly half (43%) of the respondents are looking towards the application vendor for support. If this is measured against the table of respondents with any form of externally developed systems, it could be said that nearly all companies that use externally developed systems, will need some level of support from that vendor. This support levels could vary from release upgrades to take advantage of new technology and functionality, to more involved levels of support such as integration or modification of applications.

High levels of support are available to the industrial sector. The main areas of support was in implementation support and application training. There is systems integration, modification development as well as business consulting available to more than 50% of respondents.

The third proposition is correct in that a large portion of respondents are using internal first line support. There is also a noticeable usage of outsourcing services.

5.1.4. Benefits realised.

Benefits realised were measured in four different areas, namely: time, quality, cost and capital.

Most gains were realised in the area of time, or the time involved in manufacturing and distribution of the product. Then came capital gains, followed by cost savings, and the least affected area was quality management.

Across the four areas, the perceived benefit was rated as 50%, which suggests that while benefits were realised, that there were also some negative aspects involved in using information technology in the business.

The last proposition is incorrect in that definite benefits were realised in the areas of time savings and capital usage gains, and not in cost savings as expected.

5.2 Conclusion

5.2.1 Highlights of the study

The study had three major highlights:

- The first highlight was the extent of information technology usage found in the South African industrial sector. Although widely varied in terms of scope of

functionality and type of system used, all respondents are using computer systems to support their business in some form or other.

- The second highlight is the fact that all respondents sees the benefits to be gained by using information technology to gain or maintain competitive advantage in their market place. This commitment to using enterprise resource planning (ERP) systems in their business activities, is not only a far off goal, but is reflected in committed development and expansion plans for the next five years.

- The third highlight is the apparent availability of support resources, to help these companies in reaching their information technology goals. The lessons learned by these support mechanisms will help streamline the expansion of computer usage in the industrial sector.

Finally, this study revealed the fact that South African companies' thinking is on par with trends world-wide, as far as the usage of the computer is concerned. All indications are that the development and availability of Enterprise Resource Planning (ERP) systems are going to explode into the year 2000, with better, faster and more user friendly systems appearing everywhere. This will help the South African industrial company to equip himself with the right system to support his business needs.

This fact also holds the threat, that the prospective buyer must be aware of the traps and pitfalls of buying, implementing and using Enterprise Resource Planning (ERP) systems to support their business.

BIBLIOGRAPHY

Advanced Manufacturing Research . 1994. Advanced Manufacturing Research Report, *Advanced Manufacturing Research Report* , Oct-Nov.

Advanced Manufacturing Research. 1994. Frontline: The object enabled future, *Advanced Manufacturing Research Report* , Mar.

BOYLES, C.M. 1993. Harley-Davidson simply means the best. *Plant Services* , Sep.

BRODNER, P. 1990. The shape of future technology . London : Springer - Verlag.

CONNOR, S. 1986. The value-added Equation. *Manufacturing systems* , Dec.

CONNOR, S. 1994. The evolution of ERP systems. *Marcam Corporation.*

COOPER, R. 1989. You need a new cost system when... *Harvard Business Review,* Jan-Feb.

CORNELL, T.R. 1983. Systems Integration is a mandatory component in achieving an optimum systems environment. *1983 Annual Industrial Engineering Conference Proceedings.*

CUMMINGS, G. 1993. Beyond most modern-day maintenance strategies : Strategy indicators. *Industrial Engineering Magazine* , Aug.

CURRIE, W.L. 1994. The strategic management of advanced manufacturing technology. London : Chartered Institute of Management Accountants.

DAILEY, A. 1996. The future of ERP. *1996 Gartner Group European Conference.*

DAUGHERTY, M.J. 1984. Achieving Integrated Manufacturing Systems. *1984 Fall Industrial Engineering Conference Proceedings.*

FERREIRA, J. & TREACY, M.E. 1988. How to justify computers for your sales force. *Sales & Marketing Management,* Dec.

FRENCH, R.L. 1982. Ten cardinal sins to avoid in selecting software for manufacturing management control systems. *Industrial Engineering,* Apr.

GARTNER. 1996. Proceedings of the 1996 European Symposium, Nov.

GLAZER, R. 1991. Marketing in an information intensive environment : strategic implications of knowledge as an asset. *Journal of Marketing,* Oct.

HARRISON, A. 1993. Flexicraft, operator participation keys to mill maintenance efficiency. *Pulp & Paper,* Feb.

HUTCHINS, D. 1989. Profit. *Computerworld,* Dec.

International Business Machines. 1990. CIM solutions for Midsized companies. *New York : IBM Corporation.*

JOFFE, A. , KAPLAN, D., KAPLINSKY, R. & LEWIS, D. 1995. Improving manufacturing performance in South Africa. Cape Town : UCT Press.

KELLY, C. 1991. Sweet CIM. *Manufacturing Systems,* May.

KEMEZIS, P. 1990. Computers in the CPI : Good chemistry. *Chemical Week,* 21 Mar.

KOCHAN A. & COWAN, D. 1986. Implementing CIM - Computer Integrated Manufacturing. Bedford : IFS (publications) Ltd.

LAPLANTE, A. 1990. Finding the leeway to price effectively. *Computerworld,* Oct.

MACDONALD, T. 1994. Using a CMMS to gain control of spares. *Plant Services,* Oct.

MARCAM. 1993. Positioning Manufacturing Applications for the Chief Financial Officer. *Marcam Corporation.*

MARCAM. 1994. Enterprise Management White Paper.

MCCARTHY, D.R. 1995. The extent, issues and benefits of benchmarking. Johannesburg. 79 p. (Research Project (MBA) - WITS).

MEREDITH, J. 1984. The economics of computer integrated manufacturing. *1984 Fall Industrial Engineering Conference Proceedings.*

MORTIMER, J. 1985. Computer Integrated Manufacture. Bedford : IFS (publications) Ltd.

MUSSER, S.L. 1993. How to leverage your investment in applications software. *Manufacturing systems,* May.

PAPAMARCOS, J. 1991. CMMS cuts emergencies. *Plant Services,* Jul.

PARAS. 1992. Process MRP System Evaluation.

RICCIUTI, M. 1993. Build custom apps at packaged prices. *Datamation,* Jun.

SADOWSKY, R.P. 1984. History of computer use in manufacturing shows major need now is for integration. *Industrial Engineering,* Mar.

SIVULA, C. 1989. A test-bed for IBM's strategy. *Datamation,* 15 Oct.

SPERBER, R.M. 1992. Informate before you automate. *Food Processing,* Jul.

STERLING, T. 1974. Guidelines for humanizing computerized information systems.

STEVENS, L. 1991. MRP II Comes to process manufacturing. *3X/400 Information Management,* Feb.

SULLIVAN, C.H. 1982. Rethinking computer systems architecture. *Computerworld,* Nov.

TAYLOR, D.A. 1993. Back to basics. *Object Magazine,* Jul-Aug.

THOMPSON, O.W. 1986. Upgrading accounting and costing systems. *Manufacturing Systems.*

THOMPSON, O.W. 1986. Managing critical resources : A total manufacturing planning system. *P&IM Review with Apics News,* Mar.

VACCA, J.R. 1992. Getting an edge in process manufacturing. *Midrange Systems,* 18 Feb.

VOS, A. 1992. Production & Inventory control software helps ISO 9001 certification. *Chemical Processing,* Dec.

WALSH, M. 1994. The importance of training in implementing a CMMS. *Plant Services,* Apr.

WILLIS, R.G. & SULLIVAN, K.H. 1984. CIMS in perspective : Costs, benefits, timing, payback periods are outlined. *Industrial Engineering,* Feb.

APPENDIX A

QUESTIONNAIRE

Dear Participant

The Extent and Trends of Enterprise Resource Planning (ERP) System usage in South Africa

To be totally competitive in the world markets, South African Industrial companies will have to find ways and means of "leapfrogging" competition.

One way to gain the upper hand, is to use computer technology as a strategic tool, to propel the business to new competitive levels.

This research project, undertaken as part of a Masters Degree in Commerce at RAU, will attempt to establish the extent to which computer applications are used in Industrial companies throughout South Africa. Trends and issues relevant to the subject will be explored.

In this regard I would be grateful if you would complete the enclosed questionnaire and return it in the envelope provided. It is not necessary to divulge confidential information and no reference will be made to individual organisations in the research report.

Your co-operation will contribute to a growing body of knowledge that will help local companies face the realities and challenges of international competition.

Thanking you in advance.

Yours sincerely

B. Worst B. Eng. (Industrial)

PS. The research is conducted under the co-ordination of Mr. H. Van Schalkwyk.

The Extent and Trends of Enterprise Resource Planning (ERP) System usage in South Africa

Please provide the following information about yourself and your organisation.

A. Position : _____

B. Organisation : _____

(Question B is optional)

1. What is the number of employees in your organisation?

0-50 ☐ 50-100 ☐ 100-250 ☐ 250-500 ☐ More than 500 ☐

2. How many production and distribution sites does your organisation consist of?

Production Sites _____
Distribution Sites _____
Other Sites _____

3. What is the primary nature of your business ?

Manufacturing - process ☐
Manufacturing - discrete ☐
Distribution ☐
Retail ☐
Mining ☐
Engineering & Construction ☐
Other (Please specify) ☐

_____

4. Please comment on your estimate of the appropriateness and effectiveness of systems currently implemented within the different functional areas of your organisation.

Functional Area	Poor	Good	Very good	Excellent
Sales and Distribution				
Production Operations				
Production Planning Functions				
Engineering and Maintenance				
Financial Systems				
Costing Systems				
Enterprise Wide Planning Systems				

5. Please indicate to which extent each of the functional area's systems are integrated with the rest of the organisation's systems.

Functional Area	Poor	Good	Very good	Excellent
Sales and Distribution				
Production Operations				
Production Planning Functions				
Engineering and Maintenance				
Financial Systems				
Costing Systems				
Enterprise Wide Planning Systems				

6. Please indicate the type of system utilised in each of the following functional areas of your organisation.

Type	Code
Manual System (Paper system)	**0**
In-house Developed System (Developed by own IT department)	**1**
Contract Developed System (Developed by outside contractor)	**2**
Spot Packaged Solution (Stand-alone package, eg. Forecasting package)	**3**
Part of Integrated Package Solution (Part of fully integrated ERP system)	**4**

Functional Area	Code
Sales and Distribution	
Production Operations	
Production Planning Functions	
Engineering and Maintenance	
Financial Systems	
Costing Systems	
Enterprise Wide Planning Systems	

7. Please indicate, in order of importance, where you believe systems have a role in providing competitive advantage to your organisation

Functional Area	Score (1 = Most Important, 7 = Least Important)
Sales and Distribution	
Production Operations	
Production Planning Functions	
Engineering and Maintenance	
Financial Systems	
Costing Systems	
Enterprise Wide Planning Systems	

8. Please indicate to what extent the systems in the different functional areas will be extended/renewed during the next five years.

Functional Area	No plans	System modification / adaption	Integration to other area / system	Replacement
Sales and Distribution				
Production Operations				
Production Planning Functions				
Engineering and Maintenance				
Financial Systems				
Costing Systems				
Enterprise Wide Planning Systems				

8. Please indicate your sources of support for current systems.
(Please tick one or more of the boxes below)

Own IT department	☐
Outsourced Support	☐
Application Vendor	☐
Other (Please specify)	☐

_____

9. Please indicate type(s) of ERP support currently available to your organisation.
(Please tick one or more of the boxes below)

Application Training	☐
Implementation Support	☐
System Integration Support	☐
Business Consulting	☐
Modification Development Support	☐
Other (Please specify)	☐

_____

_____

10. Please rate the benefits/savings realised to your organisations from organisation wide computer systems currently in use.
(Please circle appropriate value)

	LOW				HIGH
TIME (Time involved in manufacture and distribution of product)	1	2	3	4	5
QUALITY (Make the product with fewer defects, less returns)	1	2	3	4	5
COST (Make the product at lower cost)	1	2	3	4	5
CAPITAL (Turnover capital more quickly)	1	2	3	4	5

11. Please note any other critical issue relating to your organisation's information management.

THANK YOU FOR YOUR TIME AND EFFORT.