Martyn Woolfall
The implementation of an information system
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THE IMPLEMENTATION OF AN INFORMATION SYSTEM

Volume 1

By

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SUMMARY

THE IMPLEMENTATION OF AN
INFORMATION SYSTEM

By Martyn Woolfall, BSc (Hons)

In the modern world information systems (I.S.) allow businesses to change and restructure in order to meet the demands placed on them by the dynamic world. In the past, because change was not required, organisations evolved into rigid structures which meant that change was problematic.

The ability to select and implement effective I.S. in any organisation is critical to its success. It is no longer the case of simply installing a network of computers for data input but a case of restructuring the business processes to make that organisation more able to function in an increasingly interconnected world. This can lead to new opportunities and competitive advantage if implemented successfully and ruin if not. The importance and use of business analysis, selection, evaluation and implementation methods to carry out such a task is crucial.

The objective of the research is to examine the project life cycle of implementing an 'off the shelf' I.S. within an organisation in order to determine how effective they are and what quantifiable benefits such projects bring to the organisation. All too often in the news we here stories of failed I.T. projects. New systems have either failed to deliver on time, to budget, failed to improve business processes or have even been abandoned before the end of the project. Emphasis will be placed on a systems review and implementation project at a manufacturing S.M.E. called Company A.

Company A face continued pressure from key customers for faster distribution and high quality goods while cutting back on cost. This means that that the organisation, which once prided itself on high quality internal production, now looks to overseas factories to meet their capacity whilst still being responsible for the design, quality and distribution of their product.

New technology is playing an important and increasing role in aiding the company meet its objectives with the introduction of a new integrated I.S.

The new system is geared specifically towards supply and distribution, is industry specific, and allows improved control of the company's supply chain performance, offering a much greater control of stock, individual sales and sourcing orders

The thesis concludes that manufacturing S.M.E.'s are likely to find it increasingly imperative to streamline business processes in order to meet targets and deadlines set by economic factors and customer demands. New technologies and the methods utilised will continue to play a central role in achieving this.

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed....MP Woolfall........... (Candidate)

Date.....23/10/2008..........

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated.

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed.....MP Woolfall..... (Candidate)

Date.....23/10/2008........

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

Signed.....MP Woolfall..... (Candidate)

Date.....23/10/2008........

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I would like to express my gratitude to all those who gave me the possibility to complete this thesis. From the instigators of the K.T.P. for providing the opportunity in the first instance, and furthermore, to Mr. J. Mott who encouraged me to go ahead.

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Chapter 1

INTRODUCTION

"Religion hinges upon faith, politics hinges upon who can tell the most convincing lies or maybe just shout the loudest, but science hinges upon whether its conclusions resemble what actually happens"

- Attributed to Ian Stewart (1945 -)

1.1) Information

Information can be defined as follows:

Facts told; knowledge gained or given; data stored in a computer etc. (Cashmore & Lyall, 1991)

Information can also be defined as data in a context; you know the meaning of the data. Tsitchizris & Lochovsky (1982) define information as being '*an increment of knowledge which can be inferred from data*'. Beynon-Davies (1998) defined data, information and knowledge as follows:

'Data is facts. A datum of data is one or more symbols that are used to represent something. Information is interpreted data. Information is data placed within a meaningful context. Knowledge is derived from information by integrating information with existing knowledge'.

Figure one shows the relationship between data, information and knowledge.

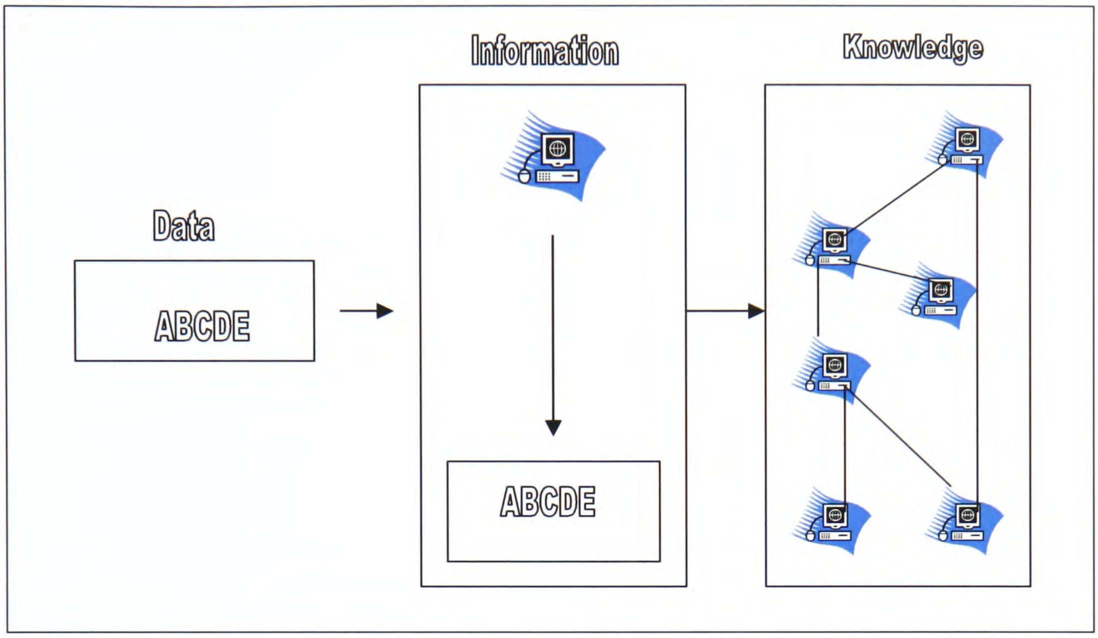


Figure 1 - Data, information & knowledge (Beynon-Davies, 1998)

History has shown us that information whether true or false can have a major impact on events. For example, Cashmore & Lyall (1991) states that in 1988 a report went onto the news that a nuclear disaster had taken place in the then U.S.S.R. similar to the Chernobyl disaster. This had a dramatic effect on stock markets as they reacted to the news, altering the value of gold. Later it was proved to be a false alarm; apparently it was only a test message.

There have been many other examples such as rumours of the death of the president of the U.S. which also had a major effect on the stock market until it too was proved to be false. These examples illustrate the importance of information and raise the issue that if an individual has a piece of information to which others are not privy, or receives information in an advance state then it can be used for advantageous purposes.

The examples given here have been in relation to the stock market however the same parallel can be drawn with organisations. Organisations should use information to react more quickly than its competitors in certain circumstances. It has been proven that the organisation that makes a strategic move first would improve and strengthen its position to that of its competitors, assuming that the move is correct. An example of this is provided by Buckley (1995) who mentions the case of M&S (page 18) who used information collected by a charge card for marketing purposes. This information allowed M&S to change the structure of the products and services they offered.

Based on these examples it is reasonable to draw the conclusion that information is a valuable asset to the organisation.

In recent times information has come to be valued as much (if not more) as any other asset to the organisation such as visible solid assets like buildings, or equipment. When one thinks of organisational assets; people, buildings, equipment, materials and money spring to mind and are difficult to ignore. Information, it has been argued, has proven to be just as important. Hiroyuki Itami (1991), professor of Management at Hitotubashi University supports this view and is indeed of the opinion that real competitive advantage comes not from the visible asserts stated, but from the invisible asset of information.

It should be noted however that just having information does not result in competitive advantage, but how that information is used can. It should also be noted that not all information is good information. People can be overloaded with information which can hinder the decision making process. The processing of data to information to knowledge is important and this is where systems and computer systems come into play.

A computer system is defined by Sinclair (1991) as follows:

The computer and all of its attachments, its actions, inputs and outputs, considered as a whole.

Systems are made up or defined by a coherent set of independent parts which exist for a specified purpose. These independent parts can be viewed separately; however it is more useful to look at the system as a whole.

Systems are recognised as having an input-process-output model in a given environment. The environment might be defined as anything outside a system that has an effect on the way the system operates.

- The inputs to any system are the resources it gains from its environment or other systems.
- The outputs from the system are that which it supplies back to its environment or other systems.
- The process of the system is that activity that transforms the system input into system outputs.

Most organisations are viewed as open systems which imply that they are affected by their environment and other systems. Every human activity system (H.A.S.) will have one or more information systems. The purpose of these information systems is to help manage the human activity.

1.2) Information System (I.S.)

In order to get information to flow from its source to an individual who can use it we have to implement some sort of system to collect, store and move the information within the organisation. Typically these systems have been a series of computer systems linked to a database holding stored information. It is the linking of individual information systems that produces a corporate information system.

This system is much more than just physical assets and is built up over a number of years, by an organisation, and as such is an asset that cannot easily be replaced.

I.S. can be diverse and have many different set-ups; however there are four common elements and these are defined by Edwards, et al (1995):

- *Collection of data: facts, figures or rumours.*
- *Storage of data: whether on a computer, folders in a filing cabinet or in ones head.*
- *Manipulation of data: arranging, collating, aggregating and interpreting it.*
- *Presentation of data: arranging, collating, aggregating and interpreting it.*

1.3) Data and information

Information within organisations is made up of raw material called data. If any useful I.S. is to survive it must be constantly supplied with the required data. This data can be collected from a wide variety of sources, internally and externally, and can comprise both facts and figures.

Data is not information until it has been arranged in a suitable manner for a particular individual to comprehend and extract meaning. Information is data endowed with relevance and purpose (context).

Information should however have purpose and contribute to the aim or the relevant organisation concerned. Information that does not contribute to this simple objective can be costly, thus data should always be carefully examined for relevance before it is collected in any way.

In the current work environment this has become difficult as (with the advance of technology) organisations have expanded the amount of information it provides managers, often without identifying, whether the information is useful and required. Figure two shows the process of collecting data to making decisions.

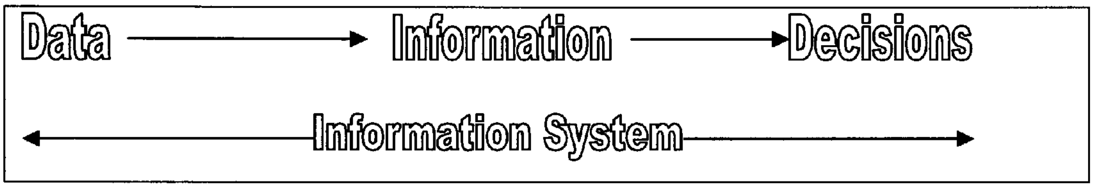


Figure 2 - Data, information & decisions

According to Cashmore & Lyall (1991) I.S. have different sub-systems, which have different functions and purposes. However they all attempt to fulfil one of the following purposes:

- *To collect and store data which are capable of being turned into useful information which may be required by the organisation at a later date.*
- *To provide, in a suitable form, the operational information required by employees to perform their jobs to the best of their abilities and to ensure the smooth day-to-day running of the organisation.*
- *To provide, in a suitable form, strategic information to managers so that they can make the best possible decisions about the future of the organisation.*
- *To extract the value chain of the business. By this it is meant that the organisation's Information System should link with the external Information Systems. In particular to those of suppliers and customers, thus creating benefit and providing further information. For example, a manufacturer of a product would find it useful to analyse final customer purchases through a particular type of retail outlet.*

The history of I.S. has shown a strong emphasis on the collection and storage of data that in some way relate to typical business transactions and on the provision of operational information. This resulted in much time spent collecting data which was typically assumed to be of importance. This was at a time when the business world was very static; in this time the future required little planning because nothing really changed. Much time was spent on typical day-to-day activities and the use of I.S. in management decision making, for strategic purposes, was not emphasised.

Recently, with the ever changing environment and increased competition strong emphasis is placed on I.S. in making strategic decisions and if several organisations are in competition, the one which has the best information (in terms of relevance, speed, accuracy etc) is most likely to succeed and gain competitive advantage.

1.4) Importance of I.S.

The importance of information, and information systems, in the modern organisation is critical if the organisation wants to survive long-term and make profit. Information and I.S. helps the organisation meet its primary need of meeting customer needs in a more satisfactory and profitable manner than its competitors.

I.S. within the modern organisation must in some way provide a benefit that is easily perceived, or indeed reduce the cost of a particular service or product. Thus the common theory by inexperienced people that I.S. is just used to store data, or automate processes, is inaccurate and blind of the true potential and benefits of I.S. Information obtained should be used to provide a better service or product in terms of better quality of service, or product, in terms of cost or delivery time.

1.5) I.S. Influence on business strategy and structure

Successful organisations can be seen to have correctly integrated I.S. within their organisations (Bagranoff & Brewer, 2003), and where organisations have been less than successful the implementation or reengineering of system to business processes has often broken down (Lee & Lee, 2000).

There might be different levels of organisational structure brought about by technology and the change will vary according to this. For example, a small book keeping system introduced in a small family business might make the employment of a bookkeeper unnecessary. Depending on the scale, the I.S. may directly affect the change of structure of the organisation, and with the evolution of more integrated systems, enterprise resource planning systems (E.R.P.) are now being used to govern the very structure of the organisation.

Just as I.S. can change the structure of businesses and organisations they can also alter entire industry structures. An example of this is given by Buckley (1995) and mentions the case of M&S and how they changed the retail industry by introducing a simple charge card. They introduced the charge card and this brought retailers into the market of customer finances, historically only provided by banks. Consequently, they were able to build large databases of customer information and were able to extend into financial insurance and change the structure of the products and services they offered.

Other examples of effective use of I.S. are provided by Robson (1997) and Beynon-Davies (2002) in industries such as electronics, banking, hospitals and the airline industry. All these examples demonstrate how the creative use of information can lead to new products, services and competitive advantage.

The use of effective I.S. has had a knock on effect of changing the way retail is conducted. However, there have also been a number of instances where I.S. has either been delivered late, at higher than expected cost or where perceived benefits have not been realised. Typical U.K. examples are provided by Robson (1997), Nash (2000), Beynon-Davies (2002), and the Economist (2004) in various industries such as healthcare, air traffic control, stock markets and government.

In most cases failed I.S. projects result in inconvenience or spiralling costs; however they can also cost lives. Beynon-Davies (1995) documents the case of the London Ambulance Service Computer-Aided Dispatch system (L.A.S.C.A.D.) implemented in 1992, which found it could not meet the demand of emergency calls entering the system, and consequently, calls were left unanswered. It is estimated that 20 to 30 lives may have been lost as a direct result of this system failure which also cost £1.5 million.

Such failure is not just limited to the U.K.; Oz (1994) describes the case of the Confirm reservation system in the U.S. which overran to the cost of $125 million. In recent times, U.K. government I.S. projects have received much attention as they continually run late, over budget and are besieged with technical problems. The most recent examples includes upgrades to the N.H.S. patient records system (Major N.H.S. I.T. project hit by delay, 2006) while other projects such as the issuing of passports, the criminal records bureau and the child support agency have all suffered well publicised problems (Pym, 2006).

According to Taylor-Cummings (1998), Beynon Davies (1998), Clarke, et al (2000) and Burton, et al (2001) most I.S. failures seem to be linked with the social-technical interface meaning that even if the I.S. is well built and the project well managed it may still fail for user, organisational and/or environment reasons. This implies that there is a culture gap between the I.S. professionals and their business counterparts, and that projects tend to be focused primarily on technical concerns, and as a result, user, organisational or environmental concerns are not always accounted for. This would suggest that a combination of business analysis methods, such as business process reengineering (B.P.R.) & soft systems methodology (S.S.M.) are crucial to the success of any I.S. or change related project.

1.6) Need for research

Information Systems are changing at an increasing rate and with the new technology comes new opportunities for organisations to change the way they do business. Typical perceived benefits are

1) More efficient information flows through systems integration.
2) Reduction of overheads through automation.
3) Better access to management information.
4) Greater ability to adapt to changes in the market place.
5) Increased use of resources through tighter control.
6) New market opportunities though the use of new technology.

Despite the perceived benefits many I.S. projects have failed in whole or part, equally many organisations have implemented new systems and not realised any real benefit.

1.6.1) Thesis aim

The aim of the research is to determine the need, best practice and critical success factors when implementing information systems in the SME environment, in order to determine how effective they, are and what quantifiable benefits are realised. Emphasis will be placed on a systems review and implementation project through the use of a single company in-depth case study approach.

The current literature with regard I.S. implementations, and in particular when referencing information systems solutions, and the associated critical success factors, is advanced but few studies focus on such projects from the S.M.E. perspective. The S.M.E., like all organisation types, has become increasingly dependent on technology in the rapidly changing and interconnected global world.

This research project will help to bridge the gap between information systems implementations, critical success factors and the S.M.E.

1.6.2) Thesis objectives

In order to explore these issues and come to a conclusion about information system projects in relation to the S.M.E. it is necessary to undertake the following.

a) Review the business analysis, system selection and implementation methods typically used when implementing information systems in the S.M.E. environment.
b) Review the role of technology in relation to the S.M.E. to better understand the opportunities available.
c) Identify the critical success factors adopted by organisations in I.S. change related projects.
d) Identify the need for and benefits gained by such projects and how they are measured.
e) Review the business processes of an active S.M.E with the view to improving the current situation by way of implementing an off the shelf software solution:
    a. Utilise identified business analysis methods and perform an analysis of the organisation, business processes & information flows and produce a weighted user requirements document which is auditable and traceable to the business analysis.
    b. Develop a software selection process which can be used to identify, evaluate and shortlist solutions based on the results from the business analysis carried out.
    c. Re-engineer the business processes by the combined implementation of more integrated financial & customer/supplier-oriented software along with appropriate hardware base.

d. Produce financial figures to determine the projected benefits and savings over a five year period after implementation in order to determine the success of the project.

f) Based on the active case study, expand on current literature and develop critical success factors and/or guidelines which would be applicable to other S.M.E.'s going through a similar change related project.

The main activities of the project will be concerned with addressing the software and hardware systems required to meet the company's objective of increasing cost effectiveness. A highly efficient up to date supply chain management I.S. will be the main focus in achieving the company's objectives.

The ability to integrate order processing to the accounting ledgers is seen as crucial in making the whole system more efficient and removing potential errors due to the double handling of data.

Changes will be made to the network infrastructure to allow all sites to access the network and place orders on the system. This will complete the supply chain for automatic stock and order processing which is presently carried out on a manual basis.

The case study of Company A will allow the author to understand best practice in terms of systems selection, implementation and business analysis as well as understand the expectations and eventual results such change brings. Company A is discussed in more detail in Chapter 4.

1.7) Chapter conclusions

In this first chapter an introduction to data, information, knowledge and the information system was provided along with their importance to the organisation.

In the modern world I.S. allows businesses to change and restructure in order to meet the new demands placed on them by the dynamic world. In the past, because change was not required, organisations evolved into rigid structures which meant that change was problematic.

The ability to implement effective integrated I.S. to any organisation is critical to its success. It is no longer the case of simply installing a network of computers for data input but a case of managing, restructuring or reengineering the business processes to make that organisation more able to function in an increasingly global, interconnected, competitive and streamlined world. E.R.P. systems have helped in this regard by removing traditional walls between departments and integrating business processes.

This can lead to new opportunities and competitive advantage if implemented successfully and ruin if not. The importance and use of business analysis methods (such as B.P.R. and S.S.M.) is critical when implementing new systems.

The case study of Company A will provide first hand experience in terms of business analysis, requirements gathering, information systems selection and implementation as well as provide an understanding of the expectations and eventual results such change brings.

1.7.1) Thesis chapter summary

Provided over the next two pages is a brief description of the chapters of the thesis.

1.7.1.1) Chapter 1 – Introduction

Chapter 1 has introduced the area of research and clarified important concepts at a high level. This chapter introduced the relationship between data, information, knowledge and information systems and gave examples of their importance to the organisation.

1.7.1.2) Chapter 2 – literature review

The literature review will cover the various methods used to select, evaluate and implement information systems into the organisation, in particular, business process reengineering (B.P.R.), soft systems methodology (S.S.M.) and requirements engineering.

1.7.1.3) Chapter 3 – Research method

This chapter will state the research strategy, methods and techniques adopted for the research.

1.7.1.4) Chapter 4 – Company A - an introduction

Chapter 4 will introduce, in more detail, the case study of Company A which will offer first hand information on implementing an information system. This chapter will concentrate mainly on the feasibility study stage of the project and will identify economic trends which are impacting on the organisation and have initiated various change related projects.

1.7.1.5) Chapter 5 – Company A – soft systems specification

This chapter will begin to look at the business analysis stage of the project by applying a soft systems analysis to Company A in order to understand the various users and stakeholders within their environment.

1.7.1.6) Chapter 6 – Company A - business analysis specification

Chapter 6 will continue to look at the second stage of the project: that of formally analysing the business requirements, in terms of managing the product line and order cycle. Process analysis techniques will be adopted.

1.7.1.7) Chapter 7 – Company A – network analysis

This chapter will conclude the business analysis by looking at the network set up within Company A.

1.7.1.8) Chapter 8 – Company A - business requirements specification

This chapter will look in depth at the I.T. requirement of Company A and the I.T. evaluation and selection process adopted thereafter with regard to both hardware and software.

1.7.1.9) Chapter 9 – Company A- implementation stage

Chapter 9 will look at the third stage of the project, that of implementation. Emphasis will be placed on the main issues surrounding change in key areas. This chapter will also look at the constraints the project faced from multiple angles, for example, changes to the project plan and how these were managed.

1.7.1.10) Chapter 10 – Company A – cost benefit analysis

Chapter 10 will concentrate on post implementation issues, either left over from the implementation stage of the project, or other factors which had arisen since that stage. This chapter will look at the original aim of the project and attempt to measure the benefits realised.

1.7.1.11) Chapter 11 – Conclusions

This final chapter will provide a summary of the conclusions of the thesis. It will also provide a formal response to the thesis aims and objectives.

1.8) Chapter summary

This first chapter has introduced the importance of information and the information system to the organisation. It also established the importance of keeping pace with technology from the organisational perspective and provided examples of this. Chapter 2 will research business analysis methods used to implement information systems into the organisation, in particular, two distinct approaches to analysing the place of information systems within the context of the organisation, B.P.R. and S.S.M.

The review will also look into requirements engineering, implementation strategies, total cost of ownership and role of the E.R.P. system, from the perspective of the S.M.E., in order to assess its suitability and affordability at providing an integrated software option.

C h a p t e r 2

MAIN LITERATURE REVIEW

"I have yet to see any problem, however complicated, which, when you looked at it the right way, did not become still more complicated"

- Alderson, P. 1969. New Scientist, 638.

2.1) Chapter overview

Chapter 1 introduced information systems (I.S.) and provided examples of their importance to the organisation. This chapter will review specific factors that are relevant in implementing an 'off the shelf' I.S. within an organisation.

Organisations have responded to the age of global competition by analysing and then reengineering their business processes (B.P.). They have introduced changes to organisational structures and used technology as a key enabler to do so. More integrated enterprise wide information systems, for example, have helped to tear down traditional and functional walls between departments and to streamline B.P.

In this chapter traditional business analysis methods, in terms of business process reengineering (B.P.R.) and soft systems methodology (S.S.M.) are reviewed, extending to requirements engineering, systems acquisition, implementation strategies and enterprise resource planning (E.R.P.) systems in identifying if they are suitable and affordable for small to medium sized companies. Consideration will be given to the relevance of the issues discussed to the case study of the organisation Company A.

2.2) Traditional Business Analysis (B.A.) methods & the S.M.E.

According to the Oxford English Dictionary a method is a '*way of doing something or a system of procedure*' whereas a technique '*is a specific approach to producing some product of I.S. development*'. We can therefore say that a method is some organising framework for the application of techniques.

Beynon Davies (1998) considers two different levels of method; the first considers two approaches to analysing the place of I.S. within an organisational context, a process defined as business analysis (B.A.), the second concentrates on four distinct approaches to the development of I.S.

The term B.A. is used here in the context of the analysis of I.S. within S.M.E.s. This means, the process of analysing the organisational objectives and needs within its environment. The end purpose of this process would be to change the way the organisation operates by a more appropriate use, or alignment, of technology and in particular the information system.

In carrying out a business analysis the following needs to be considered, as described by Beynon-Davies (2002):

- *The analysis of the informal systems of the organisation.*
- *Analysing the overall objectives and needs of an organisation and identifying the place of the organisation within its environment.*
- *Considering different ways in which an organisation (whole or part) may work.*
- *Identifying the most fruitful place for information systems and information technology within some organisation.*

The role of the business analyst has emerged over the last ten years and is relatively undefined in that many employers advertise for business analysts with varying business and/or technical skills, which are usually the job of a systems analyst, or at the other end of the scale, a strategic analyst (Paul & Yeates, 2006).

A typical definition of the role of the business analyst from the literature is as follows: *'the business analysts role is the production of clearly stated business requirement definitions, which can be passed to a system designer to be turned into specifications that are the input to the development processes'* Yeates & Wakefield (2004). Thus the business analyst is not typically involved in the software development process, but sits between the organisation and the systems developers.

This view is supported by Paul & Yeates (2006) who state that B.A. is covered by three areas, strategic analysis, I.T. systems analysis and the core activity business analysis.

Senior management will make the strategic analysis decisions for any organisation while the business analyst will support this activity, in identifying transformation actions, and will at least need to have access to and understand whether technological developments can open up strategic opportunities for the organisation. Typical activities in this area might include external and internal analysis, in order to understand how economic and political factors are impacting on the organisation, and this could feed into the S.W.O.T. analysis in order to analyse the results.

I.T. systems analysis sits at the opposite end of the spectrum and is concerned with specifying the I.T. system requirements in enough detail as to be able to produce a detailed requirements specification; this will be used as the first stage in the development of a bespoke I.S.

Typical activities include process, data and functional modelling, in order to describe the system requirements in terms of what the system will be required to do at various levels. This technical analysis would directly feed into the software engineer who would then develop the associated code. Many organisations separate this function from the B.A. in that it is deemed outside the role of business analyst, and is the job of the I.T. department, and in particular the systems analyst. In this scenario the business analyst produces a less technical document of business requirements which is used as the input to the systems development or tendering process.

In reality the business analyst should sit between the areas of strategic and systems analysis and have an understanding, if not direct involvement, of the two. Business analysts are required to investigate a business system, where improvements are required, and the role is usually defined as follows:

1) Resolve a localised issue, or issues, by recommending actions that would overcome the identified issues and achieve business benefits, which usually involve efficiency or effectiveness. The plan of action is usually a detailed process analysis which is backed up by a sound business case.

2) The second scenario usually involves enhancing or replacing existing I.S. in line with business requirements. In this instance the business analyst would engineer a requirements document which defines what the organisation requires the I.S. to provide.

In either scenario the analysis begins with the business analyst gaining an appreciation of the organisation in question. The initial problem is usually defined in specific and general terms and requires a more detailed understanding.

The business analyst needs to understand the processes, systems, people and culture involved in any situation and will use various techniques such as stakeholder analysis, business process modelling and requirements engineering in order to improve the business system.

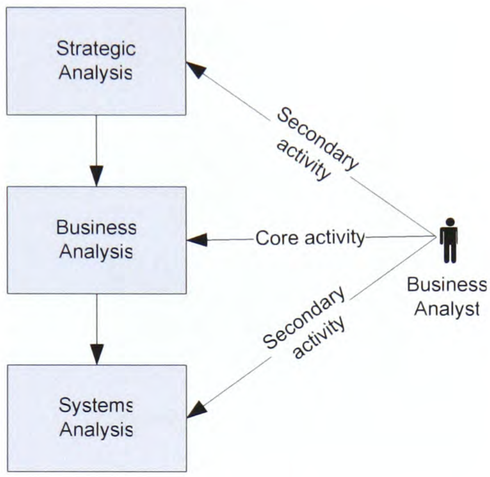


Figure 3 - Range of business analyst role

In this sense a more useful definition of the business analyst role is provided by Paul & Yeates (2006) and is as follows:

'An internal consultancy role that has the responsibility for investigating business systems, identifying options for improving business systems and bridging the needs of the business with the use of I.T.'

Figure 3 illustrates the range of roles of the business analyst and whilst there is a unified approach to systems development, there is no such approach to business analysis and systems development, which had led to the abstraction gap (Kleppe et al., 2003), (Frankel, 2003) and (Tolvanen, 2005).

This abstraction gap can lead to a misalignment between written code and the original business requirements (Figure 4).

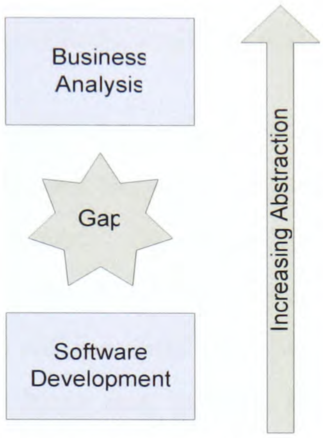


Figure 4 - Abstraction gap

2.2.1) Conclusions

B.A. is the analysis of I.S. within the organisation. That is the process of analysing the organisational objectives and needs within its environment. The end purpose of this process would be to change the way the organisation operates by a more appropriate use of technology and in particular the information system. The business analyst is an internal consultancy role that has the responsibility for investigating business systems, identifying options for improving business systems and bridging the needs of the business with the use of I.T.

Within organisations there is some confusion between the roles and responsibilities of the business analyst and software developers and there is no agreed, and unified, approach that covers both business analysis and systems development. This often leads to a misalignment between written code and the original business requirements called the abstraction gap.

In the following part of the literature review it is appropriate to concentrate on the business analysis methods used to analyse the place of the information system within an organisational context. In terms of Company A, no software development is required and the B.A. carried out will be used to specify the requirements required of an off the shelf I.S. Beynon-Davies (2002) describes two distinct approaches to achieve this, business process re-engineering (B.P.R.) and soft systems methodology (S.S.M.).

2.3) Introduction to Business Process Reengineering (B.P.R.)

B.P.R. first appeared in I.S. journals in the early 1990s (Hammer, 1990) and (Hammer & Champy, 1993). Hammer & Champy (1993) define B.P.R. as: "*The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed.*" Put more simply several years earlier Davenport & Short (1990) define B.P.R. as "*The analysis and design of work flows and processes within and between organisations*". Teng et al. (1994) defines B.P.R. as "*the critical analysis and radical redesign of existing business processes to achieve breakthrough improvements in performance measures*".

The common thread between all these definitions is the focus on the business process (B.P.); Hammer & Champy (1993) define a B.P. as *a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer.* Davenport & Short (1990) define the B.P. as *a set of logically related tasks performed to achieve a defined business outcome.*

Porter & Miller (1985) propose the value chain method as a useful technique for identifying B.P., by which the organisation delivers a product or service, and while there are many instances of B.P. there are three types common to the organisation; management, operational and supportive processes.

Table 1 lists the typical characteristics of the B.P. from the literature while Figure 5 illustrates a set of activities that transform a set of inputs into a set of outputs.

Business process characteristic	Comment
Customers & boundaries	Input, process & output.
Varied and complex	Involving resources and information.
Dynamic	B.P. need to respond to market conditions and the changing demands from customers.
Distributed	B.P. often spans multiple locations, applications and technical platforms.
Long running	B.P. can take long periods of time to complete the cycle. For example an instance of a sales order may take several months before an invoice is settled.
Largely automated	Through the use of technology most B.P. have been automated.
Invisible	Business processes are often undocumented and deeply embedded into the organisation.
Dependent on the human factor	Despite being largely automated B.P. are still dependent on the human factor for unstructured tasks and to make use of information flowing through the value chain.

Table 1 - Business process characteristics

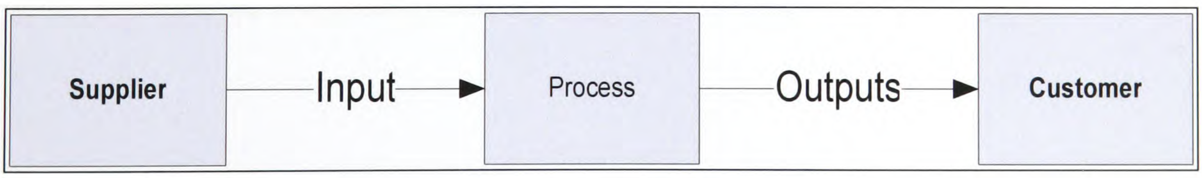


Figure 5 - Typical business processes

A B.P. can be part of a larger, surrounding process and can include other B.P. or sub-processes that have to be included in its process. Within this context a B.P. can be viewed at various levels of discrete components of ever-smaller size. These multi-level processes have to add value to the organisation and are seen as the workflows which realise an organisation's use-cases.

In the modern environment B.P. need to be managed and/or modified for a variety of reasons. Global competition, changing customer requirements, joint ventures, legislative factors and mergers all place demands on the organisation to be able to modify existing processes, in order to adapt, and during the 1990s re-engineering was the preferred method by which to meet these increasing demands. As such, a B.P. was usually the result of some form of re-engineering work, while business process modelling was used to capture, document and reengineer B.P.

During the reengineering heyday of the 1990s the alternative business improvement methodology to B.P.R. was continuous process improvement, which recommends small and measurable changes to an organisation's current processes and systems. Continuous process improvement has its origins in total quality management (T.Q.M.) and six sigma. Six sigma and T.Q.M. are terms often confused with B.P.R., as all are change initiatives, with the main difference being B.P.R. (top down) is focused on radical change while Six Sigma and T.Q.M. focus on continuous, (bottom up) incremental improvement (Davenport, 1993), (Teng et al., 1994), (Al-Mashari & Zairi, 2000), (Selladurai, 2002), (Tonnessen, 2000), and (Ursic et al., 2005).

The literature concerning these two approaches is mixed in that there is a long history of conflicting reports as to their overall effectiveness. Some authors such as Emrich (2000), Hendricks & Singhal (2000) and Williams et al (2004) express support for T.Q.M. in terms of relevance, and financial performance for the organisation, while others suggest the approach is not effective in reducing costs, or identifying strategic failure and has been little more than a passing fad with many organisations implementing T.Q.M. in the wrong areas of the business (Byrne, 1997), (The cracks in quality, 1992), (The straining of quality, 1995), (Gerstner, 2002) and (Willcocks, 2002).

B.P.R. was born and evolved from a T.Q.M. background in that many organisations who use B.P.R., have either used T.Q.M., or are using a combination of both, as in reality few organisations will take the risk of scraping all B.P. and starting from a clean slate as advocated by B.P.R. research (Edwards & Peppard, 1994) and (Selladurai, 2002). The dividing line between these two approaches (radical and incremental change) can be blurred in that what appears to be radical change from a distance, on closer inspection, may be gradual incremental changes as part of a more radical long term plan with the research indicating that many projects during the 1990s did not offer radical change (Winslow 1996), (Lillrank & Holopainen, 1998) and (Willcocks, 2002).

B.P.R. has its advocates in terms of Davenport & Short (1990), Hammer & Champy (1993) and Earl (1994); however it has also received criticism from O'Connor (1994) who states that it is unnecessary if the organisation already practices effective quality management, while Smith & Fingar (2002) and Ramesh et al. (2005) are of the opinion that B.P.R. has never offered a path to execution, and business process management (B.P.M.), not reengineering, is required to control internal B.P. B.P.M., unlike B.P.R., is an ongoing process which believes that B.P. are continually evolving, and the organisation needs to change or adapt without starting from scratch each time. B.P.M. advocates a universal process language that manages the entire lifecycle of an organisations business improvement initiative.

Continuous process improvement and T.Q.M. are effective to obtain gradual, incremental improvement. However, over the last 15 to 20 years several factors have accelerated the need to greatly improve B.P. and Table 2 lists these.

Cause of B.P.R.	Comment
New technologies	New technologies (such as the Internet) are quickly bringing new capabilities to businesses and increasing the competitive edge and the need to improve B.P. ('Adapt or die' warning to companies, 1999), (Quinn, 2001). Increased evidence that competitive advantage and the implementation of new technology is related (Mason et al, 1997).
Various trends and factors	Downsizing, Y2K, pervasive networks, the Euro, deregulation, & terrorism – all require dynamic B.P. (Smith & Fingar, 2002).

Cause of B.P.R.	Comment
Global marketplace	The opening of world markets and increased free trade (China joins the WTO – at last, 2001). Such changes bring more countries & competition into the marketplace and competing becomes more difficult. In today's marketplace major changes are required just to maintain your position and it has become a matter of survival for many organisations as customers are demanding products and services at reduced prices. (Chinese manufacturing - a commercial imperative for most S.M.E.'s, 2004), (A rose-tinted vision, 2004) and (M&S asks suppliers for price cuts, 2006).

Table 2 - B.P.R. causes

As a result of these trends, organisations have sought out methods for faster business process improvement. Organisations are not satisfied with incremental changes and need wholesale change quickly. Because the rate of change has increased for everyone, few businesses can afford a slow change process and the one approach which does allow for structural change and dramatic improvement is B.P.R.

2.3.1) B.P.R. process

There is no one agreed approach to B.P.R. work although Beynon-Davies (2002) and Barber & Weston (1998) broadly define a five point process:

1) **Strategic analysis** – Developing a strategy and vision to move the organisation forward and identify transformation opportunities.
2) **Business analysis -** High level mapping of the organisational processes using a form of systems modelling, indicating key process boundaries. From the processes identified, priority needs to be given in terms of importance to the project.
3) **Process redesign** – Involves the reengineering team identifying problems with the current processes and along with stakeholders, challenging assumptions of new approaches to organisational activity.
4) **Process specification –** The modelling of the existing and the design of new processes using an agreed notation.
5) **Process implementation –** Generally agreed to be the most difficult part of the process, introducing new work practices and technologies into the organisation.

B.P.R. does not recommend any one particular form of system/process mapping; however, typical examples include conceptual, structural and object modelling. These approaches are used in a top-down manner in that systems can be broken down into sub-systems, and each of these can be broken down further depending on the level of detail required. Structured systems analysis and design methodology (S.S.A.D.M.) or the unified modelling language (U.M.L.) are particularly suited if the project is one of software development, requiring detailed systems analysis, however (refer to 2.2.1) there is no unified approach to both business and systems analysis.

Gunasekaran & Kobu (2002) and Mentzas (1999) document numerous modelling techniques typically adopted when undertaking B.P.R., and where they are best suited. Appendix 1, Table 1 describes and lists several methods and techniques typically adopted by a systems analyst in order to model data and information within the organisation.

2.3.2) I.T. as the B.P.R. enabler

In addition to T.Q.M., B.P.R. can be categorised in the following areas of interest (Earl, 1994) Business Change, Change Management and Systems Analysis. Hammer (1990), Earl (1994), Beynon-Davies (1998) and Ursic et al. (2005) add to this by linking additional elements such as a greater emphasis towards B.P. and I.T. as the key business enabler to the change. The research also suggests that I.T. is the biggest single cost during the change process (Willcocks, 2002).

The most striking characteristic is the notion that I.T. is the main enabler of B.P.R. work. This is taken further by Earl (1994) who suggests that I.T. dominates B.P.R. work. Despite this fact Moad (1994) writes that I.S. people find it difficult to work on B.P.R. projects, because of their revolutionary nature, and tend to take a traditional approach of automating existing processes rather than radical re-design.

Moad goes on to suggest that this is because of the traditional nature of creating applications for single departments, as opposed to multiple functions, which was starting to happen as organisations became more integrated and streamlined. This view is also shared by Hammer & Champy (1993) who state that "*The fundamental error that most companies commit when they look at technology is to view it through the lens of their existing processes. They ask, 'How can we use these new technological capabilities to enhance or streamline or improve what we are already doing?' Instead they should be asking, 'How can we use technology to allow us to do things that we are not already doing?*"

In recent times organisations have to adapt continually to economic and technological change. Downsizing is a result of several trends, such as returning to core competencies and the flattening of organisational structures, and in all these cases, I.T. has been a key enabler (Hammer, 1990) and (Caron et al., 1994). Despite this research many organisations still do not understand or appreciate the benefits of I.T. and simply treat new technology as they would a utility as advocated by Carr (2003). However, unlike utilities I.T. cannot simply be purchased and installed, it needs to be customised and aligned with the business, information and technical requirements of the organisation. I.T. must have a clearly defined role and the I.T. infrastructure has to be compatible with, and support, the B.P.R. strategy (Al-Mashari & Zairi, 2000).

There have been documented examples where I.T. has been implemented poorly and these examples originated from a lack of understanding as to how I.T. would be integrated into the organisation and these led to various degrees of business failure (Why General Managers Need to Understand Information Technology, 2006), (Beynon-Davies, 1995) and (Economist, 2004).

Research suggests that B.P.R. projects can fail for a variety of reasons, with the literature suggesting that only 30% of projects are successful (Hammer & Champy, 1993). B.P.R., as specified, is high risk in that it promotes revolutionary change to the organisational business processes and this has proved difficult for most organisations to introduce.

2.3.3) B.P.R. failure

Hammer (1990) and Hammer & Champy (1993) suggest that the main reason for this high failure rate is the lack of ongoing support, or ambition from project sponsors, although they note that B.P.R. projects are high risk. This lack of ambition is supported by Willcocks (2002) who found that the majority of organisations using B.P.R. (in the 1990s) were setting their sights low and away from core processes. Thus achieving significant and radical improvement, as prescribed by Hammer (1990), was always unlikely. Several articles suggest additional reasons for the high failure rate and these are presented in Table 3, while Table 4 lists popular misconceptions regarding B.P.R. which has led to the misalignment of the method within the organisation.

Reason for B.P.R. failure	Comment
Narrow view	Delvin (2002) believes that a narrow view of B.P.R. inherently inhibits progress and adds to B.P.R. failure. He goes on to say that a wider view would advance academic research and industry practice. The argument made by Delvin is that B.P.R. is only concerned with making changes to B.P. and this misdirects developers into focusing exclusively on processes while ignoring other important factors. Delvin concludes that the B.P.R. method must embrace a wider perspective as re-engineering may differ depending on the strategic direction of the company, inherent culture, leadership and the supply chain. (King, 1994) B.P.R. projects fail because they compromise strategic dimensions and place too much emphasis on tactical aspects. This view would suggest that B.P.R. inherently has strong strategic dimensions which are often overlooked. King goes on to suggest that the ultimate success of B.P.R. lies with how well the organisation can motivate the people involved, at all levels, in applying their knowledge to the re-design of the B.P.
Lack of Flexibility	Bashein et al. (1994) and Fitzgerald & Siddiqui (2002) argue that for reengineered systems not to inhibit future business and environmental change, flexibility must be incorporated into the B.P.R. activities. They suggest adding a flexibility analysis to the B.P.R. process in order to move the focus away from current requirements towards a longer term, more flexible and enduing set of requirements.

Reason for B.P.R. failure	Comment
Association with downsizing	During the mid 1990s the method became linked with the economic depression in the U.K. B.P.R. was seen as a means to cut costs and jobs as organisations looked for ways to restructure (Death by a Thousand Cuts, 1995). Bashein et al. (1994) Organisations set out to remove workers rather than redesign work processes as Hammer had intended. According to Smith & Fingar (2003) the misuse of Hammers work, and the intent behind his slogan "Don't automate, obliterate" was partly a backlash against the tendency of some corporations to believe that further enhancements in productivity could be gained solely by a redeployment of office automated systems rather than the much harder task of serious and significant organisational change.
Lack of soft systems involvement	B.P.R. involves complex socio-technical changes which are often not accounted for. (Teng et al. 1994), (Clarke et al., 2000). Likewise human, organisational and/or political components have traditionally not been catered for in many I.T. related projects which are based around engineering concepts (Bennetts et al., 1999).

Table 3 - Reasons for B.P.R. failure

B.P.R. Misconception	Comment
Radical change?	Despite the literature calling for radical change (Hammer and Champy, 1993), most companies use one of several approaches to change including not only reengineering but continuous process improvement, restructuring techniques and ad-hoc incremental approaches (Davenport, 1994) and (Willcocks, 2002).
B.P.R. support not required at lower organisational levels	B.P.R. is a top-down-approach to change, however its success depends very often on the participation and acceptance of workers at the grass roots level which is often overlooked.
Reengineering Vs Transformation	B.P.R. contributes to organisational transformation (O.T.) but cannot transform the organisation alone. According to Yogesh (1998), O.T. involves broader changes to the organisation not only including the B.P. but also organisational structure, strategy and business capabilities.

B.P.R. Misconception	Comment
Big bang approach	B.P.R. authors have tended to be of the opinion that organisations should not automate processes but start from scratch (Hammer, 1990). In practice this is rare, with the implementation usually achieved over several phased projects and this is supported by Stoddard & Jarvenpaa (1995) whose finding goes against Hammer (1990) in suggesting that while reengineering can deliver a radical design it does not promise a revolutionary approach to change. They go on to say that organisations that go with the revolutionary approach face the highest risks and costs.

Table 4 - B.P.R. misconceptions

Recent business initiatives have made the need to streamline, integrate and automate processes more pressing. Companies are seeking ways to integrate redundant processes and eliminate unnecessary tasks to a new level and according to Ulrich (2000) two things differentiate B.P.R. efforts of the 90s to the 2000s.

1) *The motivation for process integration within and beyond the main enterprise.*

2) *The ability to deliver technological solutions that not only streamline processes but also support external e-business requirements. The growth of the Internet requires that companies integrate processes that can extend to third parties.*

Ongoing developments in software development point to E.R.P. and E.R.P. 2 as changing the automation of the B.P. E.R.P. systems aim to integrate many departments and functions across the whole organisation onto a single system that can serve all the different departmental needs and requirements, ensuring accountability, and maintaining accurate and easily retrievable information (Business Process Re-engineering – is E.R.P. the answer?, 2005).

With the increased need for integration, automation and streamlining of business processes B.P.R. continues to be relevant in the modern scenario. With all the experience gained, new technology continues to be the main enabler and this is supported by the research. What is also supported by the research (Teng et al., 1994) is that B.P.R. involves complex socio-technical changes which are often not accounted for.

The most recurring reason for B.P.R. failure is that they do not consider the human and organisational consequences of the change and according to Reisman & Oral (2005) there is a common belief that a soft systems analysis and traditional systems thinking are mutually exclusive when in fact they are complementary.

Organisations are made up of human activity systems or activities which are performed by a group of people (users & stakeholders) and this must be accounted for when undertaking any change which involves systems and B.P. (Clarke et al., 2000). B.P.R. must encompass technical and human centered issues within a framework that allows both to contribute to the change. The alternative approach which has traditionally dealt with these soft, human centered issues has been soft systems methodology (Checkland, 1981).

2.3.4) Conclusions

Business analysis, in terms of B.P.R. and S.S.M., is the process of analysing the company objectives and needs within its environment. The key enabler to this is new technology, and typically more integrated information systems.

B.P. needs to be managed and/or modified for a variety of reasons. Global competition, new technology, downsizing, changing customer requirements, joint ventures, legislative factors and mergers all place demands on the organisation to be able to modify existing processes in order to adapt to the market and B.P.R. is a commonly used method by which to meet these demands.

B.P.R. is the fundamental rethinking and radical redesign of B.P. to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed. This radical nature of B.P.R. is seen as the major reason why 70% of projects fail, with many organisations carrying out continuous process improvement rather than the more radical 'Big Bang' strategy advocated in B.P.R. literature.

The research also suggests that many B.P.R. projects fail because they do not consider the human, and organisational consequences, and the popular belief has been that soft systems methodology and traditional systems thinking to be mutually exclusive when they are complementary. B.P.R. must feature both the empowerment of human resources and the use of I.T as the key enabler of the change.

2.4) Soft systems methodology (S.S.M.)

Most I.T. projects require a form of business analysis and it is widely agreed that both a 'hard' and 'soft' form of analysis is required, although there is no one agreed approach to conducting this. B.P.R. and formal process modelling (Gunasekaran & Kobu, 2002) can be considered a hard or formal business analysis method, which is useful when defining physical or structured situations. Soft systems methodology (S.S.M.), developed by Checkland (1981), was designed to deal with the real world, social, soft or ill-structured problems and will be considered in this section of the review.

Checkland (1981) argues that systems analysis typically encounters complex problems that are not well defined, and while it is relatively easy to define and model data and processes, these do not account for the inherent human activity systems (H.A.S.). A human system is defined as a collection of activities in which humans are involved. Checkland places great emphasis on people in his model, people who may have different and conflicting objectives, perceptions and attitudes which need to be accounted for in a given environment.

Wilson (1990) provides a suitable analogy when trying to understand the need for using a hard and soft form of analysis. He states that there are two forms of problems, and each requires a different method. The first example provided is that of a flat tyre. This type of problem is well defined, and the solution is clear. Hard methods are suitable in this regard because they are concerned with achieving assumed goals in the most efficient manner. The second example concerns problems in which the answer is more complex and unknown.

A current example would be what should western governments do about the problems in the Middle East? These types of problems are difficult to define, solve and measure and soft methods are needed in order to understand the various actors, problems, politics and environment. In this sense the solution, which is predictable in hard systems thinking, is unpredictable when using a soft method.

The literature on S.S.M. can be divided into three separate periods, each of which has resulted in a publication by Peter Checkland. The first, published in 1981, documented what is known as the seven stage model, while the second included the abandonment of the seven stage model in favour of a more flexible and iterative approach known as mode 2. The most recent period, does not include any further S.S.M. developments, but documents the increasing use of S.S.M. within various I.S. and management disciplines Checkland (1981), Checkland & Scholes (1999) and Checkland (2000).

2.4.1) Mode 1 approach

Defined originally in 1981, Checkland proposed a seven stage process to S.S.M. in which a problem situation is defined and alternatives considered. This is illustrated in Figure 6.

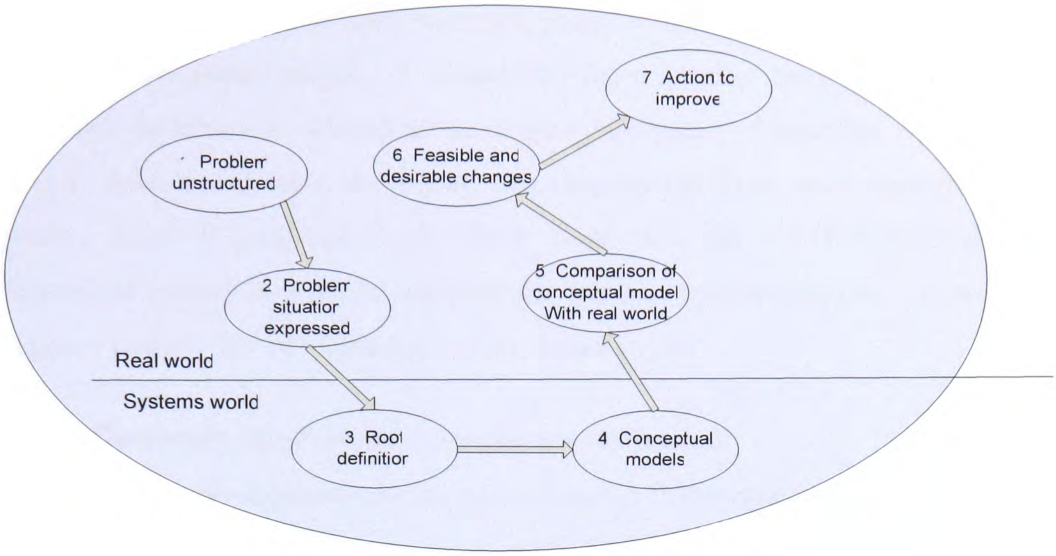


Figure 6 - S.S.M. (Checkland, 1981)

The first two stages (typically combined) involve analysing the problem situation from the different users present. In this regard there will be many different views and perspectives to account for, with many conflicting opinions from the users and stakeholders present. At this stage of the process it is important to identify as many of these as possible in order to appreciate the situation.

A rich picture is typically used in this regard and is simply an abstract high level drawing to represent the problem situation, by identifying the environment, structures, clients, processes and issues (or conflict areas) which are of most importance. The rich picture is usually constructed based on interviews, observations, and stakeholder analysis and is carried out by the B.A. This stage is typically iterative and does not attempt to solve any particular problem but helps identify issues and stimulate discussion between the various users.

The third stage of S.S.M. uses root definitions of the system in order to address themes from earlier stages. A theme may be a conflict between departments. The root definition is defined for each user perception of what the system does, why it does it and what the inputs and outputs are from each identified view point. Bergvall-Kareborn et al. (2004) states that the C.A.T.W.O.E. analysis (described below) is a useful method for creating root definitions in order to support the process of eliciting ideas for future actions.

- **Customer** who benefits from the transformation.
- **Actor** who facilitates the transformation to these customers.
- **Transformation** process from start to finish.
- **Weltanschauung** gives the transformation meaning.
- **Owner** to whom the system is answerable and/or could cause it not to exist.
- **Environmental** constraints that influence but does not control the system.

Stage 4 involves creating a conceptual model for the root definitions already identified. This model is a diagram of activities that attempt to identify what the system will do. This is an iterative process which attempts to stimulate debate and further modification of the root definitions in order to arrive at a final understanding of the problem situation.

Stage 5 involves comparing the rich picture, created in stage 2, with the conceptual model created in stage 4. This stage will also include further debate between the users and should lead to a set of recommendations as to the change required. This is also an iterative process.

Stage 6 is concerned with addressing the gaps between the conceptual model and the real world situation, identified in stage 5, and drawing up proposals which are needed.

The final stage recommends the action required to help the problem situation. These may include changes to identified activities or the introduction of new activities. Checkland does not recommend any particular method to do this; S.S.M. is at its best when identifying and defining a problem situation and not when implementing new solutions.

2.4.2) Mode 2 approach

The seven stage process described by Checkland (1981) is the method most referred to in the literature; however an alternative was proposed by Checkland & Scholes in (1999). This alternative suggests using a more generalised and iterative approach using the traditional S.S.M. models. Through this change, S.S.M. has moved away from focusing on specific activities to be carried out, and actions to be performed, and instead concentrates on the different perspectives behind these activities.

In this regard the seven stage model has changed to the two stream model (cultural and logic-based enquiry) eventually ending up in a basic shape model consisting of four phases (finding out, modelling, comparison, and taking action) Checkland & Scholes (1999).

- A stream of cultural enquiry.
    - Analysis of intervention.
    - Analysis of the social systems.
    - Analysis of the political system.
- A stream of logic-based enquiry.
    - Analysis of the Human Activity Systems.
    - Comparison with the real world situation.

The cultural enquiry examines the problem situation by considering the structure and culture of the organisation. The logic-based enquiry uses the human activity systems to illuminate the problem situation by comparing models with the perceptions of the real world. These comparisons aim to engineer a debate about the change process. The original focus on present structures and processes has been replaced by a social, political and historical focus.

2.4.3) S.S.M. applications

Evidence of the use of S.S.M. in complex social environments has been widely documented in various industries. For example, Clarke & Wilcockson (2001), Cook et al (2001) and Gibb et al. (2002) write how S.S.M. has been adopted in a number of health care environments where great emphasis is placed on resources, team working and where inter-agency practices have been prominent over the last decade. In these examples S.S.M. has successfully been used to introduce new care processes.

S.S.M. has also been adapted to more traditional organisational functions such as strategic and production planning in which it shares many attributes (Presley & Meade, 2002), while Mingers (2000) provides a detailed literature review of published case studies, using S.S.M., in many different and varied application areas. From this research there is evidence of not only the successful application of S.S.M. but also the use and linking of S.S.M., in combination, with other methodologies. In this regard S.S.M. provides a user-centered focus while the more traditional I.S. methods provide the detailed systems design and implementation.

Important characteristics which make S.S.M. popular in these examples are its adaptability & flexibility, in that it can be adapted to many different types of process modelling. Its nonlinear nature promotes a detailed learning scenario of the given problem situation and it's centered on promoting change through user involvement.

2.4.4) S.S.M. discussion

It is appropriate, and plausible, to adopt both a 'soft' and 'hard' form of business analysis (Atkinson, 2000). This is because S.S.M. is useful when defining the problem, and understanding the environment, but not helpful when implementing the solution. Consequently, attempts have been made to combine all the required elements into one methodology, with research indicating that a unified approach has still not been established (Al-Humaidan & Rossiter, 2001).

One particular example is a combination of S.S.M. & S.S.A.D.M. called Compact (CCTA, 1989), while another approach called Multiview uses S.S.M. techniques in the early stages and is aimed at smaller projects which do not require be-spoke development (Beynon-Davies, 1998), (Avison & Fitzgerald, 1995). Avison & Wood Harper (1990, 1997) and Lewis (1994) discuss various examples of the application of Multiview for information modelling, while Atkinson (2000) focuses on soft approaches to information requirements elicitation and systems development.

All these approaches have the ability to encompass the social, human, organisational and technical aspects of analysis work by incorporating the tools and techniques of the more structured approaches, such as, data flow and entity diagrams or object oriented design as well as the S.S.M. tools and techniques described.

From these methods the complication arrives in deciding how best to graft, or link, the techniques of S.S.M. to the structured method, with the conceptual model often used to link to other methodologies (Al-Humaidan & Rossiter, 2004) and (Dang, 2000). The conceptual model is a useful and logical stage to link the techniques of S.S.M. to the more recognised data flow diagram typically associated with structured methods. The conceptual model, as well as the data flow diagram, can be used to document the activities of a particular system. The example of this research will be to place increased resolution onto each of the activities of the conceptual model by converting them into a more detailed data flow diagram, each representing a particular organisational activity.

The conceptual model will represent the minimum set of activities that the system must do as defined by the root definition, while the data flow diagram will represent the set, or sequence, of actions required to perform each of the identified activities. The project at Company A is not one of systems development, but one of understanding, and deriving the business requirements, for the purchase of an off the shelf system. Consequently, creating or designing a database is not required but the understanding of the business processes is.

It is not the intention of this thesis to present a unified approach to business analysis and systems development. The linking of the conceptual model to the data flow diagram is used to aid the business analysis, and allow the analyst to identify and define the requirements through a consultative and inclusive process. To this end a combination of techniques to aid the business analysis, and define the requirements is utilised, and linked via the conceptual model (Chapter 3, 5 and 6). It is also not the intention to present explicit links between the various models and approaches. In some cases the information captured (in the rich picture for example) cannot be explicitly represented in another diagram. The intention of this process will be to allow the researcher to understand what is present and what is required by using a combination of techniques.

In terms of business analysis work, B.P.R. and S.S.M. can offer a complementary multi-disciplinary approach to the change project. While B.P.R. is focused on a top-down approach to radical change to the business processes and culture of the organisation, S.S.M. allows the re-visioning of the business processes whilst retaining a cultural perspective.

The inclusive, bottom up approach of S.S.M. allows a consultative approach to be used, and has the ability to balance out the limitations and radical approach of B.P.R.

2.4.5) B.P.R. vs. S.S.M.

In order to justify the use of two types of Business Analysis it is appropriate to list the similarities and differences between B.P.R. & S.S.M. These are listed by Beynon-Davies (2002):

Similarities

- *Both utilise a systems model of organisations, B.P.R. implicitly and S.S.M. explicitly.*
- *Both focus on the issue of business change.*
- *Both assume organisations can be designed.*
- *I.S. and I.T. are seen as key enablers of business change in both approaches.*
- *Both maintain that the design of organisational work and the design of IT systems must be considered together. Hence they can both be seen as founded in the socio-technical tradition of organisational thinking.*

Differences

- *B.P.R. had its genesis in the business arena, particularly the US business arena. S.S.M. had its genesis in the academic arena.*
- *B.P.R. in its original form focuses on radical business transformation, revolutionary change in organisations. S.S.M. focuses on more evolutionary forms of business change.*
- *B.P.R. is interventionist and top-down. It works with the premise that change should be initiated by managers planning and introducing change into organisations. S.S.M. is consultative and bottom-up. It works with the assumption that representatives of various stakeholder groups should participative in the redesign of organisational activity.*

Using both S.S.M. and B.P.R. within a combination approach covers the organisational technical, social & I.T. related issues.

2.4.6) Conclusions

Checkland's S.S.M. is a suitable Business Analysis method in the sense that it places emphasis on the evolutionary redesign of the organisation rather that the top-down approach favoured by conventional B.P.R. This analysis is useful in that it recognises that different people have different perceptions of problems and of the systems in place. The different stakeholders do not necessarily agree as to the problem being faced or what the solution may be, but S.S.M. focuses on change by way of an iterative process which includes all viewpoints in an attempt to formulate solutions.

S.S.M. has a long history of successful involvement in many different application areas, with the research indicating that it can be used in combination with other methods. In this regard it is useful when initiating a change project, in that it helps to define the problem, involve users and identify areas of conflict and improvement. S.S.M. is not best suited in terms of implementing the change and this is where more formal methods are required.

B.P.R. has a high failure rate, with a lack of user/human or organisational involvement typically seen as the main reason. In terms of business analysis, S.S.M. followed by B.P.R., using a combination approach, would address both the informal (unstructured), and formal (structured) aspects of the project, addressing the lack of user involvement typically given as a reason for failure in change related projects.

2.5) Technological options

The literature review has discussed various methods used to bring about organisational change with new technology being the key enabler. This new technology has increasingly been integrated information systems which have continued the trend of process management, in helping organisations to remove traditional and functional walls between departments, making them more able to respond to global competition. This section will look at the main technological options available to the S.M.E. before suggesting an alternative.

Traditional systems integration was achieved in the organisation by managing the various systems internal to the organisation (Davenport, 1998). For many organisations this was difficult, and far from seamless, with many informal processes required to manage the various systems and interactions.

The original aim of I.S. had been the idea that you could have one common system throughout the organisation integrating all departments and functions on top of one database; it took the arrival of E.R.P. to make this seemingly possible (In search o E.R.P. paybacks, 2000) and (Lewis, 2001a).

The development and take-up of E.R.P. was initially prompted by the need to upgrade legacy systems, in view of the millennium bug (Curtis & Cobham, 2002), (Bagranoff & Brewer, 2003) and (Morabito et al., 2005). E.R.P. was meant to automate and integrate departmental processes with particular emphasis on the manufacturing and back office processes.

Many organisations moved to implement E.R.P. during the lead up to the year 2000 with implementation periods taking anywhere between six months to several years (Cooke & Peterson, 1998). Research states that around 90% of these E.R.P. projects were delivered late, over budget (Koch, 1996); resulted in a decline in firm performance (Wah, 2000) or failed outright (Martin, 1998), while popular I.T. press at that time contained many examples of the difficulties associated with introducing E.R.P. to the organisation (Tebbe, 1997), (Horwitt, 1998) and Beynon-Davies (2002).

Because of these reasons organisations required strong resources in order to manage and finance implementations and typically did not see a positive financial return on investment for between 2 to 5 years after project completion (Stedman, 1999) and (Davenport, 2000). These facts meant that S.M.E.s typically did not have the resources to implement E.R.P. and vendors concentrated on developing systems for the top-end of the market (Morabito et al., 2005).

The typical E.R.P. package is illustrated in Figure 7.

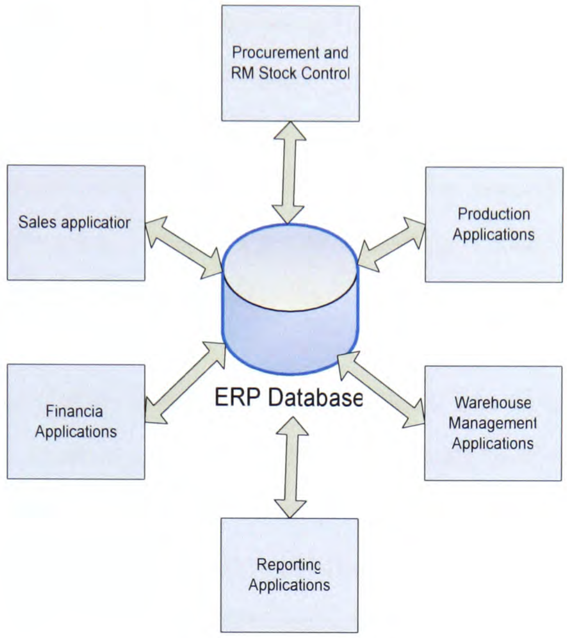


Figure 7 - Typical E.R.P. system

According to Davenport (2000) implementation problems are typically caused by organisations managing the technological project, in terms of the implementation, and ignoring the business management side. The project is viewed in the short term of automating business processes, and going live, while the wider business issues concerning user education and training, supply chain management and the overall impact of the B.P.R. that takes place is not always appreciated (Parr et al, 1999). These problems would be particularly problematic for S.M.E.s to manage as they have limited financial and I.T. related resources (Morabito et al., 2005).

When selecting an E.R.P. solution choosing the vendor would seem critical to the success of the project. However, research published by the consultancy group, The Hackett Group, suggests otherwise. What was found was that the choice of vendor had little impact on the ultimate success of the implementation at the high end of the market (Swoyer, 2004). This would suggest that the leading vendors of E.R.P. have matured and largely offer the same functionality as each other.

Hamerman & Miller (2004) and Harreld (2002) took the view of the maturing of the top end of the market as early as 2002, and indicated that E.R.P. vendors would start to make the software easier to use and deploy in smaller organisations, that had previously been ignored. To do this vendors would have to adapt their largely off the shelf packages, to fit in with organisations used to industry specific solutions, which are inherently a close fit to the requirements. Mainstream E.R.P. solutions typically require expensive consultants in order to get best use out of the system (Twentyman, 2006) and smaller organisations cannot afford, or manage long implementation periods, while employing numerous consultants to customise and implement the solution.

This increased attention on the E.R.P. middle-market was accelerated as Microsoft decided to enter the market by acquiring two large mid-market vendors, in Great Plains (April 2001) and Navision (May 2002) (Ferguson, 2002). These purchases put other middle market E.R.P. vendors on notice, as Great Plains was focused on the S.M.E. market and these acquisitions suggested that the market would consolidate over the coming years as the bigger vendors responded to Microsoft's lead (Grygo & Harreld, 2000-2001), (Twentyman, 2006). This move led to a flurry of acquisitions among the high-profile E.R.P. vendors in order to bolster their product base in an effort to fill the middle market void. This was documented by Fonseca (2003) and Hamerman & Wang (2005).

Recent research indicates that Microsoft have established the lead in organisations of between 100 to 999 employees, followed by Oracle and Sage, while Sage is still the most popular in organisations of between 2 to 99 employees (Hallett, 2006).

Despite Microsoft's gains at the bottom end of the middle-market, the most current data indicates that the biggest E.R.P. vendor is still SAP followed by Oracle, with Microsoft way behind in fourth place. The continued consolidation means that new competitors are emerging, and as a result, smaller niche placed vendors, who traditionally service S.M.E.s are looking to mergers and acquisitions in order to survive.

Figure 8 illustrates top E.R.P. vendors by total revenue.

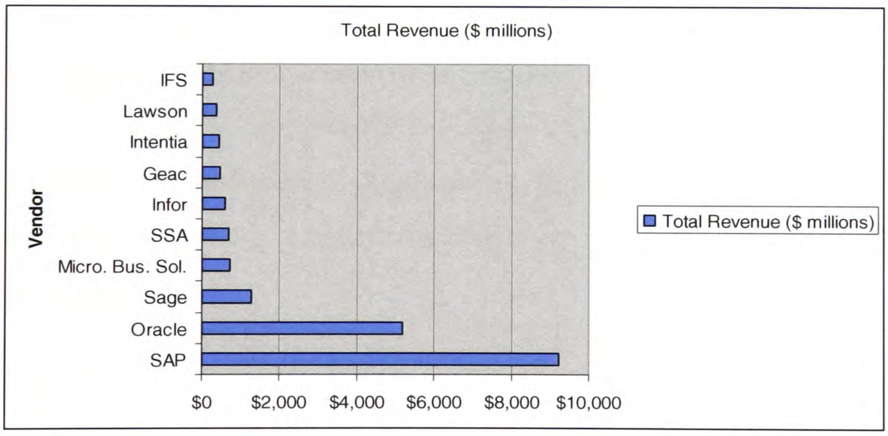


Figure 8 - Top E.R.P. vendors by total revenue

(Hamerman & Wang, 2005).

2.5.1) E.R.P. and the S.M.E.

S.M.E.s have traditionally installed niche systems to cover their core business and industry needs, while using a standard and separate accounts package for the financial functions (Adam & O'Doherty, 2000), (Frederic & O'Doherty, 2000), (Bagranoff & Brewer, 2003), and (Morabito et al., 2005). For many S.M.E.s, especially in the manufacturing sector, these niche systems were the first systems to be introduced into the organisation and were typically not integrated. E.R.P. systems were seen as too expensive, generic in the sense that they lacked specific industry experience, and difficult to implement. Software vendors who targeted S.M.E.s were often favoured for their industry experience, which proved a big selling point in terms of being able to understand niche requirements quickly, and in being able to provide consultants who were used to dealing with organisations with often little or no in-house I.T. experience.

An E.R.P. solution would seem to offer a solution for Company A. Broadly speaking the organisation is looking to integrate fragmented departmental functions and provide better access to management information, which is the main function of E.R.P. The usual E.R.P. view of expensive, generic solutions which are difficult to implement is disappearing, with vendors such as Microsoft, SAP and Oracle targeting smaller organisations and offering tailored and affordable solutions.

However, the documentation of failed projects has led to research questioning the reasons why most S.M.E.s would initiate such projects in the first place (Wood & Caldas, 2000). In a poll of managers who had gone through such projects the level of satisfaction only stood at 55% with 45% noting no improvement at all. Managers also queried the role of the E.R.P. consultant with only 47% questioned, after major projects, feeling that the consultant had benefited the project and only 23% felt they had the required skills. The poll stated that 91% of projects sought outside consultancy for the implementation (Wood & Caldas, 2000). This view is further supported by Adam & O'Doherty (2000) in that most S.M.E.s tend to have little in-house expertise to start with, making their reliance on external consultants more pressing and expensive. This places great emphasis on internal staff, working closely with the consultants, in order to gain and retain knowledge on all aspects of the new system.

Research also suggests (European Commission, 2003) and (European Commission, 2004) that despite the increased attention from E.R.P. vendors onto the S.M.E. market the rates of adoption are poor. Common reasons given for this lack of interest are a lack of resources in terms of money to invest, a lack of in-house expertise to manage post implementation tasks and ongoing systems maintenance and support.

These findings indicate that S.M.E.s must be mindful of the size of the task required in order to migrate to E.R.P. Based on the research of Adam & O'Doherty (2000), and supported by research by Bagranoff & Brewer (2003) and Frederic & O'Doherty (2000) user training, data migration and parallel running of systems are additional areas of concern for the S.M.E.

Company A, with a turnover of £10 million and less than 100 employees would be at the lower end of the S.M.E. market, and heavily reliant on external consultants during the project life cycle (Adam & O'Doherty, 2000) and (Morabito et al., 2005).

2.5.2) the third way

The literature presents two options to the S.M.E. in terms of off the shelf solutions, either standalone or E.R.P. systems, and as presented in this review both options have advantages and disadvantages.

Standalone systems have limited, or no integration, between the different organisational areas resulting in labour intensive manual processes used to bridge the gap between systems. By comparison to E.R.P. they are relatively inexpensive, and are supported by vendors that tend to specialise in the same industry as the S.M.E. and can supply consultants with specific industry knowledge.

The ERP system, despite now being aimed at the S.M.E., is still a largely expensive, generic and a difficult system for organisations at the lower end of the S.M.E. market to implement and manage. They are supplied by vendors used to dealing with larger companies who have in-house I.T. expertise and greater financial resources.

There is therefore a need for a third option, an off the shelf hybrid solution for the S.M.E. This hybrid system would offer virtual E.R.P. functionality in that it would offer integration across two or more standalone systems which would cover the main departmental boundaries of the S.M.E.

Using this option the S.M.E. would be able to retain a supplier with industry specific knowledge, used to working in the S.M.E. environment and would offer a lower total cost of ownership than a full E.R.P. implementation. Careful consideration would have to be given to this solution, in terms of how these disparate systems would be integrated, and in finding a supplier able to support the hybrid solution which by definition would be supplied by multiple vendors.

2.5.3) Conclusions

The ultimate aim of I.S. had been the idea that you could have one common system throughout the organisation integrating all departments and functions on top of one database; it took the arrival of E.R.P. to make this possible. Many companies moved to implement E.R.P. during the lead up to the year 2000 and typically implementation took anywhere between six months and several years. Research states that around 90% of these E.R.P. projects were delivered late, over budget, resulted in a decline in firm performance or failed outright.

E.R.P. solutions can have a positive impact and benefit for organisations in terms of the integration of traditional work functions and in allowing the various departments to share a common database. However, the introduction of E.R.P. is a significant step to take and a problem for most organisations to manage and introduce. Implementation problems are generally caused by organisations managing the technological project in terms of the implementation and ignoring the business management side. The project is therefore viewed in the short term of automating business processes and going live while the wider business issues concerning user education and training, supply chain management and the overall impact of the business process reengineering that takes place, is not always appreciated.

Because of the maturing top-end of the market, E.R.P. vendors have been looking to make the software easier and more affordable to use and deploy in smaller organisations. This increased attention on the E.R.P. middle-market was accelerated as Microsoft decided to enter the market by acquiring two large mid-market vendors in Great Plains (April 2001) and Navision (May 2002). This move led to a flurry of acquisitions among the high-profile E.R.P. vendors in order to bolster their product base in an effort to fill the middle market void.

The research indicates that E.R.P. take-up has been slow in the S.M.E. market with customers wary of difficult and expensive implementations with limited resources. A hybrid solution of separate but integrated systems would offer an alternative integrated solution to the S.M.E. providing the best of both worlds.

2.6) Tendering process

Following on shortly from the business analysis, defining the user requirements is the one aspect of introducing any new system, whether developed in-house or purchased commercially off the shelf that is critical to the systems success. There are many examples of systems failure and the example often given for this failure is that of incorrectly defining, understanding or aligning the system requirements, (Beynon-Davies, 1995), (Rolland & Prakash, 2001), (Lauesen & Vium, 2005) and (Paul & Yeates, 2006). The problem faced by organisations, especially in the S.M.E. environment, is that of time, resources, budget and the fact that user requirements are often presented in an unorganised form (Hay, 2003), (Alexander & Maiden, 2004), (Lauesen & Vium, 2005) and (Paul & Yeates, 2006). Users often fail to express clearly what the system needs to do for them and may feel threatened by the project, and thus be reluctant to cooperate fully (Polanyi, 1966), (Ramos & Berry, 2005) and (Paul & Yeates, 2006). Consequently, the process adopted must be rigorous in both understanding and documenting the requirements in order to avoid these and other typical mistakes highlighted in the literature.

The main aim of the requirements stage is to produce some form of requirements document (Gungor Sen & Baracli, 2004). There is no one agreed format for this document although typically the document will include a catalogue of requirements which will confirm to a standard template (Hay, 2003), (Alexander & Stevens, 2004), (Lauesen & Vium, 2004), Lauesen (2006) and (Paul & Yeates, 2006). These requirements are collected from the business analysis stage and are derived from user based activities for example process modelling, interviews, questionnaires, meetings etc (Gungor Sen & Baracli, 2004), and these methods will be discussed in detail in Chapter 3.

Before the requirements are entered into the catalogue the analyst should list, organise and subject them to close scrutiny. This should involve full traceability as to where the requirement originated from and its purpose. Once the requirements catalogue is complete it should be reviewed and signed off by key business representatives and confirmed to be a true statement of the required system. The aim of this process is to ensure that the document is well defined, clear and complete.

Hay (2003), Alexander & Stevens (2004) and Paul & Yeates (2006) provide typical examples of the key actors involved in this process which tend to be the project sponsor, key users or departmental heads, requirements owners, analyst etc. These meetings tend to follow the advanced distribution of the document for review and involve structured walkthroughs with various departmental groups and other stakeholders. The goal of these meetings is to agree and sign off the document as complete, accurate and a true account of what the system needs to deliver.

2.6.1) Defining the requirements

The requirements catalogue is the main repository of user requirements with all requirements listed. According to Hay (2003), Alexander & Stevens (2004) and Paul & Yeates (2006) there are two types of requirements: functional and non functional. Functional requirements are concerned with what the system must do while non-functional requirements are concerned with performance and the operation aspect of the system.

There are various methods and templates available for the requirements catalogue (Maiden & Rugg, 1996), (Toro, et. al., 1999), (Lauesen & Vium, 2004) and (Paul & Yeates (2006), Table 5 illustrates a typical example. In this example each requirement would occupy a typical page in the catalogue while a summary list would be provided to list all requirements in less detail.

<table>
<tr><td>Project/system</td><td colspan="2">Author</td><td>Date</td></tr>
<tr><td>Requirement ID</td><td>Requirement name</td><td></td><td></td></tr>
<tr><td>Source</td><td>Owner</td><td>Priority</td><td>Business activity</td></tr>
<tr><td colspan="4">Functional requirements description</td></tr>
<tr><td colspan="2">Non functional requirements</td><td colspan="2">Description</td></tr>
<tr><td colspan="4">Justification</td></tr>
<tr><td colspan="4">Related documents</td></tr>
<tr><td colspan="4">Related requirements</td></tr>
<tr><td colspan="4">Comments</td></tr>
<tr><td colspan="4">Resolution</td></tr>
<tr><td>Version No.</td><td>Change history</td><td>Date</td><td>Change request</td></tr>
</table>

Table 5 - Requirement template -
(Paul & Yeates, 2006)

2.6.2) Weighting the requirements

Research suggests that customers do not get every requirement they seek from any software package. Such projects are often categorised by conflicting or poorly defined requirements, unrealistic timescales or expectations and limited resources, which all have to be managed (Lauesen & Vium, 2004), (Lauesen & Vium, 2005), (Lauesen, 2005) and (Paul & Yeates, 2006). Consequently, any project with detailed requirements must prioritise the requirements by assigning a weighting, or scoring system to each and every requirement (Verville, 2002) and (Gungor Sen & Baracli, 2004). This allows the project team to manage expectation by ensuring that the most essential features are identified and included.

This priority which is assigned to the requirements must be agreed by the users and stakeholders and this can be a difficult process (Lauesen & Vium, 2004), (Lauesen, 2005) and (Paul & Yeates, 2006). Users will have their own departmental perspective as to how important a requirement is, thus gaining agreement can be difficult, needing strong and supportive management.

An approach common to prioritising requirements is to group requirements into various categories of importance. The numeral assignment technique for example provides a scale for each requirement in the requirements catalogue, while Brackett proposed dividing the requirements into three groups: mandatory, desirable, and inessential (Brackett, 1990). According to Joachim Karlsson's method, stakeholders assign each requirement a number on a scale of 1 to 5 to indicate the importance of that requirement (Karlsson, 95).

Other methods assign semi-quantitative formulae (Gungor Sen & Baracli, 2004) and (Stoilova & Stoilov, 2006) in order to assign various weighting of importance to user requirement in order to estimate the benefit, cost and risk associated with each item. A quantitative approach can be applied and the results evaluated accordingly against a predefined evaluation matrix.

An example of a weighted a scorecard is presented by (Stoilova & Stoilov, 2006) and shown in table 6.

- In this example the requirement weighting is assigned on a three point scale. Essential (3*), desirable (2*) and Nice to have (1*).
- The evaluation score is based on an analyst review who assigns as follows 0 = does not meet requirements, 1= partially meets requirements and 3 = exceeds expectations.
- The total points for the requirement evaluation is simply the multiplication (weighing * Evaluation).

Scorecard	Reviewer: Requirements	Date	Products A	Software qualification
Evaluation Criteria	Weighting	Evaluation score	Point	Notes
Workflow functionality	3*	3	9	Good
Purchase order	3*	3	9	Strong
Needs for training	3*	3	9	Excellent
	3*	3	9	Limited
Total score				
Max score				

Table 6 - Scorecard example - (Stoilova & Stoilov, 2006)

These methods aim to allow requirements to be prioritised in terms of their importance, and aid the decision making process as to which solutions to shortlist and pursue.

2.6.3) Evaluation of tenders

Little research is available into the actual acquisition process of commercially available off the shelf packages (Gungor Sen & Baracli, 2004), (Lauesen & Vium, 2004) and (Lauesen, 2005), and even less research is available as to this process from the perspective of the S.M.E. Bronsword et al. (2000) outlines a typical process for off the shelf software acquisition.

Typically, vendors are identified from the following sources:

- Personal knowledge and business contacts.
- Recommendations from other companies, or business partners, in the same market sector.
- Specialist magazines or journals.
- Specialist trade shows and exhibitions
- Ask computer suppliers who their preferred dealer is for that particular market sector
- The computer user's information service.

This thesis will produce and recommend guidelines as to how an S.M.E. can identify, select, shortlist and evaluate off the shelf solutions; however the objective of the tendering process, is to produce a number of proposals which meet the majority of the requirements identified in the requirements catalogue. This process consists of a number of generic stages, each designed to provide more information to those potential suppliers with solutions close to the requirements, whilst eliminating unsuitable proposals. These stages are largely present in the current literature (Bronsword et al. (2000), (Ball & Bititci, 2001), (Verville, 2002), (Lauesen & Vium, 2004) and (Lauesen, 2006).

A brief summary of the requirements is produced and sent to the prospective suppliers, who are asked to produce a written response, providing an outline of the proposed software, and of the likely costs involved. The aim is to use this to produce a list of between five or six, who will be invited to submit formal proposals.

Suppliers may quote for more than one option as it might lead to more customised solutions to the requirements. Likewise, if a potential supplier wishes to involve another company, this should be allowed, although the ideal should be to sign one contract with one supplier, who has responsibility for the project. A single vendor avoids the shifting of responsibility if there are problems with the solution.

When the tenders are received, they should be evaluated against the detailed and weighted requirements document, leading to the selection of the preferred supplier. The evaluation process typically consists of a number of stages:

- Evaluation of proposals against the requirements.
- Discussions with short-listed suppliers.
- Evaluation of revised proposals and selection of preferred supplier.

Different suppliers will invariably adopt different approaches in terms of preparing proposals. Some will address every point raised in the requirements, whist others will omit certain requirements usually because it is not provided for in the solution. In such examples, it is important that the recipient finds such omissions and checks back with the supplier so that they can provide an alternative proposal, which fully addresses the customer's requirements.

At the end of this process the customer must have a clear and concise analysis of fit, enabling them to decide on the tenders to be short-listed. The ideal is to list, and present, no more than three final solutions to the major organisational decision makers.

The second stage of the evaluation process involves getting to know the short-listed suppliers.

The normal procedure consists of:

- Confirming the understanding of the requirements with suppliers, users and project stakeholders. This should involve the supplier visiting key company users.
- Demonstrations of the proposed system at the vendor site.
- Customer reference sites. Visiting existing customers of the suppliers in order to assess the solution in a similar working environment, and to assess the working relationship between suppliers and their customers.
- Further clarification with the suppliers as to their understanding of the requirements.
- Verifying the financial stability of the suppliers via Companies House.
- Ongoing proposal revisions from the suppliers.

The end objective is for the management to have around three proposals which reflect the needs of the business. At this point, normal commercial negotiating can take place to enable the most suitable deal to be achieved.

2.6.4) Total cost of ownership

During the acquisition process total cost of ownership (T.C.O.) is a financial estimate designed to help the purchasing company asses the direct and indirect costs associated with the software implementation, as well as being linked to supplier evaluation and selection (Ellram, 1995), (Zeger & Roodhooft, 1999), (Khurrum & Bhutta, 2002), and (Breeding, 2006). T.C.O., which originated with the Gartner Group in 1987 offers a final statement reflecting, not just the cost of purchase, but also other aspects associated with the project for example equipment, user training, support and other costs associated with the operation.

The research indicates the T.C.O. can be applied in many different ways (Ellram, 1995), (Zeger & Roodhooft, 1999) and (Breeding, 2006) with large organisations aiming to save millions of pounds when implementing large scale software projects; however it can also be used by the S.M.E. in determining the various costs options associated with smaller scale projects, and in particular in picking up costs often overlooked (Breeding, 2006).

It is necessary that when using T.C.O. that the company should set realistic expectations and develop a comprehensive assessment of the projected costs of the project (Khurrum & Bhutta, 2002) and (Breeding, 2006). In adopting this realist perspective the proposal is strengthened with the key decision makers in terms of expectations and reduces the risk of unknowns later in the project. There is evidence (Zeger & Roodhooft, 1999) and (Breeding, 2006) which suggest that projects which are run on a limited budget have a better chance of success if the project has identified all the costs in advance.

2.6.5) Conclusions

Commercial off the shelf software packages are acquired through a tender process where the user requirements are provided by the customer, and a select number of suppliers provide their proposals. The requirements document lists functional and non-functional requirements and should be prioritised, and weighted, as to their importance to the organisation.

The requirements are reviewed and signed off by key stakeholders and are used to shortlist potential systems identified from various sources. Key project stakeholders attend various meetings, presentations and discussions with the various suppliers with a view to reaching a preferred system and supplier.

The literature has indicated a gap as to how S.M.E.s should select, evaluate and acquire commercially available off the shelf solutions and this thesis will address these issues.

Total cost of ownership is used by organisations in order to determine the direct and indirect costs associated with various projects. As discussed, the research indicates that organisations that use such methods are more likely to anticipate unforeseen costs relating to the project. This raises the question as to what other factors are present in projects seen as successful.

2.7) Critical success factors

Information systems have real benefits but also real risks to the organisation, regardless of size or resources. The high costs and failure rate commonly associated with these projects cannot be ignored (Lewis, 2001). In order to understand what would be required to implement I.S. successfully it is important to clarify the main critical success factors common to successful projects from the literature (Table 7).

I.S. success factors	Source
Top management support	Bancroft et al. (1998), Duchessi et al., (1988), Bingi et al. (1999), Holland & Light (1999), Sumner (1999) & (2000), Brown & Vessey (1999), Wee (2000), Loh & Koh (2004), Parr et al. (1999)
Project champion	Bancroft et al. (1998), Duchessi et al., (1988), Sumner (1999) & (2000), Brown & Vessey (1999), Loh & Koh (2004), Parr et al. (1999)
Stakeholder & user involvement	Bancroft et al. (1998), Checkland (1981), Loh & Koh (2004), Parr et al. (1999)

I.S. success factors	Source
Project management	Bancroft et al. (1998), Duchessi et al., (1988), Brown (1994), Holland & Light (1999), Sumner (1999) & (2000), Brown & Vessey (1999), Wee (2000), Loh & Koh (2004)
Presence of a business analyst and/or external Consultant	Bancroft et al. (1998), Brown & Vessey (1999), Sumner (1999) & (2000), Loh & Koh (2004)
Effective Business process reengineering	Bingi et al. (1999), Sumner (1999) & (2000), Holland & Light (1999), Brown & Vessey (1999), Wee (2000), Loh & Koh (2004)
Technical or tactical capabilities	Sumner (1999) & (2000), Brown & Vessey (1999)
Minimal customisation	Bingi et al. (1999), Sumner (1999), Brown & Vessey (1999), Loh & Koh (2004), Parr et al. (1999)
Effective communications and change management	Duchessi et al., (1988), Bingi et al. (1999), Holland & Light (1999), Sumner (1999) & (2000), Brown & Vessey (1999), Wee (2000), Loh & Koh (2004)
Clear business plan	Duchessi et al., (1988), Holland & Light (1999), Wee (2000), Loh & Koh (2004)

Table 7 – Typical critical success factors

1) Top management support – The project has to be supported by managers in all departments, as they provide access and influence over lower level users. Their help is critical to the successful implementation of any I.S. in terms of access to resources and ensuring the project stays aligned to the business strategy, in terms of goals and objectives.
2) Presence of the project champion – The project has to be sold to the end users who will fear change, possible job-cuts and extra work load. The presence of a project champion will market the benefits as well as set an example as to the way forward.
3) Stakeholder & user involvement – Communication with the stakeholders and users is crucial. Regular updates allow resources to be allocated, problems to be identified and dealt with and in providing the support required seeing the project to completion. User participation refers to activities that users perform before, during and after the implementation process, in allowing a better fit to the requirements and eventual system acceptance.
4) Project management – Regular meetings with not only stakeholders but other managers and users. When dealing with this level of change many tasks are occurring simultaneously, and have to be scheduled in terms of the personnel required, as normal business is ongoing and people's time limited.
5) Presence of a business analyst who understands the business processes and the cultural change taking place. Implementation projects should be focused and managed on the business change and the B.P.R. taking place, and not only on the short time view of technological change, and the automation of existing processes. There are documented cases where E.R.P. systems have been resisted and reinvented as users choose to avoid them or invent workarounds to the system (Boudreau & Robey, 2005). The failure of these projects lies with the implementation and training and not with the systems themselves. The use of external consultants will depend on the in-house expertise available.

6) Effective B.P.R. – This relates the alignment of the B.P. to the new system. The implementation should concentrate on the change to B.P. and not on the new technology (Davenport & Stoddard, 1994). Bashein et al. (1994) lists the preconditions and negative pre-conditions for B.P.R. success.
7) Technical capabilities – Relates to the hardware issues and infrastructure required to implement the solution. Also relates to an appreciation of the I.S. in place prior to the new solution, in terms of gaining an understanding of the inherent B.P., organisational structure and culture therein.
8) Minimal customisations – Where possible avoid modifying the E.R.P. system to fit the organisation and instead adopt the processes and options already available.
9) Change management & Clear business plan – A well defined plan for all the activities, including a budget and resources identified. Close monitoring of activities and budget should be ongoing throughout the project.

These are generic critical success factors and not directly associated to S.M.E.'s. This thesis will broaden the research with critical success factors that are directly applicable to the S.M.E. environment. (9.5.3. *Company A – critical success factors)*

2.8) Implementation strategy

According to the literature there are two main types of implementation strategies available for the S.M.E., the big bang or phased approach (Eason, 1988) and (Koop et al., 2003).

The appeal of the big bang implementation strategy is that it would focus the S.M.E. for an intense and shorter period of time than if the project were phased (Kimberling, 2006). This would help address potential resource shortages, common with the S.M.E., and condense the transition into a shorter period of time. Using this strategy the S.M.E. would be reliant on the implementation team, including the software supplier, to provide the resources required for both training and the handover to the new systems, as required. It would be crucial for hardware decisions, and lead times, to be identified quickly as the new systems would need to be set up for training, and data input, which would be ongoing from the start right up to the go live date.

According to the literature (Kimberling, 2006) the potential problems of the big bang implementation are that details could be overlooked, and changes to business processes may not be the best ones for the organisation, in practice, compared to how they looked on paper (Kimberling 2006). It could also be expected that the pain of transition would be more severe, due to the face paced nature of this approach. By its nature this approach is risky, aggressive and often results in less satisfaction with the system's abilities to meet important business requirements (Eason, 1988), (Kimberling 2006).

The opposite of the big bang approach would be to follow a slower, phased approach to implementation either by functional departmental area or geography. For example, a company with multiple geographical sites could phase the implementation over a defined period of time (Kimberling, 2006). The advantage to this would be that it would allow the project team to take their time in the planning, customisation, and parallel running of the systems while continuing with normal business (Kimberling, 2006). S.M.E.'s have limited resources in-house and the big bang approach would mean intense pressure on users to keep up with their normal jobs while learning new systems and performing implementation tasks (Eason, 1988), (Koop, Rooimans and de Theye, 2003) and (Kimberling 2006).

From the point of view of the S.M.E. the phased approach can be seen to lack the focus of a big-bang project which can cause employees to become disillusioned with the apparent lack of progress, or realisation of intended benefits, instead of getting the project over with in a shorter time frame (Kimberling, 2006).

2.9) Post implementation analysis

There are various logical ways to measure the success of a systems implementation, for example, was the system implemented within the timescales, within budget, resulted in an increase in turnover without an increase in staff numbers, resulted in a decrease in overheads or received a positive response from system users.

The literature advocates the utilisation of a cost benefit analysis (Nas, 1996) and (Ascot, 2006) in order to assess the financial costs, and benefits that can be tracked as a direct result of the project.

Honesty plays an important aspect to such a study as the literature suggests that many organisations can underestimate, and conservatively, present initial costs associated with large projects (Flyybjerg et al., 2002). This can lead to the project being viewed as less then successful, if the actual costs are eventually found to be much higher in the final analysis. Consequently, when identifying the total cost of ownership success can depend on identifying and presenting the true costs upfront (2.6.4. *Total cost of ownership*).

As discussed earlier in the review (Table 2) many changes that are made by such projects are related to business processes, and it is not always possible to attribute quantifiable values to such change. Consequently, the various techniques discussed in Chapter 3 can be deployed in order to interview and discuss the changes with users before, during and after implementation. If the changes made to the business processes have been accepted by users, seen to improve or streamline the process then this in itself is an indicator of success. Where financial values can be attributed then these should be identified and included, for example, staff redundancies due to process changes, or reduced customer penalties due to more accurate stock records all can be measured in terms of financial benefits to the organisation.

In reality the project stakeholders look to financial indictors to assess the success of the project, consequently, as well as the likely costs, key measurable indicators should be identified, and tracked before, during and after the project lifetime.

2.10) Chapter conclusions

Organisations have responded to the age of increased global competition by reengineering how they do their work by way of business analysis methods such as business process reengineering (B.P.R.) and soft systems methodology (S.S.M.). These organisations have introduced (in some cases) radical changes to the organisational structure with new technology as the key enabler.

B.P.R. is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed. Many B.P.R. projects fail because they do not consider the human and organisational consequences and the popular belief has been that soft systems methodology and traditional systems thinking to be mutually exclusive when in fact they are complementary.

Checkland's S.S.M. is a suitable method in the sense that it places emphasis on the evolutionary redesign of the organisation, rather than the top-down approach favoured by conventional hard analysis

Using B.P.R. and S.S.M. in combination is beneficial, in the sense that it allows a consultative approach that balances out the limitations and dangers of adopting B.P.R. in isolation. This research has made the case for linking these methods by way of the conceptual model associated with S.S.M. and the data flow diagram often utilised during conventional, process analysis and this will be explored further in Chapter 5.

Because of the maturing top-end of the market, E.R.P. vendors have been looking to make the software easier to use and deploy in smaller organisations. This has made E.R.P. more affordable for S.M.E.s that has been traditionally supplied by smaller software vendors supplying industry specific solutions.

Despite the focus on the S.M.E. market E.R.P. is still a significant step to take and a problem for most organisations to manage. This is especially true of the S.M.E. which is reluctant to take up E.R.P. because of a lack of supplier industry knowledge, financial resources and in-house technical expertise. The case has been made for another option to the S.M.E. that of a hybrid solution offering an affordable integrated solution.

Little research is available as to how the S.M.E. should select, evaluate and implement a new information system. The literature indicates the typical approaches adopted and critical success factors that are employed, for example, the use of an approved and weighted requirements, effective project management, the presence of a business analyst and the use of total cost of ownership.

This research will bridge this gap in the literature and present guidelines as to how the S.M.E. can identify, select, evaluate and implement an integrated information system and present the critical success factors identified during this process.

2.11) Chapter summary

The literature review moved on from the introduction of the information system, in Chapter 1 and introduced the various methods and solutions used to implement I.S. into the organisation.

Chapter 3 will look in more detail at the research method and strategy adopted for this thesis.

Chapter 3

RESEARCH METHOD

"There are two objectionable types of believers: those who believe the incredible and those who believe that 'belief' must be discarded and replaced by 'the scientific method"

- **Max Born** - Nobel Prize for Physics in 1954 (1882-1970)

3.1) Chapter overview

This chapter discusses the research methodology used for this project. Potential research methods are explored, described and evaluated for suitability with regard to the research project. Following on from this data collection techniques, and business analysis methods are discussed, and expected research outcomes and constraints are reviewed.

3.2) I.S. research methods

Research methods can be listed in a number of different ways. In this section of the chapter a number of these will be briefly summarised, before a decision is made as to the most suitable method for the research.

According to Hussey & Hussey (1997) the term paradigm, in reference to how research should be conducted, refers to the progress of scientific practice based on people's philosophies and assumptions about the world and nature of knowledge. In essence a paradigm, references the real and social world, and is made up of assumptions of knowledge, and how to acquire it. There are many different paradigms listed in the literature (Fitzgerald & Howcroft, 2000) and (O'Donovan & Roode, 2002). Based on the literature, there are two main research paradigms, quantitative and qualitative (Hussey & Hussey, 1997), (Wisker, 2001) and (Krauss, 2005). The literature listed a number of assumptions based on these two extremes of paradigm and these are shown in Table 8.

Assumption	*Quantitative Research*	*Qualitative Research*
Ontological	*The nature of reality is objective*	*The nature of reality is subjective*
Epistemological	*The researcher is independent of the project*	*The researcher interacts with the project*
Axiological	*The role of values is free and unbiased.*	*The role of values is biased*
Rhetorical	*The research has a formal language based on set definitions.*	*The research has an Informal language based on evolving decisions.*
Methodological	*Deductive process* *Cause and effect* *Static design* *Context free generalisations leading to prediction* *Accurate and reliable through validity and reliability*	*Inductive process* *Mutual simultaneous shaping of factors,* *Emerging design* *Categories identified during research process* *Context bound patterns* *Theories developed for understanding* *Accurate and reliable through verification*

Table 8 - Assumptions of the two main paradigms – (Hussey & Hussey, 1997)

3.2.1) Qualitative vs. quantitative research

Qualitative research has been found most useful when studying soft, human, cultural and social behaviour (Hussey & Hussey 1997), (Wisker, 2001) and (Krauss, 2005). Over the last thirty years qualitative research has gained increasing acceptance in the academic world (Trauth, 2000), and various methodologies are available (Table 9). This approach does require the researcher to collect data and understand concepts from a wide viewpoint, as it involves an in-depth understanding of human behaviour and the reasons that govern that behaviour.

Quantitative research sits at the opposite end of the scale and is concerned with both the natural and social sciences. The research data is derived from precise numbers taken by using a set process with the main objective being to develop and employ mathematical models, theories and hypotheses in relation to natural phenomena (Hussey & Hussey 1997), (Wisker, 2001) and (Krauss, 2005). The central theme to quantitative research is the process of measurement because it connects empirical observation and mathematical expression of quantitative relationships (Quantitative research, 2007).

In summary, qualitative research investigates the why and how of decision making, as compared to what, where, and when of quantitative research.

It should be noted that while these two paradigms are opposite extremes, a mixing of the methodologies in relation to data collection, is not uncommon (Hussey & Hussey, 1997), (Myers, 1997), (Gill & Johnson, 1997) and (Wisker, 2001). This allows the researcher to take a broader view of the research problem.

Table 9 lists the various methods available to the two paradigms (Hussey & Hussey 1997), (Gill & Johnson, 1997), Myers (1997), (Wisker, 2001), (Trauth, 2000), (Genzuk, 2003) and Krauss, (2005).

Quantitative	Qualitative
Cross-sectional studies	Case studies
Experimental studies	Ethnography
Longitudinal studies	Action research
Surveys	Feminist perspective
Formal methods	Grounded theory
Numerical methods	Hermeneutics
Lab experiments	Participative enquiry

Table 9 – Research paradigm methodologies

3.2.2) Research paradigm selection

In order to be able to select an appropriate paradigm it is important to consider the topic of the thesis, namely implementing information systems in small to medium sized organisation, and the literature associated with that. According to (Myers & Avison, 2002) qualitative researchers can be found in many disciplines and fields, using a variety of approaches, methods and techniques. In information systems, there has been a move away from technological to managerial and organisational issues, which has resulted in an growing interest in the application of qualitative research methods in I.S. related work (Silverman, 1998), (Trauth, 2001) and (Myers & Avison, 2002). Activities which are adopted in such projects are business analysis activities such as the analysis of documents and activities, user interviews and the detailed understanding of the various human activity systems.

The qualitative paradigm has been chosen because the data that will be collected for the research is qualitative by nature in the sense that it cannot be graphed, or displayed as any other mathematical term, and can only be understood by researching the individuals who are involved in the activities to be studied. This is supported by the growing body of research associating I.S. work with this paradigm.

3.2.3) Research assumptions

Based on the selected research paradigm, this next section will briefly state research assumptions that the researcher has made going into the project. These assumptions will influence the research methods, and techniques adopted thereafter.

- **Information systems** – The research area covers data, information systems and the users of those systems. The focus will therefore be on the social nature of the systems as all form part of the research. In terms of the data and information held within the systems this will be treated as subjective rather than reflecting reality.

- **Stakeholders and users** – The researcher will consider that all users and stakeholders of the organisation will have freewill and freedom of action and choice rather than actions that are pre-determined by either the situation or environment. The assumption of freedom of action will allow for the freedom, flexibility and acceptance of technological development.

- **The organisation** – A nominal view will be taken of the organisation as it relates to the many different perceptions users have of the problem area.

3.2.4) Conclusions

There are many different research paradigms listed in information systems literature, the two main approaches being quantitative and qualitative research. These two paradigms sit at opposite ends of the scale with the quantitative paradigm being linked with the natural sciences, where the research data is derived from precise numbers taken by using a set process, while qualitative research has been found most useful when studying the natural and social sciences.

Over the last thirty years qualitative research has gained increasing acceptance in information systems research, where there is there is a strong social and cultural perspective, and various research methods and techniques are available to support the selection of this paradigm.

3.3) Adoption of a research method

The following section describes the key qualitative methods considered for this project.

3.3.1) Action research

Action research is an iterative and reflective process of progressive problem solving and is seen as a valid method in the I.S. field (Baskerville & Wood-Harper, 1996) and (Tatnall, 2003) in which the researcher plays an active role working together with other users to bring about the desired change. The assumption being that the researcher, and the research itself, is a key part of the change. A key characteristic of this approach, as well as the direct involvement of the researcher, is the fact that the problem situation cannot be reduced for the research and the belief that learning and understanding is achieved by action.

3.3.2) Case study

With the move in I.S. work away from technical to organisational issues the case study has become the most common research strategy used to examine the problem situation in its natural setting (Alavi & Carlson, 1992), (Yin, 2002) and (Dubé and Paré, 2003). Case studies can involve one or more studies and utilise many different types of data collection techniques, collecting data from users and user groups. The interview is the most common method of data collection, retrieving data in forms such as interview transcripts observer notes etc. Case studies can result in the need to analyse and interpret large amounts of data (Hussey & Hussey, 1997).

3.3.3) Ethnography

Some published authors believe that ethnography is the most in-depth and thorough research method, and it shares many of the characteristics to the Case study approach (Hussey & Hussey, 1997), (Myers, 1999) (Genzuk, 2003) and (Ethnography, 2007). Ethnography involves the researcher spending a great deal of time within the research area, allowing a detailed understanding of what the users are doing in reality as opposed to what they say they are doing. The emphasis of this approach is to understand user's thoughts and actions in context.

3.3.4) Active case-study - Company A

Company A are a small to medium sized enterprise that faces continued pressure from key customers for faster distribution and high quality goods while cutting back on cost. This means that that the organisation looks to overseas factories to meet their capacity, whilst still being responsible for the design, quality and distribution of their product.

New technology is seen as having a crucial role in aiding the company meet its objectives with the potential introduction of a new integrated I.S. geared specifically towards supply and distribution, allowing improved control of the company's supply chain performance. The researcher has a pivotal role in helping the organisation meet this objective and this will be the basis for the research. Chapter 4 introduces Company A in detail.

3.3.5) Method selection

Having made the decision to follow the qualitative paradigm the researcher has decided to use two different approaches from the research methods listed, particularly with relation to data collection. The main reason for this is that the author requires a broad and complimentary view of the research problem.

According to the literature, the case study approach is the method most used in information systems research (Alavi & Carlson, 1992). However, the case study method is usually utilised when the researcher has little control over the events themselves and sits outside the research domain.

This first stage of the project at Company A will constitute a high-level analysis exercise with the researcher external to the organisation and not concerned will implementing change. The purpose of which will be to determine whether or not the current I.T. infrastructure is meeting the organisational requirements, and to provide recommendations as to the various options available. The interview technique will be utilised at this stage, feeding data into a formal report. Depending on the outcome of the case study report, the next approach to be used will be the action research method. This approach allows a detailed understanding of the business processes, users and stakeholders within the organisation.

Using the data analysis techniques, interview and focus groups the analysis will be accomplished by utilising S.S.M., in order to define the problem area by developing a rich picture, root definitions and the preparation of a conceptual model. S.S.M. will be particularly useful in identifying the various stakeholders, their views, conflicts and relationships with other departments in what is a small to medium sized organisation. This approach will be iterative and consultative and provide a consensus over what changes are broadly required and feasible.

The key activities identified in the conceptual model will then be used implicitly to lead into the main modelling exercise in order to map, understand and then redesign the detailed workflows within each identified activity. The research at this point will reflect characteristics of the ethnography approach in that the researcher will be spending time within the research area, gaining a detailed understanding of what the users are doing. Participant observation techniques will be used at this point in order to capture the required data.

These two approaches are not mutually exclusive with this type of exercise requiring both a 'soft' and 'hard' form of analysis in order to successfully introduce change. As specified in the literature review there are many examples of combined approaches to both business analysis, and software development using S.S.M. and structured approaches both in parallel and in a linear format (CCTA, 1989), (Avison & Wood Harper 1990, 1997), (Atkinson, 2000) and (Mingers, 2000). What is unique to this research is the linking of the conceptual model with process modelling in order to identify and map the user, their perspectives and the business processes.

In combination with the business analysis, a requirements catalogue will be created specifying what is required in terms of a new I.T. infrastructure. This document will be used to source readily available improvements.

The researcher will create an inclusive and consultative approach to the identification and selection of the eventual system using focus groups, the requirements catalogue and a scoring system to assess possible options available. Various options will be available for implementation including a phased, or big bang approach, and these will be discussed in Chapter 9. A cost benefit analysis will be used to assess the changes made in Chapter 10.

Table 10 list the various methods and techniques adopted within this project.

Project stage	Methodology	Techniques	Thesis chapters
Feasibility stage	**Case study.**	Interviews.	Chapter 4.
	Paul & Yeates (2006)	Environmental analysis.	Chapter 4.
Business analysis	**Action research.**	Interviews & focus groups.	Chapter 5, 6 and 7.
	Hammer (1990), Hammer & Champy (1993)	Stakeholder analysis.	Chapter 5.
	Checkland (1981) & (2000), Mingers (2000)	Rich picture.	Chapter 5.
	Paul & Yeates (2006)	C.A.T.W.O.E. and root definitions.	Chapter 5.
	Cutts (1991)	Conceptual model.	Chapter 5.
	Beynon-Davies (1998).	Business process modelling.	Chapter 6 and Appendix 3.
	Bergvall-Kareborn et al. (2004)	Network analysis.	Chapter 7.
	Gunasekaran & Kobu (2002)	Participant observation.	Chapter 6.
	Clarke et al. (2000)		
	Al-Mashari & Zairi (2000)		
Requirements engineering	Paul & Yeates (2006)	Requirements catalogue.	Chapter 8.
	Probert (1999), Alexander & Stevens (2004), Atkinson (2000), Ellram (1995), Zeger & Roodhooft (1999), Khurrum & Bhutta (2002) and Breeding (2006)	Scoring system.	Chapter 8.
		Total cost of ownership.	Chapter 8.
Implementation	Eason (1988), Koop, Rooimans and de Theye (2003).	Big bang approach.	Chapter 9.
Post implementation	Nas (1996) and Ascot (2006)	Cost benefit analysis.	Chapter 10.

Table 10 - Methods and techniques adopted

3.3.6) Conclusions

Various methods are available when using the qualitative paradigm for information systems research. The researcher has decided to use a combination of case study and action research. These methods will be adopted depending on the stage of the project. A case study approach will be used in the early stages of the project when a high level analysis is required and the researcher is based outside the organisation. Action research will be adopted when the researcher is directly involved in making the organisational changes based on the research.

S.S.M. and data flow diagramming modeling will be used to perform the business analysis. These two approaches will be linked implicitly via the conceptual model which will provide a set of activities which will be analysed in detail using a formal analysis technique. The business analysis will feed into the requirements documentation required for the selection and implementation stages.

3.4) Data collection techniques

The purpose of this section is to detail the data collection techniques adopted. The researcher has adopted multiple research methods, depending on the stage of the project, because the project requires different levels of analysis and direct action.

The literature supports the use of data collection techniques such as Interviews, participant observations and focus groups within the qualitative paradigm and these will be adopted (Hussey & Hussey, 1997), (Myers, 1999), (Wisker 2001), (Schensul et al., 1999A), (Schensul et al., 1999B) and (Genzuk, 2003). The data collected from these methods will feed into the business analysis and applied to the organisation in Chapters 4 through 7. Chapter 8 will detail the decisions taken with regard to the identification and selection process.

Directly following on from the use of interview, participant observation or focus group, notes will be made which will offer a detailed record of content, decisions made and, if appropriate, a plan of action. These will be cross-referenced where appropriate to check for error, misunderstanding and misinterpretation.

3.4.1) Interview

Interviews have been selected as a data analysis technique because they give the researcher the opportunity to meet the users of the research. They can provide information and insights on the organisation and business processes which cannot be duplicated anywhere else. The researcher will be looking for information based on user feeling, experience, sensitive issues and insider experience. A standard semi-structured approach will be followed when conducting interviews since small to medium sized organisation, tend to have limited resources. Semi-structured interviews will allow the interview to be highly focused and minimise the possibility of manipulating the interview answers (Myers, 1999), (Schensul et al., 1999A), and (Wisker, 2001). This type of interview also allows users to elaborate on issues of particular importance rather then forcing them down a particular path.

3.4.2) Participant observation

Participant observation will allow the researcher to capture what the users actually do as opposed to say. Participant observation will involve the researcher becoming part of a particular group, within the organisation, for a period of time, in order to better understand their perspective and the inherent processes (Myers, 1999), (Schensul et al., 1999A), (Wisker, 2001) and (Genzuk, 2003). This should lead to conversations, or unstructured interviews, which can be the source of rich insights into the department and users in question and provide the researcher greater flexibility and creativity in the research (Myers, 1999), (Schensul et al., 1999A), and (Wisker, 2001). The danger of this approach, in a small organisation, is that users may be suspicious and guarded with the researcher who is seen to be intrusive, however, it is hoped that the researcher, by becoming a working member of the group, can gain their trust (Myers, 1999), (Schensul et al., 1999A), and (Wisker, 2001).

The researcher will also adopt the role of systems support technician. This role will not only provide a unique insight into the organisation, its users, systems and applications but by supplying a service should help gain users trust and acceptance. Non participant observation would be difficult in such a small organisation and would naturally lead to suspicions, as the organisation has witnessed major changes and redundancies in recent years. The adoption of the I.T. role will provide the researcher with a role and identity.

3.4.3) Focus groups

Focus groups will be used in order to understand the responses of a small group of users. These groups will follow departmental boundaries and will be used, like interviews, in order to understand the current situation and requirements. The focus groups will follow a semi-structured approach in that it is not too closed while retaining a structure with clear direction (Schensul et al. 1999B), and (Wisker, 2001). Focus group will not be easy due to the nature of the work and resources; however they will provide a rich source of data for the project and will be used primarily during the use of S.S.M.

3.4.4) Triangulation

Triangulation will be incorporated into the research project in order to strengthen the research collected from the various sources identified. This will be particularly difficult when analysing qualitative research from a social and cultural perspective, however, by using different approaches it is hoped that errors, misunderstanding or misinterpretations can be minimised. Triangulation should counterbalance the inherent drawbacks of the different approaches adopted (Hussey & Hussey, 1997), (Myers, 1997), (Gill & Johnson, 1997), (Wisker, 2001) and (Mingers, 2001).

3.4.5) Conclusions

Various techniques have been adopted to support the research methods under the qualitative paradigm. These include interviews, participant observation and focus groups and will be incorporated in a structured and un-structured manner, depending on the situation. The data taken from these techniques will feed through to the business analysis methods applied to the organisation and described in Chapters 4 through to 7.

By using multiple techniques of data collection it is hoped that data errors and misunderstandings can be minimised, as data can be checked between the different approaches and sources.

3.5) Research outcomes

The practical outcomes expected from the research for company A are discussed in detail in chapter 4. The academic or theoretical outcomes expected are a detailed thesis which adds knowledge in terms of understanding best practice when implementing information systems in the S.M.E. environment. This involves looking at the different methods available and identifying the guidelines and critical success factors involved when implementing new technology in the S.M.E. environment.

3.6) Initial project constraints

There were a few expected constraints identified at the start of the project concerning a lack of systems documentation, the availability of users for interview and time for the initial research and analysis. The lack of documentation with regard to systems and applications will be overcome through talking with application suppliers, previously used I.T. contractors and the researchers own analysis techniques.

A potential lack of access to staff will be overcome through the support of managers and directors and through the varied data collection techniques mentioned previously. For example, by using participant observation users can be observed and interviewed, albeit unstructured, through their normal activities.

The issue of time available for research and analysis has already been solved through discussions with the researcher and the organisation. An agreed project plan has been drawn up, with contributions by the researcher, the organisation and academic staff which cover all stages of the project up to and including implementation. In accordance with action research this will be observed, reviewed and revised at key dates as required. An example of the project plan can be found in Appendix 6.

Project constraints with regard to the implementation stage and how these were dealt with can be found in *9.5) Project constraints.*

3.7) Chapter conclusions

This chapter has outlined the research method and strategy adopted for this thesis. This method was influenced by the nature of the project itself, that of implementing an information systems in the S.M.E. environment. As a result the research paradigm of qualitative research was selected and the assumptions outlined will reflect the approach and methods adopted in this thesis.

Following the selection of the qualitative research approach a number of research methods were deemed appropriate and these were identified as case study, ethnography and action research. All would be applicable at different stages of the research project and offer triangulation in terms of balancing out the weaknesses of each approach. Within these methods a number of techniques are available and suitable to use. The main techniques used are interviews, participant observation and focus groups.

A number of expected academic outcomes have been stated and project constraints identified along with how these will be overcome.

3.8) Chapter summary

This chapter has explained the research strategy and methods adopted for this research project. The next chapter introduces Company A, and their environment, in detail based on information collected during the case study stage of the project.

Chapter 4

COMPANY A INTRODUCTION – COMPANY AND PROJECT OVERVIEW

"I have nothing to offer but blood, toil, tears and sweat"

- Churchill, W. 1940. Line from Winston Churchill's wartime speech on becoming prime minister of the U.K.

4.1) Chapter overview

The aim of this chapter is to introduce Company A. This chapter will provide an overview of the organisation while discussing the project at the case study stage. This initial high level analysis was performed before the action research by Williams (2001). The key points of this report will be stated in this chapter.

4.2) Company overview

Company A, established in 1896, are the largest manufacturers of men's ties in the U.K. and one of the largest in Europe with the shareholding split between the directors and external private investors, including the bank of Wales. The head-office of the company is in South Wales and the main sales office is in London. The company also has sales (agent) offices in Hong Kong, Sydney and New York.

Company A sell mostly to contract based customers, for example M&S, Debenhams and Next although the company also manufactures for stock and has two in house brand divisions. The company has seen numerous developments during its 100+ year history and with changes in market conditions, and the loss of at least one key customer, a strategic redirection has been initiated which has seen a joint venture factory in China now producing some 80%+ of the company's product requirements.

An existing I.T. system is in place, which comprises a client/server network - one primary domain controller, some 30+ workstations, plus a variety of printers. Novell is the network operating system on the server, while most of the workstations run various versions of Microsoft operating systems from DOS through to W98SE. Application software is predominantly from two suppliers, one package covering manufacturing & related issues (XETAL) and one covering finance functions (DYNAMICS).

The network infrastructure of the company is spread over two sites. These sites are linked together by a 64k kilostream link, with the site in Wales on a BNC backbone and London using CAT5 cabling.

As part of the restructuring exercise the decision was taken to review the existing systems with a view to assessing areas that could be improved or added to. Considerations are required with regard to appropriate hardware and software for the various functions including accounts, order processing, stock control, internal/external communications and staff training. Table 11 lists the various functions and how they are managed.

Process	Application
Sales/Purchase Order Processing	XeBusiness - XETAL
Production Control/Planning	XeBusiness - XETAL
WIP	XeBusiness - XETAL
Finished Goods Stock	XeBusiness - XETAL
Bill of Materials	XeBusiness - XETAL
Quotation/Estimating	Great Plains Dynamics
Sales Ledger Control	Great Plains Dynamics
Purchase Ledger Control	Great Plains Dynamics
General Ledger Control	Great Plains Dynamics
Wages	Omicron

Table 11 - Company A process breakdown

The XETAL & Dynamics systems were purchased together via Kewill Systems in 1996. They are two off the shelf packages intended to provide a full E.R.P. solution throughout the company. However, it would be reasonable to state that these two distinctly separate 'off the shelf' packages, with separate databases, could not be defined as an E.R.P. system and have never been integrated.

4.2.1) General systems overview

The vast majority of organisations follow a hierarchical structure in which authority and responsibility extend downwards with senior management making the executive and policy decisions. Senior management has overall responsibility for the success and failure of the strategic direction of the company and has the authority to carry out associated policies. As you move down the hierarchical structure, the number of staff increases, and their status, responsibility and authority decreases.

The systems model of organisations has been a particularly dominant model of organisations for information systems work. Every organisation can be looked at as a human activity system, or a series of human activity systems. These result in every organisation having a number of information systems of some form. At the higher level the organisation is a system. On the lower level the organisation is made up of several or more sub-systems or functional areas, for example; marketing and sales, accounting and finance, production, research and development etc. Company A can be seen to be a typical hierarchical organisation. Figure 9 shows the organisational structure of Company A within its group. (See Appendix 2 for a more detailed mapping of the organisation)

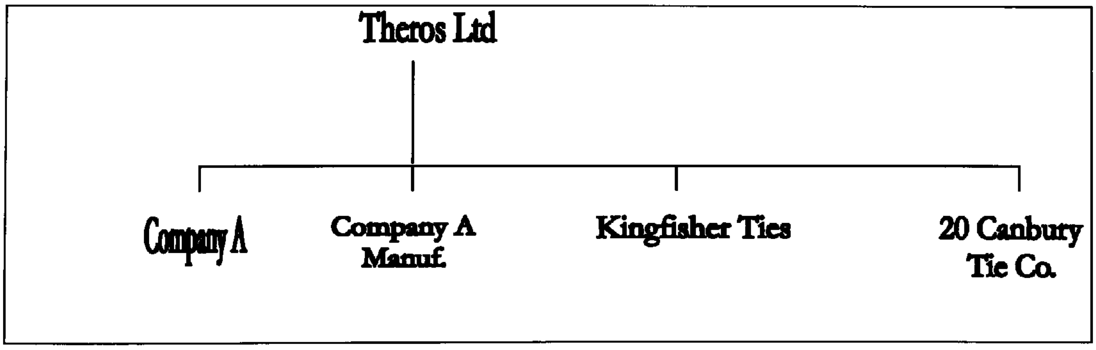


Figure 9 - Theros group organisational chart

Information systems development has been built on this organisational structure, consequently accounts will have their own financial based system; production will have their own manufacturing system etc. This is logical when you consider that I.S. must support the inherent human activity systems of the organisation. However Beynon-Davies (2002) makes the argument that those computerising, or automating existing organisational structures, can only offer incremental improvements in organisational performance. He goes on to suggest that if an organisation wants to make bigger gains then the technology must be used as the vehicle with which to drive organisational change.

Beynon-Davies (2002) lists several examples of technology driving change in the organisation including, the flattening of middle management structures, the empowerment of employees by allowing I.S., and in particular customer relationship management (C.R.M.) software to allow users to make faster decisions, and new organisational structures, such as 'hot desks' where organisations share office space.

Organisational restructuring is frequently occurring in the modern environment, in order to allow the organisation to change and adapt to environmental and technological factors. It is increasingly important to change in order to remain competitive, and technology is the key enabler of this. Company A are looking for improvement opportunities in how they use technology within their environment. Economic factors are changing their organisational structure and I.T. and I.S. are seen as an important enabler to do this.

4.2.1.1) XETAL

The Kewill XETAL system (Figure 10) is an extensive, integrated management information and control system specifically designed for use by Apparel manufacturing companies. The main function of the XETAL system is to enable the users of the system to exercise effective real-time control over all of the organisations manufacturing activities, with all users sharing a common database.

During the late 1990s it became apparent, to the organisation, that they had outgrown the XETAL legacy system. The system was not integrated with the accounting system, resulting in a duplication of invoice processing; it regularly crashed resulting in hours of downtime every month, tended to lose order data and did not maintain accurate stock records, meaning employees were physically checking stock before processing orders. In an effort to control these processes, and produce reports, staff would maintain numerous spreadsheets and other informal information systems in order to maintain accurate inventory and order details. Over the years numerous fixes, add-ons and workarounds have been adopted in an attempt to control the situation.

Such problems with legacy systems have been widely documented (Bisbal et al., 1999), while Bagranoff & Brewer (2003) and Zoufaly (2002) discuss various systems implementation examples. In these examples, organisations used the Y2K situation as the best time to upgrade from these outdated systems, in favour of more integrated solutions with the Internet and E.R.P. systems driving the change. For Company A, the main driver for change is economic factors combined with the ongoing technical support issues, and various workaround solutions needed to maintain normal activity.

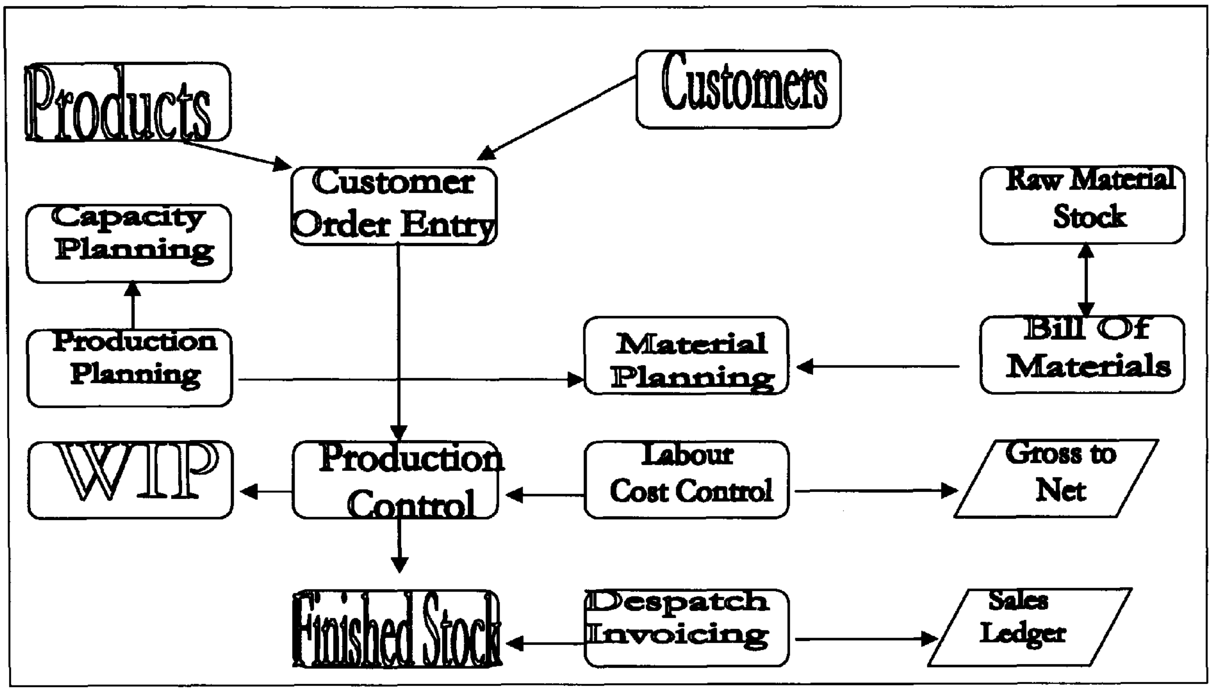


Figure 10 - XETAL system overview

4.2.1.2) Dynamics

Microsoft Great Plains Dynamics is used by Company A for accounting functions. As with XETAL, this is an off the shelf package and recognised as one of the best known financial packages available.

The only high level issue discovered early on in the project is the fact that Dynamics does not integrate with the XETAL system, consequently sales invoices generated in XETAL have to be re-entered into the Dynamics sales ledger, and purchase invoices have to be manually logged in a separate database so that reconciliation is possible against purchase order and goods receipt note raised in XETAL.

As with the XETAL system, there is a lack of user training, I.T. support and system housekeeping. The server housing the application is overworked and underspecified for the task, and as a result, there are ongoing technical support and network problems. Other problems arise because of a lack of available reports, and management information.

4.2.2) External environment analysis – S.M.E. apparel industry

Within the literature review it was established that several factors have influenced the need for organisations to reengineer their business processes and adopt new technology. These factors were identified as increased global competition and new technology in the form of increasingly more integrated I.S. in the form of E.R.P. systems.

In order to appreciate the need for a new I.T. infrastructure it was important to understand the impact that ongoing economic factors were having on the U.K. manufacturing industry at the time of the project, before and after. These factors were part of the strategic decision making process within the organisation and continue to play an important role in its future.

The board of directors had to take notice of changes that were taking place in the external marketplace, if they had not, they would have gone out of business.

These changes resulted from the trend of outsourcing production capacity to factories and other suppliers in China where the cost of production was far cheaper than the U.K.. These changes were significant, painful, expensive to implement and only time would tell if they are successful.

According to Devonshire-Ellis (2005) Hong Kong and Taiwan business people were amongst the first to move their operations to China's mainland as increasing manufacturing costs in their homeland, and a more competitive global marketplace were squeezing margins and lowering profits.

Multinational corporations followed, taking advantage of China's low-cost production base, and started to outsource some of their mass-market manufacturing operations in the early 1990s. Since the late 1990s organisations like Company A, also started looking for manufacturing opportunities in China.

4.2.2.1) Why China?

China became a member of the World Trade Organisation (W.T.O.) in December 2001 and within two years became the fourth largest exporter in the World - pushing the U.K. into fifth place in the international league of exporters (China joins the W.T.O. – at last, 2001). What is impressive about this statistic is that China achieved this progress with less than 20% of its total population in paid employment. As a result, China now posed a direct threat to western businesses, like Company A, although with membership of the W.T.O., western organisations were now free to set up joint venture partnerships with Chinese organisations.

These partnerships made sense as Chinese organisations did not yet have the knowledge to do business with western markets direct, and with the markets being so far away, both culturally and geographically, they were looking to initiate business relationships with established western organisations. Meanwhile, western businesses, under increasing pressure from these low-cost manufacturing factories were looking for ways to reduce their production costs.

The continued threat and potential of offshore production became more real for the S.M.E. as blue chip clients, who were traditionally serviced by the S.M.E., expressed their own plans to source direct, effectively removing the S.M.E. from the supply chain.

For Company A this was demonstrated by:

1) A reduction of the business done by M&S since 1998. This hurt all M&S suppliers, including Company A, who at the time were their largest supplier of neck ties. In order to remain competitive with M&S the company had to reduce their tie prices while M&S reduced the size of their supplier base.

2) C&A suddenly closed all its U.K. shops and stopped dealing with U.K. tie suppliers altogether. At the time C&A were another major customer.

3) A number of middle market store groups opted for less control over their product content, and their supply chains, in return for significantly lower prices from third world sources of production. This took a number of the company's more traditional customers temporarily beyond their reach while they looked for ways to lower their costs.

In making the decision to gradually move production capacity to China, Company A noted additional key facts as stated by Chinese Manufacturing - A Commercial Imperative for Most SME's (2004) and Devonshire-Ellis (2005).

Figure 11 illustrates the value of Chinese exports between 1999 and 2003.

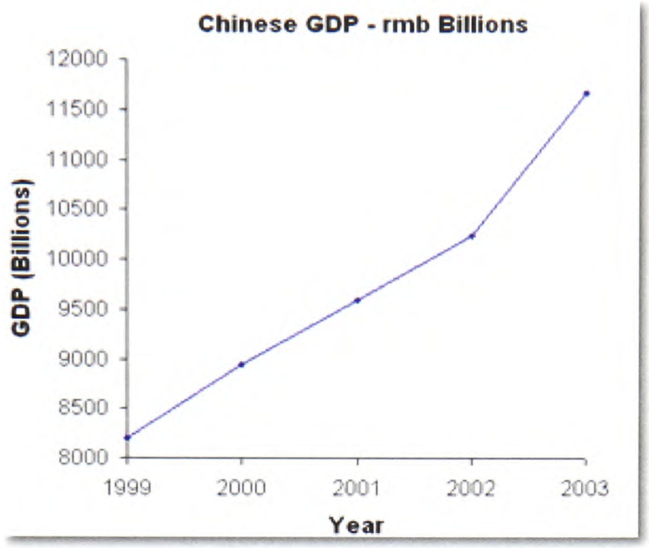


Figure 11 - Chinese exports (Chinese manufacturing - a commercial imperative for Most S.M.E.'s, 2004).

Company A started to move production to a joint venture partner in China in 2000 and, according to Devonshire-Ellis (2004), many organisations made the mistake of leaving the entire operations up to the Chinese partner to run when they had not yet acquired the systems, and quality controls, which are essential for western organisations and their customers. Company A solved this problem by sending an experienced production team to set up and manage the partnership ensuring that the quality control procedures were in place from the start.

By the end of the I.T. project in 2004, all production had moved to the Far East and Company A could be seen as a supply and distribution company as opposed to a manufacturing one. The business analysis and the eventual requirements documentation had to reflect these changes, which at the time were still ongoing.

4.2.3) Initial project options

Through a series of interviews with company staff a high level review of the I.T. infrastructure was carried out (Williams, 2001). This review set out to formulate a framework for I.T. developments within the company. The report did not recommend a particular brand, or company, although guidelines on the type of I.T. that would suit a particular business were given.

A number of key problems with regard to software application issues revolving around XETAL and Dynamics were identified i.e. a lack of integration & systems support issues.

The report also discussed problems relating to the hardware and stated options available both at the client and server end of the network.

The lack of I.T. training for staff is also discussed as is the lack of readily accessible technologies such as the Internet and email. It also became apparent that no I.T. maintenance routines, such as systems backups and virus protection, were carried out, leaving the company at continued risk of data loss and downtime.

The report made various recommendations as to how to proceed. Ultimately, a more detailed business analysis was required in order to identify and implement the most appropriate changes and this was adopted by the organisation.

4.2.4) Internal environment analysis - business process overview

- The XETAL system starts with the sales order (for brand sales) or quotation (for contract sales) and finishes at the end of the Cwmbran production line. Goods receipts notes (G.R.N.) are not raised against production orders for finished goods and brand stock is adjusted manually as required. Contract stock is not held on XETAL due to the need to reference products by both internal and external (customer) product identifiers.

- The XETAL system does not have a full warehouse management system and can not offer finished stock by location. The link between XETAL and the Dynamics system has never been established, as a result, sales invoices raised in XETAL have to be manually entered into the Dynamics sales ledger.

- Once contract stock is declared to customers, electronic data interchange (E.D.I.) is used to pull contract picking lists (call off's) into the business system. E.D.I. is not integrated with the main system and contract stock transactions are handled via E.D.I. and manual stock cards only.

- Company A source materials and fabrics from all over the world and can send these materials to China or Cwmbran (Wales) for manufacturing. The company, as well as manufacturing their own products, buy direct purchases from third parties.

- Company A have started to diversify into other apparel product ranges, for example shirts, shorts, waist coats etc. None of these products are held on the computer system.

- Products can either be manufactured in full or part by Company A or another supplier (sub contract) and in some cases part finished goods can be passed onto another supplier for completion.

    - **Products are either:** Made for stock; made to order; made to contract; bought in via third party;

    - **Products are manufacturered in full or part:** Cwmbran factory; China factory; other C.M.T. manufacturer/supplier.

- In the case of China, the company source the vast majority of the raw materials, although local sourcing does happen. The complete or part complete products are then either sent back to Cwmbran before going onto the customer or in some cases sent direct. Contract orders such as M&S are sent to their own distribution centre and are self billing.

- China is not separated from Cwmbran production on the system in any fashion. Work orders and instruction for China comes from Cwmbran and communication are established via telephone, email, fax and various spreadsheets.

- The XETAL production recording systems is integrated with the Omicron wages package, although Omicron is not linked with the accounts package. All employees are now paid a fixed wage not related to piecework incentive payments.

4.2.5) Project opportunities

Now that the company and project have been broadly defined it is appropriate to look at a summary of the main points of the project in terms of what the organisation wanted to achieve:

- Address the integration options between the software packages e.g. a lack of software integration between the accounting and order processing systems.
- Review and address the issues surrounding a lack of computerised finished stock.
- Address the operating systems issues e.g. standardisation opportunities from using DOS, Novell and Windows etc.
- Review the hardware, to implement upgrades accordingly, e.g. server, network, data communications etc.
- Assess staff I.T. skills & devise and implement appropriate training programmes.

In essence the organisation wanted to improve its business processes by the strategic utilisation of information technology.

4.2.6) Costing the benefits

Company A are a commercial company, and while various grants are available for partial costs the organisation expects to be able to save money as a direct result of the project. The organisation expects to save £90,000 in the first year after the project rising to £130,000 after three years.

The savings during the programme are to be achieved by:

1) Reduced penalties for incorrect/late deliveries. This is running at 0.5% of turnover which would effectively result in a reduction of £60,000.

2) Increased efficiency of administration e.g. reduce duplication, transcription errors etc by saving on clerical staff estimated at two staff at £12,500 pa x2 = £25,000.

Data communications improvements and the savings derived from the above would benefit both domestic and international sales with respect to links with China and London. Additional sales potential is expected due to the improved communications, faster response times and marketing opportunities.

Further efficiency gains in Inventory management and distribution, telecommunications savings, computer consultancy & support would further contribute to the savings at an expected figure of £45,000 pa.

4.3) Chapter conclusions

In this third chapter the Apparel manufacturing company of Company A was introduced. Company A, established in 1896, are the largest manufacturers of men's ties in the U.K. and one of the largest in Europe.

Information Systems development has been built on the traditional hierarchical organisational structure, consequently the various departments all have their own I.S. based on the various human activity systems. I.S. has been developed with these organisational structures in mind offering incremental benefits of automated and computerised business processes

The continued pressure from key customers for faster distribution and high quality goods while cutting back on cost has meant that companies, which once prided themselves on high quality internal production, now had to look to overseas factories to meet their capacity whilst still being responsible for the design, quality and distribution of their product.

XETAL and Dynamics form the hub of the organisations applications systems network; XETAL offers functionality for order processing, manufacturing and stock control while Dynamics covers the financial functions. These solutions were meant to offer an integrated solution to the organisation, covering all the departmental needs, but were never integrated.

The company decided that a new I.T. infrastructure, to include a new I.S., would be a key enabler with which to deal with these new processes allowing the company to adapt and respond more quickly in its environment. The project initiated by Company A, set into place a number of multi-disciplinary activities the end result of which was to identify the most appropriate way to use technology within the organisation.

The main aims of the action research project is to address software and hardware integration problems, standardisation opportunities from using DOS, Novell and Windows, the issues surrounding a lack of computerised Finished Stock and to assess staff I.T. skills & devise and implement appropriate training programmes.

4.4) Chapter summary

This chapter has introduced the company and project at a high level. The project options were stated as well as the expected benefits the company expect to realise. The areas under change have been discussed as well as the vision for the future.

Chapter 5 will initiate the action research by providing an analysis of the people at work in the company in terms of a soft systems analysis. As identified in the literature review, Checklands method is suitable for this task.

Chapter 6 will provide a greater analysis of the companies existing business processes, in terms of managing the product line and order cycle. Data flow diagrams will be used to provide a higher resolution to the activities identified in the conceptual model of Chapter 5.

Chapter 7 will analyse the running of the network in order to identify suitable hardware requirements that will be required as part of the change process.

The aim of all these chapters is to allow the business analysis to be completed so that the I.T. requirements can be formally identified, and a requirements catalogue created.

Chapter 5

COMPANY A – SOFT SYSTEMS ANALYSIS

"The cradle rocks above an abyss, and common sense tells us that our existence is but a brief crack of light between two eternities of darkness."

- Attributed to Vladimir Nabokov (1899-1977)

5.1) Chapter overview

Chapter 5 will begin the second stage of the project lifecycle that of formally analysing the business processes. This chapter will look at the soft systems analysis of Company A by using and interpreting Checkland's seven stage model (Checkland, 1981). This will lead into the formal or hard business analysis for Company A (Chapter 5) which in combination leads to the creation of the requirements documentation. The use of soft systems methodology (S.S.M.) supports the qualitative approach taken to the research and fits into the action research methodology as defined in Chapter 3.

5.2) Soft systems analysis

Hard forms of business analysis can be characterised by the fact that they are well defined. There is a definite process to follow and a number of specific goals that can be been identified. In essence, with this 'hard problem' you can define what success would look like prior to embarking on implementing the solution. The problem, in this sense, is one of technology which is solved by technological means.

New information systems are very often met with a lack of user acceptance, or are misplaced as a viable solution, and this is not always because they are not well designed, or structured, but because the methodology followed did not consider the different user perceptions of the original problem.

A soft approach believes that if a change is made to the technical systems, then the social systems are also affected and vice versa. Emphasis is placed on this relationship, and one cannot be designed without the other, although these soft problems are more problematic to define because they have a social component.

S.S.M. was developed by Checkland (1981) for the purpose of dealing with these soft problems. Checkland had been in industry for a number of years, and had worked with a number of hard system methodologies. He saw how these were inadequate for the purpose of dealing with complex problems, which had a large social component, so he turned to the University of Lancaster in an attempt to research this area. S.S.M. was first published 1981 and has remained largely unchanged ever since.

The main criticism aimed at Checklands approach is its lack of detail in terms of analysis and design later in the process, however, S.S.M. it is at its strongest when defining a problem and then leading onto a more formal and technical analysis. This is how S.S.M. has been adopted with regard to Company A.

Company A is a small to medium sized company, and an understanding of the various users and stakeholders is crucial, as they will pay a pivotal role in the success or failure of the project. S.S.M. will provide an understanding of their roles, environment, conflicts and perceptions of where change is deemed to be required. In an environment of change, users fear they are not being heard, or fear new ideas are an attack on their security. S.S.M. is a useful method for encouraging these people to express themselves in a structured manner. This is not possible by simply adopting a technical analysis.

5.2.1) Company A - stakeholder analysis

Stakeholders interpret problems differently and have different perspectives with regard to any system. For this reason it is important to identify the different stakeholders, and understand their needs and perspective with regard to the current situation, as they will influence the selection, implementation and post-implementation process.

The involvement of these stakeholders, during the various stages of the project, will improve the eventual system acceptance and overall satisfaction. This view is shared by Newman & Sabherwal (1996) who identify a risk in a project of this nature as user resistance, and various examples of this are provided by Hirschheim & Newman (1998). In their examples user resistance was more prevalent in departments where stakeholder involvement was low suggesting that a fine balance of user and stakeholder involvement must be made throughout the project. In identifying these stakeholders, a better understanding of the current situation will be gained.

Within Company A the stakeholders were identified through interviews as follows:

Managing director (M.D.) – Key stakeholder and instigator of the project, the M.D., under pressure from competitors and shareholders, understands the need for change and fully backs the project.

Financial controller (F.C.) – The project champion and due to the fragmented nature of the current systems would benefit the most from a more integrated, streamlined system and timelier access to management information.

Contract sales director – Has a strong influence on the other directors and the company's main customers. He is deeply frustrated with the current systems to the point of refusing to use them. Relies heavily on self-made solutions to facilitate his information needs, and wants his sales agents to concentrate on selling products and not order processing, which is causing a conflict with the Procurement department, who have inherited this task.

Brand sales director – Suspicious of computer systems and not happy with the current availability of management information. She is also unhappy with the allocation of Sales personnel for duplicate data entry, and other manual processes, facilitating the lack of system reporting and integration.

Production director – Suspicious of the benefits of I.T. projects because of previous experience, although, acknowledges that change is required. Ultimately believes that the project will just bring more work and problems to the department.

Procurement manager – Deeply frustrated with the current system which result in his department inheriting other jobs. Procurement tends to be a bottleneck during busy periods, creating conflict with other departments. Procurement is the hub of the work flow and constantly fire-fighting problems as they arise. This department has the best I.T. skills and systems knowledge.

Internal Production manager – From a narrow perspective does not see the need for any new systems, as in-house production capacity is falling. This manager has poor I.T. skills and no desire to learn new systems.

Planning manager – Current systems do not handle overseas production, which still has to be planned and resourced in terms of materials. External production is increasing with no formal I.T. systems capable of supporting or managing the load. This current capacity is supported by informal and social systems along with experience. The Planning manager does not want to learn new I.T. skills so close to retirement.

Warehouse manager – Works efficiently with manual processes used over many years, and would not appreciate new computerised processes, whatever the benefits. He does not like change or other departments interfering with his job, and likes the standalone nature of the current manual system, in which he has complete control. He does not easily delegate responsibility, or control to other warehouse personnel, let alone, other departments or systems.

This analysis unearthed the different perceptions and fears various stakeholders brought to the project. Some feared the anticipated change because of previous I.T. experiences, while others championed the project, frustrated by the ongoing problems. It is useful to identify how various personnel identified the need for change, and accepted I.T. as a key enabler, while others were nervous and suspicious of new technology. Several users were close to retirement and simply did not want to have to learn new systems, while others were used to established manual processes and were content with the way things are.

All these views would impact the project in terms of departmental participation, acceptance and motivation and had to be understood beforehand so that planning can take place. Users will need to be sold the benefits of the project while others (uncomfortable with I.T.) will need individual training and attention. The project can not work without the acceptance and involvement of the users; consequently, bringing them onboard is an important goal.

The classic S.S.M. approach has seven stages. Stage one suggests that you have to have a problem situation which is considered problematic. The researcher has decided what it is that needs to be explored and this was discussed in Chapter 4. In stage two this area is expressed using the rich picture. The rich picture of Company A is described and illustrated next.

5.2.2) Company A- rich picture

Rich pictures are an attempt to illustrate (loosely) the cultural context of a problem situation. Figure 12 illustrates the rich picture drawn for Company A. The rich picture shows the interactions between the various stakeholders of the company, including the emotional content of the communication lines. The lightning symbol is used to denote a conflict, while a monitoring action is represented as a large eye, a common symbol used to illustrate monitoring taking place.

Other elements visible on the picture are the process, communication flows, and the thoughts and feelings of various users and stakeholders. In practice, many rich pictures cover significant areas of the whole organisation and its environment, for example, Patching (1990) shows a rich picture of an entire urban community to show the effect of opening a new pub in the middle of a town.

There is no standard notation for rich pictures, elements commonly shown include: communication flows, documents maintained, actors in the process, any monitoring activities (the eyeball), emotions such as frustration, conflict or harmony between departments and stakeholders and the general attitudes of the people involved.

The purpose of drawing a rich picture is to get as full a view as possible of the personalities involved in the problem situation, and especially the elements relating to politics, attitudes and emotions. This technique is particularly useful in providing a fast non-technical appreciation of the political and cultural issues within every department of the organisation.

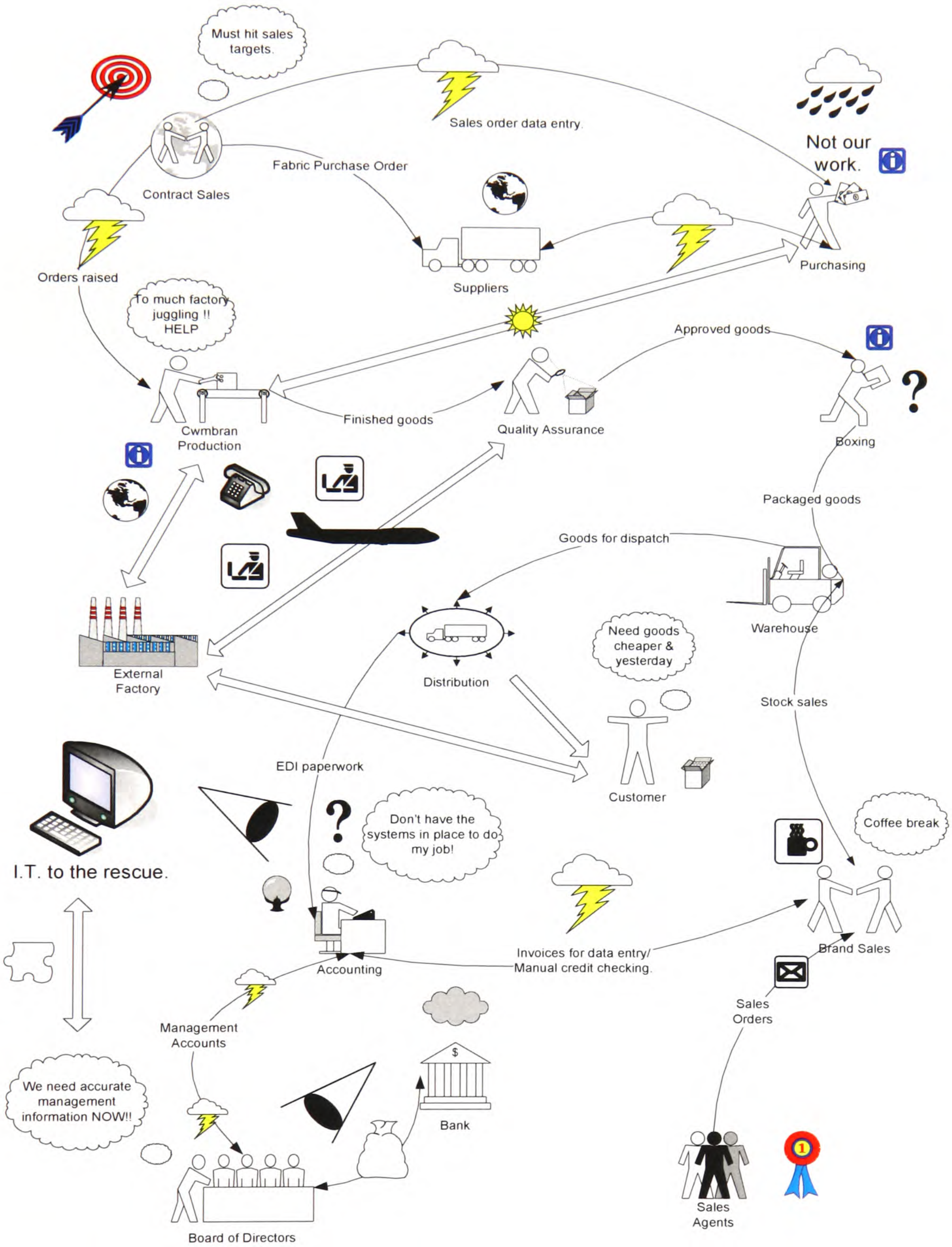


Figure 12 - Company A - rich picture

5.2.2.1) Rich Picture analysis

The rich picture drawn for Company A brings a number of perceptions, conflicts and political views which could not have been identified by simply following a hard process analysis technique. These are listed in Tables 12 and 13:

Departmental Conflicts	Comment
Brand sales Vs. accounts office.	Conflict arises due to invoice re-keying and manual credit checking customers to orders between the sales order processing and sales ledger systems. This leads to errors in terms of invoice discrepancies and orders being dispatched when the customer is on credit hold.
Contract Sales Vs. procurement.	Conflict caused by procurement inheriting sales order entry tasks due to I.T. problems in the London office. The culture of contract sales (design background) means that they have poor I.T. skills and are happy to pass this job onto another department. Even when the technical problems are solved they will be reluctant to take this job back.
Board of directors Vs. accounts office.	A lack of timely management information/accounts is an ongoing cause of conflict. The financial controller regularly complains of the lack of adequate systems needed to do the job. The F.C. is the main project champion.
Production Vs. contract sales.	Conflict occurs because of a lack of readily accessible production and stock records relating to customer orders.

Departmental Conflicts	Comment
Supplier Vs. purchasing.	A lack of detailed information relating to timescales on finished stock & raw materials being shipped worldwide to tight schedules.

Table 12 - Departmental conflicts

Department	Monitoring Activity	Political View from other departments
Accounts.	Closely monitored by supervisors and directors.	Viewed as getting the best equipment and systems.
Brand sales.	Department fragmented over two sites with no supervisor in the main office.	Perceived as being lazy due to a lack of on-site supervision.
Procurement/ production.	The hub of the company workflow with close attention from other departments.	Perceived as being the cause of workflow bottlenecks. As a result, procurement & production feel constantly under-attack and working against the tide. This has brought the two departments closer together.
Contract sales.	Closely monitored by directors with Contract Sales making 80% of turnover.	Perceived to be customer focused in terms of entertaining and not with regard to menial tasks. Often viewed as having the best working conditions and poorest I.T. skills.
Warehouse.	Well established manual activities.	Requires greater integration with stock system and other departments.

Department	Monitoring Activity	Political View from other departments
Customer.	Close relationship with sales.	Requires high quality, cheaper goods with a faster turnaround.
Board of directors.	Closely monitored by company shareholders.	Employees concerned about their long term future with the company as restructuring takes place.
Supplier.	Closely monitored and chased by Procurement.	Perceived to not be providing enough useful progress information.

Table 13 - Departmental views

5.2.3) Company A – C.A.T.W.O.E. and Root Definitions

The problem situation at Company A has been represented in pictorial form via the rich picture. The root definitions have been used here as a technique for identifying the perspective of each actor, or stakeholder, in the rich picture. Each stakeholder may have a different perspective about why the organisation does what it does, or what its priorities should be.

A root definition states the core purpose of a human activity system in terms of input-process-output. Checkland states that the C.A.T.W.O.E. analysis is the most useful method of creating root definitions. The acronym C.A.T.W.O.E. has six elements (Pidd, 2003):

- **Customer** who benefits from the transformation.
- **Actor** who facilitates the transformation to these customers.
- **Transformation** process from start to finish.
- **Weltanschauung** what gives the transformation meaning?
- **Owner** to whom the system is answerable and/or could cause it not to exist.
- **Environmental** constraints that influence but does not control the system.

Despite the acronym, C.A.T.W.O.E., the starting point is the Transformation (T). Once the transformation has been identified it is important for everything to flow from that point. Thus, in constructing the C.A.T.W.O.E. for Company A the following order is used: Transformation, Weltanschauung, Customer, Actor, Owner and Environment.

In the example of Company A the researcher is interested in the various stakeholders *(5.2.1. Stakeholder analysis)* identified and the processes within their area of the organisation. In this example each stakeholder will represent a customer and a C.A.T.W.O.E. analysis will be performed on each in turn. Each transformation activity will represent the process of input, process and output linked with that stakeholder in terms of their system.

It is then the intention of the researcher to express a root definition for every stakeholder used in the C.A.T.W.O.E. as ideally a root definition is based on one transformation activity (Pidd, 2003). Each root definition is a brief mission statement, which applies to an activity identified in the analysis.

The idea and use of S.S.M. in this example is to understand the organisation from the various stakeholders' perspective, in identifying, the key transformation activities and understanding what they require from information systems. This is where the researcher aims to build a consensus from the stakeholder's viewpoint as to what is currently happening, and what should be happening.

Table 14 lists the C.A.T.W.O.E. analysis and root definitions for the stakeholders of the company.

T.	Increase profitability by outsourcing production.	Monthly cash, sales and purchase invoices into a set of management accounts.	Designs/samples to sales orders.	Old-stock to sales orders, picking tickets and dispatch notes	Sales orders to purchase orders for raw material being booked into stock.	Sales orders to production orders.	Production orders to works orders.	Raw materials to high quality delivered finished goods.	Finished goods from the production line, into the warehouse and out the door to the customer.
W.	Companies like ours are either going out of business or restructuring.	Every month the M.D. requires a complete set of management accounts to direct the business.	Salespeople need to be close to their customers and understand market trends. Agents need to be monitored and supplied with good products.		We need good quality fabric and ancillary parts delivered quickly (world wide) to meet tighter schedules.	Nothing can happen without the correct materials delivered on time.	Production orders have to be met on time in order to fulfil sales orders and make a profit.	High volume sales orders need to be fulfilled quickly and to a high quality.	Customers want their product; we finally send it to them.
C.	Managing director.	Financial controller.	Contract sales director.	Brand sales director.	Procurement manager.	Planning manager.	Production manager.	Production director.	Warehouse manager.
A.	Directors and managers.	Accounts staff.	Contract sales team.	Brand sales team.	Buying team.	Planning team.	Shop floor workers.	Production team.	Warehouse personnel.
O.	The shareholders.	Managing director.	Managing director and customers.		Suppliers and customs.	Production director and suppliers.	Planning manager.	Managing director, quality control and customs.	Quality control.

E.	Economic factors mean we cannot compete with suppliers in the Far East.	Increased financial pressure means that faster, accurate and timelier management accounts are required. Fragmented systems slow down the process.	Economic factors mean customers are reducing their supplier base; we have to become more competitive and high in quality. We don't have time for form filling and data entry.	Increased legislation with regard to transporting raw materials internationally.	Economic factors mean that the roles of procurement and production are merging.	More production orders are going abroad.	Economic factors mean production, procurement and routing takes place all over the world.	As products enter the warehouse from locations all over the world, different economic and legislative issues can enter into the critical path.
Root Definition	A system to maximise our resources and assets by facilitating and controlling internal stock and overseas production in order to lower our costs and be more competitive.	A system to achieve a set of management accounts by means of automating, processing, reconciling and valuing stock, sales and purchase invoices in order for strategic decisions to be made.	A system to quickly create, process and report on invoices by means of entered sales orders in order to reach our targets.	A System to raise goods receipts for raw materials by means of raised purchase orders, and received sales orders, in order to meet production requirements.	A system to raise production orders and plans by means of sales orders in order to distribute the work load by factory.	A system to raise and progress works order by means of production plans in order to allocate work to a line.	A system to produce finished goods by means of raw materials so that sales orders can be met and revenue generated.	A system to dispatch finished goods, by warehouse and location, by means of traceable stock transactions, in order to provide customers with their goods.

Table 14 - Company A - C.A.T.W.O.E.

5.2.3.1) C.A.T.W.O.E. analysis

C.A.T.W.O.E. is particularly useful because the transformation itself makes it difficult to model in the rich picture. The transformation and world view make the core of C.A.T.W.O.E. Every activity in the system can be expressed in many ways, using different world views. Consequently, it is a good idea that different world views are used to develop different root definitions. C.A.T.W.O.E. recognizes the need to account for ownership, performance, beneficiaries, victims and external constraints, which are important things to account for.

In this example it is particularly useful in identifying how each stakeholder views the system from their own perspective. From the M.D. seeing the trend and impact of low cost production, and responding by restructuring the organisation, to the production and procurement managers, nervous of their future role in the changing company.

It is also interesting to note that both sales departments share many views, including one where their personnel should spend more time with their customers. This indirectly points to the conflict highlighted in the rich picture as to who should perform data-entry tasks. This will need to be handled with care during the implementation phase, in which the procurement department will logically want to hand the job back to the sales department.

5.2.4) Company A - conceptual model

Given the root definitions stated earlier, an agreed overall root definition has been agreed, and a conceptual model drawn. The conceptual model is known as a first resolution model, in that it gives high-level activity descriptions. The conceptual model is a human activity model that conforms to the root definition using the minimum set of activities.

The conceptual model is derived from and implicitly illustrates the activities necessary to carry out the Transformation activity along with its dependencies. The value of the conceptual model lies is the resulting debate between the researcher and stakeholders of the organisation, and the comparison with the real world that is now possible to make.

Each root definition in the conceptual model can result in its own conceptual model; however it is the intention of the researcher to agree with the stakeholder's one high level conceptual model to move forward with.

The conceptual model is the last of the techniques recommended by Checkland (Figure 13).

5.2.4.1) Overall root definition

- A manufacturing, supply and distribution system owned by the shareholders which honours sales orders and contracts provided by customers
- By processing purchase/production orders and outsourcing production to an agreed quality
- Given the constraints of the global economy
- In order to achieve our sales targets set by the shareholders

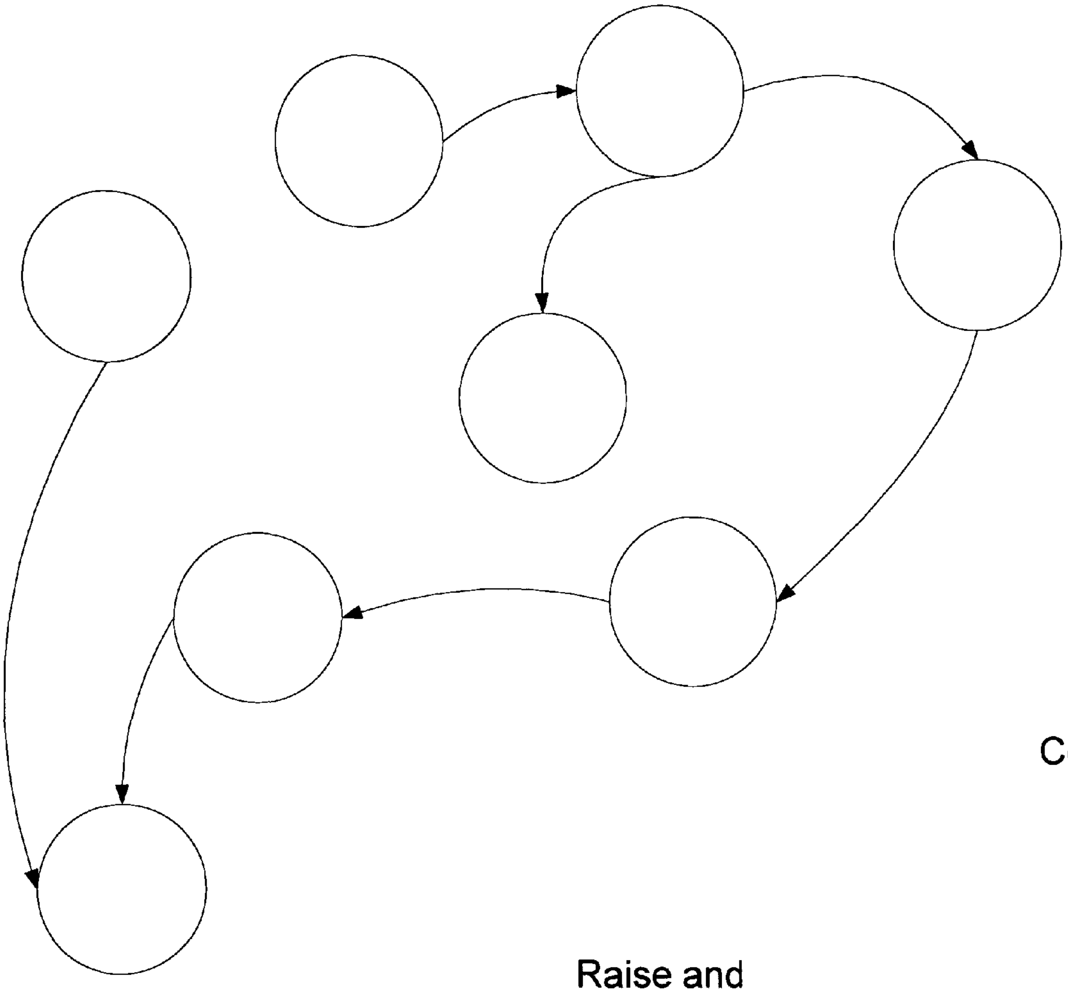


Figure 13- Company A conceptual model

5.2.5) Steps five to seven

In the later stages of S.S.M. the conceptual model is compared with the real world (rich picture) and various insights are drawn from that comparison, and ideas reached for improvements. In the literature Checkland suggests various ways of achieving this from unstructured discussions, structured questioning, to dynamic modelling. In terms of Company A various discussions took place in the form of focus groups in which the researcher, stakeholders and users identified what is present and possible alternatives.

This information feeds into the higher resolution data flow diagrams, referenced in Chapter 6, where detailed departmental issues are listed and Chapters 8 and 9, where requirements are identified and decisions made with regard to what is required.

At this point of the analysis the researcher has gained a strong insight into Company A, its users and culture, and now a more detailed focus is required with regard to the activities identified. One way of achieving this would be to view each activity in the conceptual model as a new system and a new root definition and conceptual model created, and this could continue to add more detail as required. However, Checkland never regarded his methodology as exclusive and insists that separate analyses should be run in parallel, or combination, to add detail to the understanding. To this end S.S.M. has been used as a starting point for the researcher in terms of understanding the users, stakeholders and their different perspectives with regard to the place of the information system in the organisation. Data flow diagrams will now be used to further understand the main activities identified in terms of what is happening and what is required.

5.3) Chapter conclusions

The research suggests that many I.T. projects fail because they do not consider the human and organisational consequences, and according to popular belief, soft systems methodology and traditional systems thinking has been mutually exclusive when in fact they are complementary.

An analysis of the soft systems of Company A was an important step in understanding the company's social systems. Checklands S.S.M. was a suitable method in the sense that it placed emphasis on the evolutionary redesign of the organisation, rather that the top-down approach favoured by conventional hard analysis.

This analysis recognised that different people have different perceptions of problems and of the systems in place. The different stakeholders do not necessarily agree as to the problem being faced or what the solution may be.

Various perceptions and stakeholder viewpoints have been identified as well as conflicts that exist. All will have to be accounted and planned for during the project life-cycle. The information generated helps define the problem situation and lead into the hard analysis, and must be taken into account when identifying the eventual solution.

5.4) Chapter summary

Chapter 6 will build on the business analysis by looking in more detail at the activities identified in the conceptual model by means of data flow diagramming.

Chapter 6

COMPANY A – BUSINESS ANALYSIS SPECIFICATION

"Lord, make my words sweet and reasonable. For some day I may have to eat them."

- Ashdown, P. 1998. Speech at Liberal Party Conference, Brighton, broadcast on BBC Radio Five-Live.

6.1) Chapter overview

Chapter 6 will continue the second stage of the project lifecycle, that of formally analysing the business requirements. This chapter leads on from the soft systems analysis to look at the detailed analysis of the business processes of Company A. In combination with the soft systems analysis, this formal analysis will contribute to the creation of the requirements catalogue which will be utilised for the selection of a solution thereafter.

6.2) Detailed business process analysis

Business process reengineering (B.P.R.) was discussed in Chapter 2 where it was described as a radical rethink, or redesign, of the B.P. with I.T. as the primary enabler. Part of the reengineering process is to identify and understand the existing B.P. The purpose of such a study is to define the problem, and assess the scope of the project. This study also forms the basis with which to move into the requirements specification stage.

A number of tools and techniques are available to support B.P.R. work, in terms of analysing and modelling the organisation. Gunasekaran & Kobu (2002) and Obolensky (1994) document such tools to support B.P.R. work although there is no one agreed approach.

In terms of Company A it is important to identify the core processes and identify how these relate to other business processes. In order to do this it was appropriate to adopt a form of process analysis and this view is supported by Bagranoff & Brewer (2003). Process analysis takes a dynamics view of information systems and the techniques adopted concentrate on the movement and transformation of data through systems. A number of different techniques are available to do this, the most influential and popular being data flow diagramming, systems analysis and design techniques and entity-relationship diagrams (Curtis & Cobham 2002), (Avison & Fitzgerald 1995) and (Robson 1997), through to object oriented modelling (Mentzas, 1999).

In terms of Company A, the analyst collected many unwieldy batches of notes sourced from interviews, observations and other activities (Chapter 3) as it became apparent that simply reading the existing technical documents would not be sufficient in terms of understanding the current systems and processes. Many informal systems had evolved and been adopted as workaround solutions, either due to a lack of system training, but mainly due to a failure to successfully implement the original systems to the B.P. in the first instance.

Company A already have established systems in place and the end result of the project is not to design and code a new system, but improve their business processes either by upgrading existing systems, or purchasing a new off the shelf information system. It is not appropriate to create or map database tables or create multiple levels of data-flow diagrams.

Technical systems documentation is available from the existing system supplier, and the end result of the analysis is not to hand over a technical system specification, to a software engineer, or business requirements, to a systems analyst, but create a requirements catalogue, with which to source improvements.

Data flow diagramming (Cutts, 1991) is used in order to gain an appreciation of how formal, and informal data and information flows around the company, and how they utilise or did not utilise their existing computer systems. This has been selected because it is flexible, easy to understand and assimilate and allow the analyst to quickly create diagrams based on time spent in the various departments.

Data flow diagrams are made up of four basic elements, processes, data flows, data stores and external entities. When conducting the analysis of Company A it has also been useful to incorporate additional notation in order to map the physical world. Documents and goods flow have been added to make sure that relevant documents such as invoices and order forms are collected, and examined, in what is a partly computerised organisation. It is useful to record these documents by name on the D.F.D (Beynon-Davies, 1998).

An overview data flow diagram will be utilised as an analysis tool which will incorporate both manual and computerised processes. This method will also be used to represent the proposed new system during the implementation stage. Figure 14 illustrates the notation used.

The disadvantage associated with data flow diagrams is that it does not represent people and their roles, and as specified in the literature review, and demonstrated in the previous chapter, Checklands S.S.M. is suitable in this regard.

To this end, and unique to this research, the activities identified in the conceptual model will be used as the starting point of this analysis. Data flow diagramming will allow the system to be modelled at a higher level of resolution with each activity of the conceptual model analysed so that a detailed understanding is gained. The researcher is not necessarily recommending a one to one explicit relationship between the activities of the conceptual model and the data flow diagram. Certain activities of the conceptual model could be combined to form a more detailed data flow diagram where appropriate. Table 15 shows the links established between the conceptual model activities and the data flow diagrams.

This stage of the analysis will start by looking at general organisational issues before moving onto the activities of the conceptual model. Reference will be made to various diagrams and process descriptions held in the Appendix of the thesis.

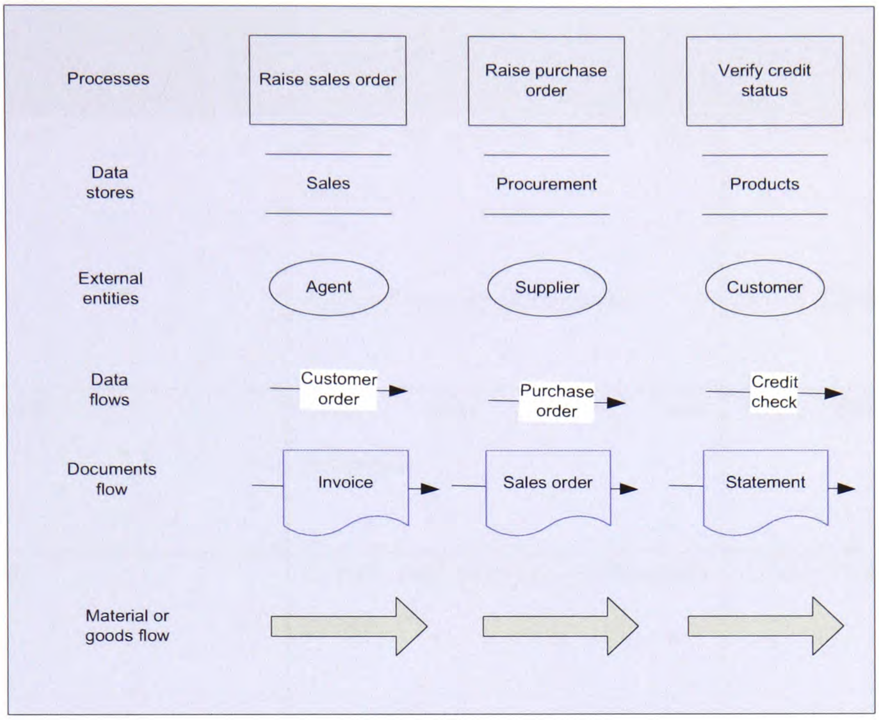


Figure 14 - D.F.D. notation

Chapter section	Conceptual model activity	Appendix D.F.D. & process descriptions
6.2.2) Sales divisions.	Raise and process brand sales orders. Agree contract sales order.	*3.1.1) Brand sales analysis.* *3.1.2) Contract sales analysis.*
6.2.3) Procurement.	Order and receive raw materials	*3.1.3) Procurement analysis*
6.2.4) production.	Create and process production orders.	*3.1.4) Production analysis.*
6.2.5) Warehouse management and E.D.I.	Book quality approved goods into finished stock. Dispatch goods and raise invoice.	*3.1.5) Warehouse management & E.D.I. analysis.*
6.2.6) Invoice processing.	Process sales invoices Process purchase invoices.	*3.1.6) Accounts analysis – sales ledger.* *3.1.7) Accounts analysis – Purchase ledger.*

Table 15 - Conceptual model to D.F.D. join

6.2.1) General issues

Based on the initial analysis work (Chapter 4) the main issues which need to be addressed are systems integration, readily accessible management information and warehouse management. These three issues have resulted in the organisation continually allocating resources to enable various workaround solutions, in order to maintain these processes. Consequently, it is already appropriate to consider various integration options, such as an E.R.P. solution, in order to remove the manual processes between the various functions. The issues surrounding a lack of training and technical support are also causing ongoing problems.

Table 16 summarises the findings and lists the issues common to all departments

In the following section of this chapter it is appropriate to look at the issues faced by each of the organisational departments. This will be accomplished by an analysis of the activities identified in the conceptual model of Chapter 5. The issues will be listed and data flow diagrams referenced in Appendix 3.1.

General Issue	Cause 1	Cause 2	Comment
Lack of systems integration.	XETAL does not link with the Dynamics accounting package, thus invoices have to be re-entered / reconciled, processed with the Dynamics ledgers. Two people in two different departments are employed full time in order to bridge the systems gap.	The EDI system is not integrated with the XETAL system thus contract stock is manually maintained in two systems.	XETAL was set-up as an E.R.P. solution; however an E.R.P. solution (Enterprise Resource Planning) attempts to integrate all departments and functions across a company onto a single computer system. The data duplication caused is difficult to reconcile and causes extra work for the users.
Lack of computerised stock records.	The system does not have the ability to facilitate multiple stock locations, full warehouse management facilities or reference stock by customer and company codes.	Historical lack of stock-takes, stock processing & unmanageable stock qty.	Company A have gone through major changes, which are not uncommon for manufacturing companies. The result of this is that stock is held in different locations around the world.
Access to management information & standard reports.	Lack of training as how to construct reports using standard report writers. Technical & historical problems due to issue 1.	Numerous large and fragmented data sources make compiling reports difficult & time consuming,	The need for information within the organisation is critical; information should be timely, accurate, and meaningful to the recipient.
System performance issues.	Lack of housekeeping/systems maintenance routines since the main systems was introduced to the company in 1996, due to a lack of procedures, user training and in-house I.T. expertise.	Poor server, client & network infrastructure.	This lack of housekeeping procedures and end-of-day routines demonstrates the need for system training and written I.T. procedures. This point suggests how users have become frustrated by ongoing technical support issues.
User training.	New I.T. users are not trained on the systems and the only knowledge they have, has been gained by trial and error and other users.	Staff turnaround has led to difficulties justifying the cost of retraining.	Users have only a perception of what the system can do and they had inherited bad practice. As a result, systems are not being used to their full potential and users are not as productive. This has led to frustration and alienation towards I.T.
Traceability.	Lack of integration & accurate finished stock records. Technical problems due to issue 1.	DOS based interface lacks interface drill downs.	Requirement for the business to be dynamic, streamlined and accountable means it is necessary to be able to trace all orders on the system down to the last part throughout the process.

Table 16 - General system issues

6.2.2) Sales divisions

Within Company A the production of invoices fall into the following three broad groups:

a) Benjamin James trade (stock) sales are all handled via the XETAL system, and invoices printed and passed to Accounts where they are manually entered into the sales ledger.
b) M&S contracts are all handled via E.D.I., which produces all the paperwork. The invoice data is only entered to the sales ledger on receipt of the M&S self-billing invoice.
c) All other business is contract sales. Some of these orders are received via E.D.I. and all the paperwork is generated by EDI. In all other cases warehouse personnel creates a manual delivery note and this is passed to accounts where an invoice (if required) is typed and then manually entered into the sales ledger.

Thus, within Company A, there can be seen to be two distinct sales divisions, brand and contract. These will be dealt with separately.

6.2.2.1) Raise and process brand sales orders

Many of the problems from a brand sales point of view are minor concerns, which could be rectified on the XETAL system by adding new fields, or by making the system more usable from an interface and data entry viewpoint. Other complaints have arisen because of a lack of systems housekeeping, rather than functionality, and as such are technical support issues and have been referred to the XETAL helpdesk.

The following table was compiled following interviews and observations of the users of the system, and are the more pressing issues. These centre on systems integration and warehouse management and are summarised, specific to brand sales, in Table 17. For a more detailed description of the business processes of brand sales please refer to *Appendix 3.1.1) Brand sales analysis*

Brand Sales Issues	Causes	Comment
No integration between XETAL Sales order processing and the Dynamics sales ledger.	Systems never successfully integrated.	This task employs one person full time in order to re-key invoices into the sales ledger.
Because of issue 1, no automated credit control is possible between posted cash and new orders being processed.	Systems never integrated.	This is handled with a manual credit list which is prone to error, with orders being despatched where the customer is on credit hold. This causes ongoing conflict between the two departments.
Inaccurate brand stock records.	Not all stock is invoiced or held on the system. Agents take stock without raising invoices. Computer records are never updated by way of traceable stock transaction. Lack of stock-takes.	Brand stock is never booked correctly into stock, with adjustments made only. Historical problems mean that stock has grown with no adequate resources available to perform full stock-takes. Much is gained with internal knowledge as computer records are not trusted.
Concessions visibility.	Agents hold stock and no internal records are kept as to the stock levels that are being held in this fashion.	A system is desired to be able to track stock at multiple warehouses, locations therein and in transit.
London personnel unable to access I.T. systems held in Wales.	Technical network infrastructure & unreliable, poorly administered system database.	Technical problems mean that using the network applications in London that are based in Wales is slow to unworkable.

Table 17 - Brand sales issues

6.2.2.2) Agree contract sales order

The vast majority of Company A's business originates from contracted, made to order sales which follows an agreed bulk delivery schedule. An example of a contract customer would be the likes of M&S, Next, Debenhams or Littlewoods. Brand also sells goods on a contract basis and the process adopted there is the same as for the main contract customers.

The issues with contract sales are specific and centre on a lack of functionality available to perform quotation calculations - and directly load bulk order flow information - a lack of computerised finished stock and customer related order flow information.

C.R.M. software would be beneficial, although the way Company A load quotation orders will require be-spoke software to be written. The issue of the dual identity of products will need a system able to reference products by internal, and customer specific, codes, however the question has been asked as to whether customer product codes could be made available when they are initially loaded onto the system, removing the need for Company A to assign their own identifier in the first place.

Table 18 lists the findings while *Appendix 3.1.2) Contract sales analysis* provides a detailed description of the processes.

Contract sales issues	Cause	Comment
Unable to perform quotation costing calculations on XETAL.	Lack of updated be-spoke development. The Organisation has outgrown existing functionality.	XETAL is an off the shelf package and in order to do accommodate this calculation, bespoke work would be required on the front end system. This also requires costing information, relating to the bill of materials and landed costs, to be up to date and this is not in place within the company.
XETAL unable to reference products by company, and customer unique identifiers, meaning no contract stock can be held on XETAL.	Lack of system functionality.	Customer orders from the likes of Marks and Spencer, Next etc are dispatched by call-off via an E.D.I. system in the warehouse. E.D.I. produces the paperwork e.g. dispatch note, invoice etc and the product I.D. used on these documents is generated by the customer and is not known when the initial order is raised and loaded. As a result products are loaded on XETAL under a unique code generated by the company, and because they are called-off via E.D.I., the employees in the warehouse update the manual stock cards using the customer product code, even though from the internal systems point of view they exist under a different identifier.
London unable to access I.T. systems.	Technical network infrastructure.	As described with Brand Sales Issues.
Lack of C.R.M. functionality.	Due to issue 2, a lack of integration, technical issues and available functionality.	Sales use various spreadsheets in order to monitor customer order flows.

Table 18 - Contract sales issues

6.2.3) Procurement

Procurement and production are two departments very much dependent on one another within Company A, and from experience gained they are the two departments with the best working relationship, and XETAL skills. Due to economic considerations, the distinction between these two departments is becoming blurred, as more production is moved to external factories, the company is moving toward purchasing finished goods as opposed to manufacturing them in-house. As a result, low level capacity planning and labour cost controls, typically utilised by manufacturing companies, are no longer required.

At the start of this project, Company A had outsourced 80% of production overseas, yet had a computer system designed to handle only the 20% in-house. For the purpose of this analysis the two departments will be analysed separately, although it was expected that the two departments would eventually become one.

Please see *Appendix 3.1.3) Procurement analysis* for a detailed description of the business processes.

6.2.3.1) Procurement issues

From the perspective of Procurement the system is used, in the main, as intended. Some issues which arise are due to a lack of system housekeeping, although morale in the office is low due to inherited jobs from other departments.

The vast majority of raw materials are delivered to the Cwmbran factory first, while raw materials needed for China, are logged and subsequently sent out via carrier.

The method of including China on the Cwmbran plan confuses the local capacity requirements and creates unnecessary data, which is not deleted.

The control of raw materials at China is incomplete and unsatisfactory. Raw-material stock-takes are performed regularly to ensure that records are up to date in house.

The pressing issues for Procurement are summarised in Table 19.

Procurement issues	Cause	Comment
Inherited jobs.	Network issues between company sites.	Procurement has the best knowledge of how to use the system, which has meant that they have inherited other department's data entry work; in particular London sales order entry. A cause of conflict.
C.M.T. control.	Lack of system functionality.	Company A are moving production capacity abroad and the lack of a C.M.T. functional module is causing confusion between internal and external factories, raw material usage and capacities at both factories.
No suggested purchase order module or M.R.P.	Lack of system functionality.	No suggested purchase order module, or M.R.P., which looks at raw material stock levels against production orders and suggested purchases to meet the demand. As with other departments, information is taken from disparate sources in order see the whole picture. This is time consuming, labour intensive and prone to error.
The G.R.N. is raised correctly for materials coming in however, purchase invoices are logged in Dynamics which is not integrated, and consequently automatically matching one to the other is not possible.	Lack of systems integration.	A database in procurement bridges this gap in which an employee manually maintains and matches up purchase invoice, G.R.N. and the original purchase order. This is labour intensive, taking up one person full-time to maintain. There is also a conflict of interest as accounts should be reconciling purchase invoices with goods received and ordered.

Table 19 - Procurement issues

6.2.4) production

Company A manufactures neck ties in two factories, China and Cwmbran (Wales). The China factory was set up as a joint venture partner in order to cut production costs, and as a result, the majority of the company's capacity quickly moved overseas with China accounting for over 80% of production at the time of the project.

The XETAL system provides low level modules which are designed to meet the needs of internal manufacturing companies, for example, bar-coded Work In Progress tracking, labour cost controls and low level Capacity Planning. With China now controlling the majority of production this level of control is no longer required.

With regard to China a production order serves little more than a purchase order, the company tells them what they need in terms of specification, units required and when they are required and the rest is left to China. Company A will simply be invoiced for the service received (see Figure 15).

Company A have no need to monitor low level progress as they would in their own factory. They only need information relating to key stages of production in order to identify if any lead times are going to be missed. Each production order has a critical path of events in order to ensure that it is meeting the agreed delivery date for the customer. Company A need to identify if any of these key dates are going to be missed.

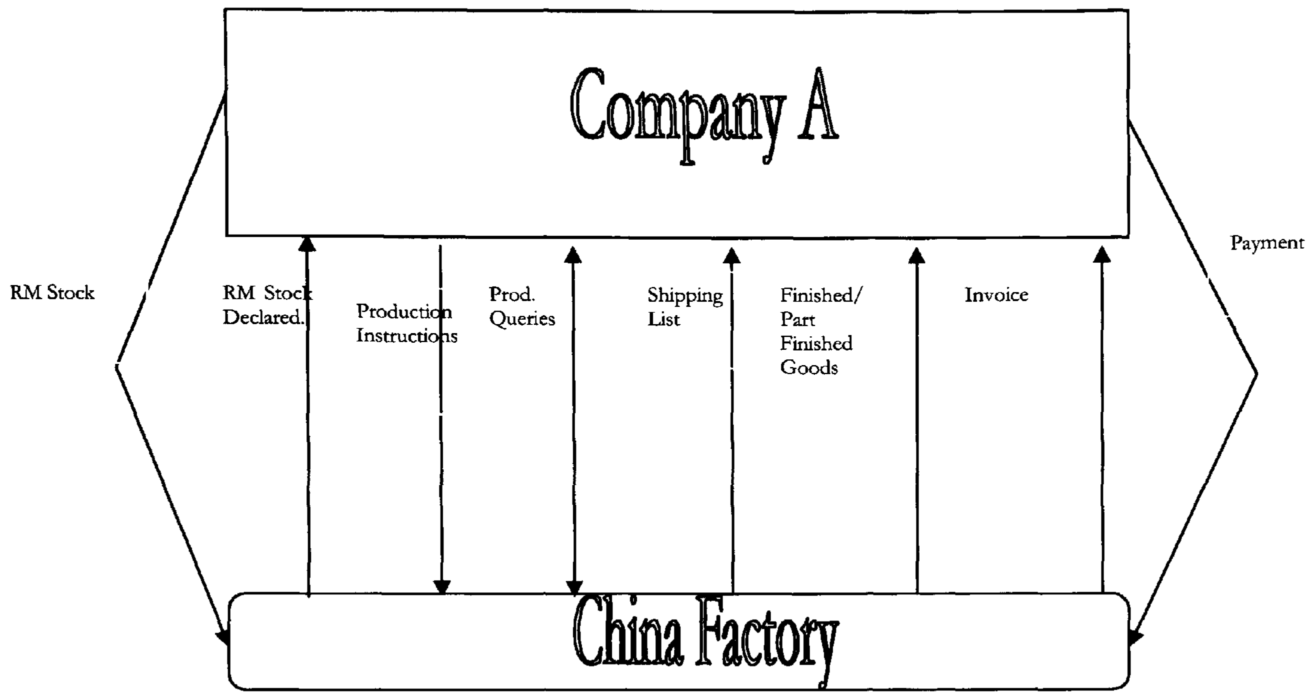


Figure 15 - Company A & China factory high level process diagram

The Cwmbran factory has seen shop floor capacity cut from 300 employees to around 40 and no longer use the labour cost control modules of XETAL. Shop floor employees are all on the fixed wage Payroll system.

Bar-coded work in progress monitoring is still maintained, however, information generated by the low level capacity planning is not. The capacity in Cwmbran is so low that visibility of orders on the shop floor is clear, and knowing the progress of part of an order on a particular machine is not needed.

All overseas production arrives back into the Cwmbran warehouse, with few occasions where goods are sent direct to the customer. This is avoided where possible, because the controls are not in place, i.e. there have been occasions where goods sent direct to the customer have not been invoiced.

Quality control in Cwmbran inspects a small sample of every production order before finished goods go into stock.

Cwmbran issues China with production orders and monitors the progress via emails, faxes & telephone calls. China sends a packing list (paper document) to Cwmbran letting them know what is currently due to be sent back in a particular week and Cwmbran would match this against their production flows.

On receipt of these goods into the Cwmbran warehouse the goods would be checked by quality control, before the warehouse staff count the goods and book them into finished goods. The manual stock cards are updated, however no computer system is updated and no G.R.N. produced. The main reason for this is the problem of the dual identity of contract products.

Brand production (raised mostly in Cwmbran) is adjusted into computerised stock and not booked in via G.R.N. due to a lack of training.

Production plans for contract sales are created by a batch routine. Plans for stock replenishment are entered manually. C.M.T. requirements are all included with Cwmbran production as internal plans, either at the quotation stage or in response to overload on Cwmbran. The capacity includes both Cwmbran and China.

Capacities are only recorded in standard hours – skill group capacity is not needed. This means that capacity for China could be recorded as ties per week if required to fit in with a C.M.T. type module in the future. Alternatively China could be set-up as factory two and the C.M.T. plans moved from one to two.

All production orders have the last operation claimed so that all production is processed through to off-line and available for receipt into stock. However, stock is still recorded on manual record cards under the customer identification code, and not the XETAL code, and no production order is booked into finished stock.

6.2.4.1) Production issues

Table 20 lists the issues faced by the production department which centre on a lack of control and visibility of over-seas production while *Appendix 3.1.4) Production analysis* provides a more detailed analysis.

Production Issues	Cause	Comment
Visibility of China orders.	Distance and lack of systems control.	Production personnel are not happy with information they receive from China. They do not need detailed work in progress monitoring but do need to identify when a particular product has passed a key stage of production. For any particular order they would want to know when the main fabric has been cut, when it has entered main production, when it has entered boxing, completed.
The balance of information.	Ongoing trend of moving production capacity abroad.	The balance of information over both factories is not in proportion to their importance. For example, detailed information is available within the Cwmbran factory which accounts for 20% of the products made, while poor information is available for China which accounts for the rest. Documents sent back from China (packing list) is often illegible and torn.
Dual identity of products.	Lack of system functionality.	As with contract sales the dual identity of certain products causes confusion. Production understood products by the XETAL code; however goods at the end of the production line are packaged with the customer's label, generated via E.D.I., which contains the customer's code only.
Spreadsheets – the lack of C.R.M.	Lack of system functionality.	For the main contract based customers the sales department use spreadsheets which monitor a critical path of events that the customer requires to be updated on their system over the Internet. This means that M&S, for example, require their suppliers to update their system. Key milestones on the critical path such as receipt of fabric, production date, Q.C. completion, delivery dates etc needs to be maintained. The sales and production team share a spreadsheet which is updated continuously for each contract in a given season. This information is collected from a variety of sources and personnel and not available via the XETAL system.

Table 20 - Production issues

6.2.5) Warehouse management and E.D.I.

The XETAL system was purchased without a full warehouse management system. Consequently, the system only offers basic stock functionality not including the option of stock by location. The main warehouse is located in the Cwmbran factory although some finished stock, produced in China, is held in their warehouse as it awaits shipment back to the U.K.

Most of the brand stock is held on the XETAL system although new product ranges, other than neckties, are not held due to XETAL's inability to hold products with multiple sizes. Contract stock is held on manual stock cards and the E.D.I. system. E.D.I. is not integrated with XETAL and is used to declare stock to the contract customer, and to print off dispatch notes and labels for Contract orders.

The stock in the Cwmbran warehouse is vast and no logical pattern exists as to the way stock is located. No full stock-take has been performed in many years, and due to resources is seen to be impractical. Perpetual stock-takes are performed on popular brand stock ranges and the stock records adjusted on the system, however stock records in external locations such as China and other external suppliers and agents is limited.

Contract stock tends to be continually moving, thus this is not a problem. Any stock left over from completed contracts is later moved to the brand division, under a new identification. There are other orders processed outside the system, and this is achieved by the warehouse sending paper documents to accounts so that manual invoices can be raised.

Finished products from China are mostly sent back to Cwmbran to be booked into stock and await call off. In some cases products have been sent direct to the customer, and this has caused problems in terms of raising invoices with the Accounts department.

Internal raw material stock is less of a problem with stock records updated correctly, however stock records concerning raw material left over in China is poor, as is wastage in the Cwmbran factory. Full stock-takes of raw materials are carried out, offering tighter control as opposed to finished goods stock. At stock take work in progress valuation in Cwmbran is adequate, but seen as less important in China, due to the fast turnaround. Goods are generally seen either as raw materials or finished goods and nothing in between.

6.2.5.1) Warehouse management & EDI issues

Table 21 summarises the issues faced in the warehouse, concentrating on a lack of computerised stock and control of manual invoices while *Appendix 3.1.5) Warehouse management & E.D.I. analysis* provides a more detailed description of the process.

Warehouse Issues	Cause	Comment
Lack of computerised locations.	Lack of systems functionality.	The warehouse does not relate to locations on XETAL, which cannot hold stock by location, consequently, when brand stock is picked for dispatch the warehouse personnel have to rely on internal knowledge. This is less of a problem for contract stock which tends to be fast moving, and does not stay in the warehouse for long periods of time.
Lack of complete stock records.	▪ Brand neckties are held on XETAL without costing information. ▪ Contract stock held on E.D.I. and manual stock cards. Neither of which are integrated with the main systems nor hold costing information. ▪ Poor data relating to China stock. ▪ No data relating to agent stock. ▪ No way of identifying goods in transit. ▪ No full stock-takes performed.	Stock records are held in multiple locations which makes stock reporting problematic. Likewise stock reconciliations and valuations are difficult to impossible. Perpetual stock takes are carried out, on an ad-hoc basis, but does not solve the problem. This causes problems in terms of maintaining accurate records for stock availability when taking orders, and an even bigger problem for Accounts that have to put a value on the stock which has no costing data maintained.
Lack of integration.	Contract orders are dispatched via E.D.I. and this system is not integrated with XETAL or Dynamics.	When a contract order is dispatched the manual stock records are updated by hand and the invoice sent to the accounts office, on a piece of paper, for the sales ledger to be manually updated. This takes time and is prone to error.
Missing invoices.	The only way contract orders are invoiced is when the warehouse manager in Cwmbran receives the call off via E.D.I. This produces the paperwork, prompting him to update his stock records and send the self billing invoice to accounts.	On some occasions goods are sent direct to the customer from China as the customer is located in the Far East. On such occasions the only internal person to know about this would be the sales person, who has taken the order, and the production director. Neither of which would invoice the customer. The warehouse manger would not be aware of the stock (not been booked into his warehouse) and the paper work was not always generated via E.D.I., nor the customer self-billing.

Table 21 - Warehouse issues

6.2.6) Invoice processing

Great Plains Dynamics is used to cover the sales, purchase and general ledgers, cash book, management reporting and other standard accounting functions. Dynamics is a well established accounts package and offers the functionality required to meet the accounting needs of a company the size of Company A.

6.2.6.1) Accounts issues

From an accounting perspective the biggest concerns have already been mentioned, in terms of the lack of systems integration between XETAL and Dynamics. This means two people are employed full time re-keying, logging and reconciling purchase and sales invoices between the two systems. The other issues centre on the inability to maintain and produce accurate stock records and access to standard accounting reports, and these are briefly summarised in Table 22, while a detailed description of the accounting process is provided in *Appendix 3.1.6 & 7).*

Accounts Issues	Cause	Comment
Stock valuation.	Lack of adequate computerised stock and costing information.	The company has large quantities of finished stock in various locations, and does not have the resources or means to accurately count or value this.
Systems integration.	Lack of ability to integrate systems.	As mentioned previously.
Standard reports.	Due to issue 1 & 2. Standard reports are not automated and are difficult to create manually such as: ▪ Detailed & summary sales margin reports ▪ Detailed & summary stock valuation reports. ▪ Agent commission reports. ▪ Royalty reports. ▪ Automated debt chasing letters.	As with other departments the ability to generate standard reports is difficult due to the incomplete and fragmented nature of the data and lack of ability to use available report writers.
Lack of stock visibility.	Tend to have stock located in multiple factories, warehouses, in transit & agent locations world-wide.	
Expensive forms	Use of pre-printed paper and lack of ability to email sales invoices and statements.	Many systems now offer the ability to move away from pre-printed paper while the increasing use of the Internet allows for forms to be emailed direct from the application. Many customers and suppliers would allow forms to be emailed.

Table 22 - Accounts issues

6.3) Chapter conclusions

The internal departments have numerous and recurring issues with regard to the existing systems, for example, the lack of systems integration between the order processing and accounting systems results in a duplication of effort with regard to the processing and reconciling of invoices. This means that two staff members spend all their time re-keying and logging invoices as well as generating the reports associated with the various invoice types.

The stock system cannot handle stock by location, stock referenced by customer and company unique identifiers or track customer order flow information. This means that manual records are kept with regard to contract stock transactions and valuations as well as the customer order flow, meaning, that preparing management information from the many different sources is time consuming and prone to error.

A lack of bespoke development means that contract quotations cannot be generated with regard to new sales orders on the system. This means that the sales department use custom spreadsheets in order to calculate new quotations which results in fragmented sales and costing information held outside the main system. This has an effect on Accounts who require this information in order to generate sales margin reports.

A lack of user training and in-house I.T. housekeeping means the systems are not being used as intended. As a result users, in places, have adopted workaround solutions where none was needed. The performance of the network is causing ongoing performance and support issues which have never been solved despite various fixes, support initiatives and new hardware.

Economic considerations means that production is moving to external factories and the systems needs to be able to handle stock in multiple locations, while low level manufacturing functions are no longer required.

The company can no longer afford to allocate resources for duplicate data entry; the systems need to be integrated so that different departments can access the same data, real time and respond more quickly. An integrated Information System would solve many of the problems identified by removing manual labour intensive processes and centralising information into one database, allowing the organisation to react more quickly in its environment.

6.4) Chapter summary

Chapter 6 has followed on from the analysis of the people and users of the company and followed a typical hard line of identifying the business processes by way of process analysis techniques. Chapter 7 will complete the business analysis by looking at the network set up at Company A in order to identify changes that will be required as part of the project.

Chapter 7

COMPANY A – NETWORK ANALYSIS

"Science and technology multiply around us. To an increasing extent they dictate the languages in which we speak and think. Either we use those languages, or we remain mute."

- BALLARD, J.G. 1974. Introduction to the French edition of *Crash.*

7.1) Chapter summary

Chapter 7 concludes the business analysis carried out in the previous two chapters by looking at the hardware, security and training issues the company are facing.

7.2) Network analysis

In this chapter an analysis of the network infrastructure has been carried out so that the requirements for the new systems can be fully specified.

7.2.1) Network description

The original network infrastructure can be seen to follow a star topology consisting of hubs from which cable segments radiate to each component on the network.

The network is located over two sites, Cwmbran and London, with the connection established by utilising a 64k leased line. Cwmbran holds the main Novel server which provides application, printer and database services, and runs on a BNC backbone, with London on CAT5 cabling.

London has two servers, a Novel server, which acts as a print and application server to the XETAL database in Cwmbran, and lastly an NT4 server that's used for internal/external e-mail and runs Exchange 5.5. Internal email is routed externally over a direct dial I.S.D.N. bridge

Within the network hubs have been added to create new points on the network. In the case of London multiple hubs are daisy chained together creating bottlenecks which slow down the network.

Early in the project this was resolved by replacing several 10mbit hubs for one 100mbit switch. This increased the network speed in London and removed a bottleneck, although London can still not use XETAL over the network until the Cwmbran infrastructure is changed.

Internet access within the company is achieved only by the use of individual modems and dial-ups to Internet service providers, and is not available on all machines. There is no centralised network access to the Internet or any firewall or centralised (and updated) virus protection on either site. There is no housekeeping performed on any system and no system documentation available on the current infrastructure; neither are there any formal or informal I.T. policies or procedures in place.

Running a back-up of the main Application server is very slow and often fails. To run a back-up of the server lasts around six hours and this can only be run at the end of the day. The back-up is run from a client machine, over the network and the media is never taken off-site. The mail server in London is never backed up. The network is slow and printing, application and file access from the server is largely unworkable. From an accounting point of view posting batched transactions can take a whole day, while in London it can take several hours to retrieve data from the server over the kilo-stream link.

Figure 16 shows the network at the start of the project. (It contains the new switch which was installed early on in the project to provide a partial solution to the speed of response between the two sites). Table 23 lists the initial network components used in the company.

7.2.1.2) Network diagram

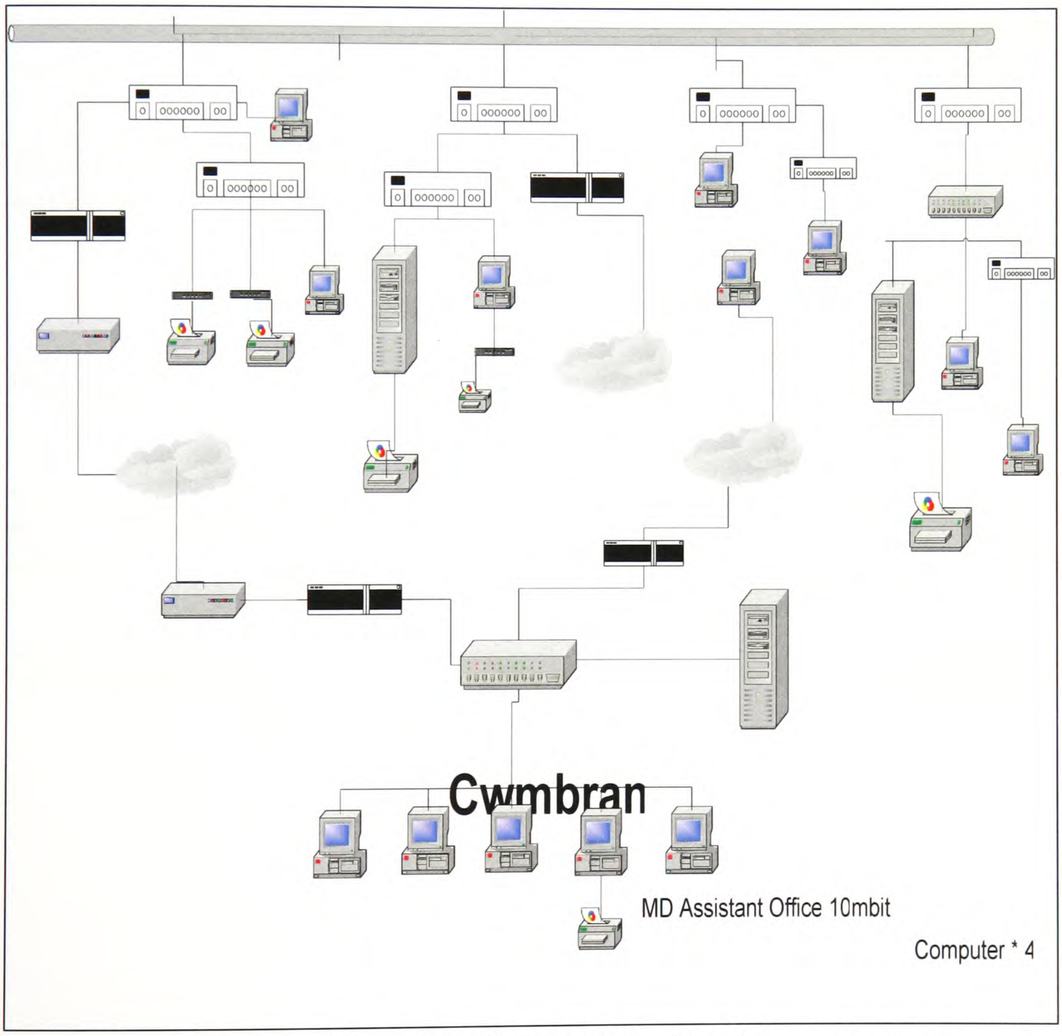


Figure 16 - Company A - Initial network diagram

Hardware	Description	Comment
Fileserver * 2	Opus tower Pentium P90 fileserver 1G.B. SCSI hard disk, 16M.B. R.A.M. 32 BIT network card. Advanced Netware v3.12.	Underspecified for the job at hand. Often crashes.
Mail server	HP, NT 4 mail server running Exchange 5.5	Housed in London & never backed up. Regularly crashes and requires restarting. R.A.M. should be upgraded.
Typical client workstation	Opus 486 DX266MG workstation S.V.G.A. colour screen, 16MB R.A.M., 420MB hard disk, DOS 6.2.	In places, clients have been upgraded to basic Pentium machines running various versions of Windows.
Desktop Printer	Kyocera laser printer FS-1550	Various other desktop printers have been incorporated.
4 * Network printer	Epson DF5000 heavy duty printers 136 column, 480/96 CPS	Printers regularly fail due to overload and network problems.
Communications	2 * LAN dial 520-w remote site Ethernet I.S.D.N. bridges.	Upgraded to 64K leased line.

Table 23 - Initial network infrastructure

7.2.2) Security

With the exception of Payroll no other I.T. systems are secure. All users have full access to all areas of the network and most systems users are using one generic login, making it impossible to differentiate between them.

- Users have full administration control on the network, whereas they should have customised rights and privileges dependent on their requirements.
- Passwords to the main administration accounts and users passwords generally are easily guessed and not changed.
- Users do not have their own directory space on the server, thus are saving files to their local drive. Users are not backing up their local drive so this data is at risk of being lost or corrupted.
- User identification – It is difficult to track the source of problems on the network and identify users as they are using the same login.
- Internal E-mail – All users on the internal e-mail system have access to everyone else's e-mail account. No size limits are set on user accounts.
- The Internet is available through individual modems. This un-centralised approach is difficult to secure and monitor.
- Company A have lost data and files through viruses, and a scan initiated on the main server discovered over 100 viruses housed in the main directory. Anti-virus software is not loaded onto each computer or kept up-to-date.
- No I.T. asset list is available for insurance and audit purposes.

7.2.3) Training

Users have never received any formal training, thus what they know is what they had taught themselves or learned from others, and this has resulted in incomplete knowledge and inherited bad practice. Users are continually frustrated and this has affected productivity and morale.

The lack of training also means that users of XETAL and Dynamics are not fully aware of the capabilities of the systems and are dependent on on-going technical support. This has led to many of the informal systems discussed, which have replaced functionality required from the main systems.

Basic I.T. training would remove unnecessary support jobs and allow users to utilise the technology they already have.

Table 24 summarises the issues faced by the company with regard to the network infrastructure.

Issue	Cause 1	Cause 2	Cause 3
Slow network	Underspecified and overworked server & client machines.	Poorly administered/structured & supported network.	Network cabling infrastructure has resulted in performance bottlenecks.
Slow applications	Lack of I.S. housekeeping.	Slow network.	Ongoing support issues.
Lost, damaged files	Lack of centralised & backed up user directory space.	No networked & updated antivirus solution.	No systems backed up.
Unsecured systems	Lack of user defined passwords.	No user networked privileges.	Numerous & varied I.S.P.s.
Software Workaround solutions	Lack of user I.T. training.	Lack of expert I.T. support.	Frustrated users.
Legal	Lack of Software licensing information.	Unknown data protection compliance.	Health & safety.

Table 24 - Network issues

7.3) Chapter conclusion

The network is located over two sites, Cwmbran and London. This connection is established by utilising a 64k leased line. Cwmbran holds the main Novel server and London has two servers, a Novel server which acts as a Print and Application server and an NT4 server that is used for e-mail routing.

The network has evolved over the years, in an ad-hoc fashion, with new hubs and routers being added as new points of access were required and this has led to performance bottlenecks. As a result, London users have stopped using the network applications housed in Cwmbran.

I.T. users have no network privileges, such as directory space or individually set up user accounts and passwords. No application, except Payroll, is adequately backed up.

7.4) Chapter summary

In this chapter the business analysis has been completed. It is now possible to prepare the requirements documentation which will state what the company requires in terms of a complete solution in terms of hardware and software.

The following chapter will identity the requirements and look into the selection process adopted thereafter.

Chapter 8

COMPANY A – BUSINESS REQUIREMENTS SPECIFICATION

"One thing is clear: We don't have the option of turning away from the future. No one gets the vote on whether technology is going to change our lives"

- Gates (1995)

8.1) Chapter overview

At various points in the life of any organisation the existing computer systems no longer provide the information, which the organisation requires and it becomes necessary to choose a replacement system (Swanson, 2000). With regard to Company A, the reasons for this were typical and matched other organisations at the time, as documented by Frederic & O'Doherty (2000), Willcocks (2002), and Bagranoff & Brewer (2003), these were:

- A change in the nature of the business.
- Outdated/failing legacy system.
- The need for improved services & information, through integrated systems.
- Economic changes in the market and headcount reduction.
- Pressure from competitors for enhanced product quality and response times.

Chapter eight leads on from the business analysis carried out in chapters 5, 6, and 7 and look to explain the work involved in selecting the appropriate solution. This chapter will reference the requirements catalogue and evaluation documents in Appendix 4 and 5 respectively.

In the context of Company A, the statement of user requirements summarises each department of the organisation in terms of what they require from any information system. The purpose of this document is to initially assess the suitability of potential suppliers without going into great detail. Consequently, the document has to be relatively brief, and to the point in terms of content.

The ideal supplier will be from the Apparel industry and used to dealing with manufacturing organisations like Company A, thus the document is a useful tool when opening discussions as detailed content is not required at that stage. This document has been derived from interviews, and other techniques, adopted as described in Chapter 3.

Each short-listed supplier will be assessed against the more detailed requirements catalogue (Paul & Yeates, 2006). The requirements catalogue (Appendix 4, Table 2) is derived from, and linked with, the businesses process modelling (Appendix 3.1), interviews and observations of company staff (Alexander & Maiden, 2004) and (Paul & Yeates, 2006). Each short listed supplier will need to provide a formal response to the document. The requirements catalogue lists all of the requirements and provides a detailed specification on each in turn, four examples of which can be found in Appendix 4, Tables 3 to 6.

Each of the requirements in the catalogue is weighted as to its importance to Company A, as defined in Table 25. This model allows the analyst to attribute a score card to each requirement allowing each solution to be evaluated against each requirement. The weighting assigned to each requirement is only added to the solutions score if it meets the requirement during the evaluation process.

Weighting	Evaluation score	Overall score
1 * Does not matter	0. Does not meet requirement	(Weighing * Evaluation Score)
2 * Not crucial		
3 * Important	1. Meets the requirement	
4 * Very important		
5 * Essential		

Table 25 - scoring system

The requirements catalogue also assigns one of twelve requirement groups to each individual requirement. The purpose of this is to enable the researcher to summarise the requirements, and scoring, against potential solutions when making decisions during the evaluation process.

The requirements catalogue's purpose is as follows:

- To supply the stakeholders with a list of requirements that they can sign off against.
- To provide a weighting, and scoring, against each of these requirements, in terms of importance, to enable potential systems to be measured in terms of suitability. These requirements will be grouped into suitable categories and an overall percentage of organisational fit produced.
- To enable potential suppliers to obtain a clear idea of what is needed and provide sensible quotations.
- As a weapon to hit the supplier with if the system subsequently does not perform properly.

8.2) Project objectives and benefits

Before undertaking the computer system selection exercise, the management of the organisation had to identify the objectives in undertaking this work and the benefits which they hoped to achieve. The objectives were seen to include replacing, or upgrading a system which the company had outgrown, but not include investing in technology for technology's sake.

The benefits could be seen as intangibles, or soft benefits, such as improved efficiency, reduction in downtime, improved decision making based on newly available data, to the strictly financial such as improved profitability. All objectives and projected benefits had to be quantifiable (where possible), identified beforehand, and kept in mind throughout the process. These benefits are also reflected in the research of Frederic & O'Doherty (2000), Willcocks (2002) and Bagranoff & Brewer (2003).

8.3) Summary of requirements

The principle objective for the eventual supplier is to provide an enterprise wide solution. The solution has to improve on the existing information systems by providing an integrated management information system. This will allow decisions to be made based on timely and accurate information, rapidly available in a format understood by users throughout the organisation. Crucially, the organisation is looking to improve stock control and integrate systems to allow faster order processing, and reduce stock levels.

Table 26 lists the requirement groups as defined in the requirements catalogue (Appendix 4, Table 2), and also provides examples of the requirements therein which implicitly reflect the explicit requirements listed in the catalogue. Table 26 sources these examples back to the business analysis tables provided in Chapter 6, just as the requirements catalogue sources back the individual requirements to the business analysis data flow diagrams in Appendix 3.1.

The total number of points available under each requirement group (as defined in Appendix 4, Table 2) is listed as is the average weighing of the requirements held in that group. This allows each requirements group to be prioritised in terms of importance, which will be used to evaluate and separate solutions which are equally matched.

In conjunction with Company A the researcher added further selection criteria which will be incorporated into the requirements, and are specific to the S.M.E. These are listed in Table 27.

8.3.1) High level requirements

Company A are looking to achieve the following:

Requirement group	Points available	Summary example of requirements from catalogue	Business analysis source
Consultancy, training and support services.	Total weighting points = 38 Average requirement weighting = 4.2	Acceptable data communications between sites.	Table 16, 17,18, 19, 20
		Secure network through firewall and anti-virus software.	Table 16
		Network and client operating systems standardised.	Table 16
		User training and technical support.	Table 16
		The supplier will be able to supply or recommend a hardware solution.	Table 17
In-house production.	Total weighting points = 23 Average requirement weighting = 2.3	Solution for in-house production.	Table 20

Requirement group	Points available	Summary example of requirements from catalogue	Business analysis source
Interface and customisation.	Total weighting points = 27 Average requirement weighting = 3.8	Secure and adaptable Windows interface with drill-downs.	Table 16
Off-shore production & procurement.	Total weighting points = 185 Average requirement weighting = 4.1	C.M.T. sourcing & M.R.P. control.	Table 16, 19, 20
		Visibility of overseas stock – shipping reference.	
Reporting options & forms.	Total weighting points = 153 Average requirement weighting = 3.8	Multidimensional sales margin information generated and reported automatically as orders are placed.	Table 22
		Accessible, summary and detailed management information and standard reports.	Table 16
		Company forms no longer requiring pre-printed paper.	Table 22
		Email alerts and ability to email order and/or invoice documents.	Table 22

Requirement group	Points available	Summary example of requirements from catalogue	Business analysis source
Sales and warehouse management.	Total weighting points = 113 Average requirement weighting = 4.5	Contract & Brand stock able to be held and valued on the computer system.	Table 16, 17, 18, 20, 21, 22
		Functional stock-take facilities which allow full and perpetual stock-taking, stock transfers, auditing facilities and goods in transit control.	Table 16, 17, 20, 21, 22
		Full warehouse management by multiple warehouses and locations including computerised, traceable and auditable stock transactions.	Table 16, 17, 20, 21
Systems integration, accounting solution.	Total weighting points = 22 + 291 Average requirement weighting = 3.6 + 4.4	Sales invoice generated from dispatch and posted directly into the sales ledger.	Table 16, 17, 21, 22
		Automated credit checking.	Table 17, 22
		Integration with E.D.I.	Table 21
		Automated reconciliation of purchase invoice, G.R.N. and purchase order.	Table 16, 19, 22
		Ability to quickly access and link from production order to sales order.	Table 16

Requirement group	Points available	Summary example of requirements from catalogue	Business analysis source
		Ability to quickly access and link from sales invoice to associated sales order.	Table 16
Quotation system.	Total weighting points = 10 Average requirement weighting = 5	London users able to access the system and place their own bulk order flows through custom-built proposals/quotation system.	Table 18. 20

Table 26 - Summary of key requirements

Requirement group	Points available	Summary of requirements
Company profile.	Total weighting points = 25 Average requirement weighting = 5	The supplier of the solution should have Apparel industry experience.
		The supplier's financial position must be vetted and approved by the financial controller.
		The supplier must be able to demonstrate a successful system's implementations in other organisations such as Company A.
		Identified solutions must be from the mid-range market, aimed at the S.M.E., and be readily available off the shelf.
		Supplier should be based in the U.K.
Future projects.	Total weighting points = 5 Average requirement weighting = 2.3	The supplier should be able to recommend or integrate with future projects such as bar-coded warehouse management and ecommerce.
Total cost of ownership.	Total weighting points = 5 Average requirement weighting = 5	The implemented solution must be within the organisational budget.

Table 27 - Additional requirements

8.4) Selection methodology

Following the formal business analysis, and the creation of the requirements documentation, a process was required in order to identify and select a range of solutions. In conjunction with the requirements documentation the following process was created, adopted and used to shortlist options for consideration (The E.R.P. selection process survival guide, 2005). Bagranoff & Brewer (2003) and Paul & Yeates (2006) advocate the use of departmental modelling which was incorporated into the process as follows, and in Figure 17.

1. Selection process
    a. Prepare Requirements Documentation.
        i. Summary statement of user requirements.
        ii. Requirements catalogue.
    b. Identify solutions from.
        i. Personal knowledge & contacts.
        ii. Specialist magazines & journals.
        iii. Trade shows and exhibitions.
        iv. Computer user's information service.
        v. Internet queries.
    c. Tendering process.
        i. Discuss with the supplier the potential fit using the statement of user requirements.
        ii. Verify financial stability of vendor using Companies House.
        iii. Compare solution against requirements catalogue. Formal written feedback required at this stage.
        iv. Demo of solution at supplier site with researcher.
        v. Company A - Cwmbran & London site visit.
            1) High level talks with supplier and key stakeholders.
        vi. Demo of sub modules in-house to key stakeholders.
        vii. Departmental modelling of sub-modules with key users.
        viii. Board level presentation & supplier reference site visits.
        ix. Contract negotiations.

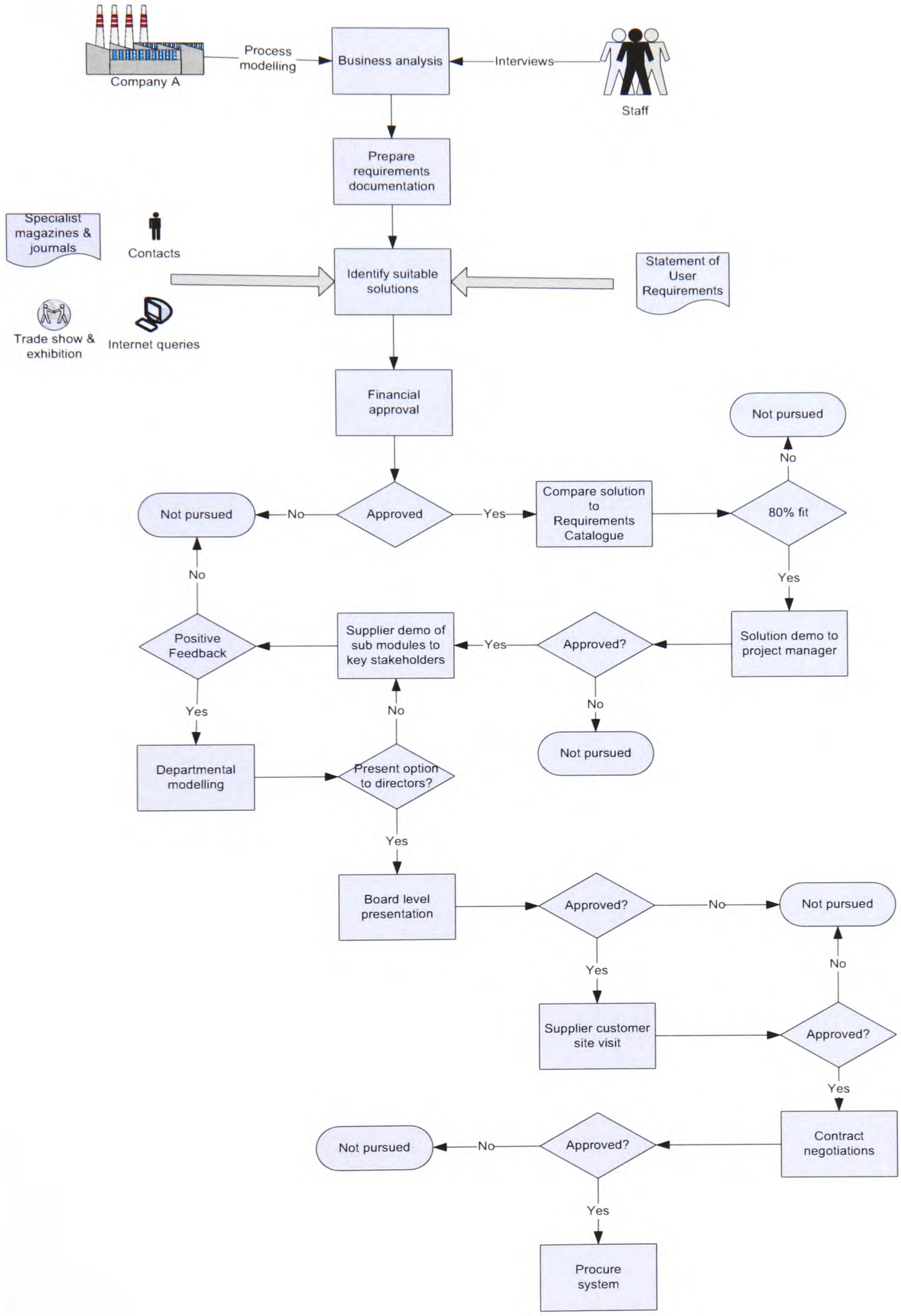


Figure 17 - Selection flowchart

At any level of this process, if the solution was deemed inappropriate, it did not proceed to the next level. In order to be short-listed the solution had to satisfactorily meet all levels stated. Ultimately, the board of directors and stakeholders had to approve the most suitable suppliers.

The main purpose of this process was to allow the board of directors to consider the most suitable solutions, and to allow all stakeholders to be involved with and buy into the process. This process was a learning process for the researcher, stakeholders and users of the company and all available business knowledge needed to be involved throughout the selection process. This also allowed any potential supplier to get to know and understand the organisation, which made the final presentation more customised to the organisational requirements.

8.5) Shortlist of options

The choice of potential I.S. suppliers, within the United Kingdom, is vast. There are, at least, 10,000 suppliers, 3,000 Accounting packages, and 250 Manufacturing packages available. There are a number of options available to the organisation, those considered are as follows.

8.5.1) Upgrade of existing systems

Current system suppliers are offering upgrades to the existing systems, and these may or may not meet the requirements. Because of the cost benefits of upgrading, and the fact that this would be easier to implement, in terms of data transfer and user training, this is an attractive option.

The lack of systems integration has been the main recurring issue identified from the business analysis, and had led to the duplication of data throughout multiple systems. This in turn has led to delays in processing invoices, and resources continually allocated to the re-keying, analysis and reporting tasks required to work around the problem.

Both system suppliers believe that integration is possible between XETAL and Dynamics, although neither can provide case-studies of successful integration. This option inspires little confidence, with much evidence of the failed attempts and workaround solutions that have been adopted over the years.

8.5.2) E.R.P. solution

The second solution would be to select an E.R.P. solution, which would integrate all departments and functions across the organisation onto a single I.S. This would aim to serve all the different departments' information and processing needs. This option would solve the problem of integration by consolidating financial, order processing, manufacturing and distribution applications, eliminating the problems associated with multiple information systems, such as data redundancy, integrity and management reporting.

The disadvantage of E.R.P. is the level of financial commitment, coupled with the reality of many documented failed projects, or projects which have overrun schedule and budget. Discussions have taken place explaining the trends in the E.R.P. industry, about the consolidation of the market, increased focus on the S.M.E., and the fact that software is modular based and more able to be adapted and customised to different industries. Despite E.R.P. now being aimed at the S.M.E., Company A do not have the resources with which to invest in the project, and are nervous about selecting a supplier with limited Apparel experience, as E.R.P. suppliers do not tend to specialise in one industry type in isolation. During the selection process, no suitable E.R.P. supplier was found which could meet all the conditions set out (see 8.4), in particular, proven Apparel experience.

8.5.3) Hybrid solution

The third option would be to adopt new systems to directly replace XETAL and Dynamics. These systems would not offer true E.R.P. functionality but would, in combination, aim to integrate all departments and business processes.

The reasoning behind selecting this option would be that a true E.R.P. solution would be seen as too high risk, problematic and expensive to install in an S.M.E. In selecting this option, consideration would be required as to how these systems would be integrated, as the original solution of XETAL and Dynamics was meant to be.

This solution could cause implementation and support problems as multiple systems typically require technical support from multiple suppliers, which could cause the deferral of responsibility when support is required.

This option is often preferred by the S.M.E. because they cannot afford the E.R.P. solution. Company A fits into the mid-range market which typically means the adoption of a niche system, with industry experience, to cover the various functions, and this grew to be the preferred option based on the selection criteria adopted.

8.5.4) Conclusions

The statement of requirements documentation defined the organisational needs and was used to shortlist potential suppliers. Potential suppliers were identified from personal knowledge and contacts, exhibitions, recommendations and specialist journals. There were various solution types available to the company including upgrading existing systems, introducing new separate systems to cover the various functions or to introduce an E.R.P. system to cover all the departmental needs.

8.6) Evaluation of options

Following the identification of various solutions, tenders were received, and had to be evaluated in order to lead to the selection of the preferred solution. The evaluation process consisted of various discussions and the refinement of proposals in order to meet the requirements.

On reading the proposals, it became apparent that there were differences in the approaches adopted by different suppliers. Some covered every point raised, often in some detail, while some omitted large areas of requirements. Some identified each point in the requirements and specifically addressed it, whilst other proposals were disorganised in that the recipient needed to check in detail to find the answers. All omissions were checked with the potential supplier, and the degree of fit was noted. If a supplier was able to meet a particular requirement they were awarded the points associated with that requirement from the requirements catalogue. These were then added together with other requirements, under the appropriate requirement group, and a percentage of fit established. Using this approach, higher ranked requirements would be assigned greater weighting in the final analysis.

At the end of this process the company had an analysis of fit, enabling them to decide on the tenders to be short-listed. The aim was to list the two most suitable solutions. Table 28 shows a broad list of identified solutions, along with the degree of fit to the requirements catalogue, while Table 29 summarises key reasons, against the requirement groups, why solutions failed this process. Appendix 5 contains the detailed evaluation of the two highest ranked solutions: XETAL & Dynamics and STYLEman & Open Accounts against each individual requirement under the 12 requirement groups.

Solution	Supplier/Re-seller	Accounting solution	Company profile	Consultancy, training and support services	Future projects	In-house production	Interface and customisation	Off-shore production & procurement	Reporting options & forms	Sales and Warehouse Management	Systems integration	Total cost of ownership	Quotation system	Overall
Anesis	Esperus Software Ltd	271/291	10/25	38/38	5/5	23/23	27/27	145/185	148/153	100/113	22/22	5/5	0/10	87%
Answer solutions	Answer	251/291	12/25	23/38	0/5	23/23	22/27	165/185	148/153	100/113	17/22	0/5	0/10	82%
Caliach Vision	Caliach Ltd	291/291	10/25	28/38	0/5	23/23	27/27	160/185	133/153	98/113	17/22	0/5	10/10	88%
Control E.R.P.	Control Group	241/291	15/25	22/38	5/5	23/23	27/27	180/185	143/153	113/113	22/22	5/5	10/10	89%
Creation solution	Micar Computer Systems Ltd	291/291	10/25	23/38	0/5	23/23	27/27	145/185	153/153	113/113	22/22	0/5	0/10	89%
Epicor	Epicor	271/291	10/25	28/38	5/5	23/23	27/27	165/185	143/153	113/113	22/22	0/5	0/10	8
E.R.P. solutions	FWL Technologies	261/291	10/25	33/38	5/5	23/23	17/27	165/185	133/153	108/113	22/22	0/5	0/10	8
Infor Swan	Infor Swan	271/291	10/25	28/38	5/5	18/23	17/27	165/185	143/153	103/113	10/22	0/5	0/10	8
K3 solutions	K3	271/291	15/25	38/38	5/5	18/23	27/27	155/185	123/153	103/113	10/22	0/5	0/10	8

Solution	Supplier/Re-seller	Accounting solution	Company profile	Consultancy, training and support services	Future projects	In-house production	Interface and customisation	Off-shore production & procurement	Reporting options & forms	Sales and Warehouse Management	Systems integration	Total cost of ownership	Quotation system	Overall
Lilly Software Associates	Visual Solutions	261/291	10/25	28/38	5/5	23/23	17/27	165/185	143/153	108/113	22/22	0/5	10/10	88%
Mertex/Camtex	Reflex Data Systems Limited	251/291	10/25	28/38	5/5	23/23	27/27	170/185	138/153	113/113	22/22	0/5	0/10	87%
Movex Fashion	Intentia	261/291	10/25	38/38	5/5	23/23	27/27	160/185	143/153	108/113	22/22	0/5	0/10	88%
Navision Axapta	New Planet	291/291	10/25	28/38	5/5	23/23	27/27	185/185	153/153	113/113	22/22	0/5	0/10	95%
Prima Solutions & Open Accounts	Prima Solutions	291/291	10/25	28/38	5/5	23/23	27/27	185/185	122/153	113/113	0/22	5/5	0/10	90%
SAGE	Micro Dynamics	291/291	10/25	28/38	5/5	18/23	22/27	180/185	143/153	103/113	22/22	0/5	0/10	[illegible]
Solutions	McGuffie Brunton	281/291	10/25	28/38	5/5	18/23	22/27	180/185	148/153	108/113	17/22	0/5	0/10	[illegible]

Solution	Supplier/Re-seller	Accounting solution	Company profile	Consultancy, training and support services	Future projects	In-house production	Interface and customisation	Off-shore production & procurement	Reporting options & forms	Sales and Warehouse Management	Systems integration	Total cost of ownership	Quotation system	Overall
SAP	Various	291/291	10/25	28/38	5/5	23/23	27/27	185/185	153/153	113/113	22/22	0/5	0/10	96%
Style Man & Open Accounts	OSL	291/291	25/25	38/38	5/5	0/23	27/27	185/185	151/153	113/113	22/22	5/5	10/10	97%
Swift	Swift Computing	271/291	10/25	28/38	5/5	18/23	22/27	175/185	122/153	108/113	22/22	5/5	0/10	87%
System 21	Geac	271/291	10/25	28/38	5/5	23/23	22/27	175/185	143/153	113/113	22/22	0/5	0/10	90%
TEMACS	Jay by Jay	271/291	10/25	28/38	5/5	23/23	22/27	145/185	117/153	113/113	0/22	5/5	0/10	82%
TEXpro	Open Systems Group Ltd	0/291	15/25	38/38	5/5	23/23	27/27	185/185	122/153	113/113	22/22	5/5	0/10	62%
TMS	TMS Software Ltd	0/291	25/25	38/38	5/5	23/23	27/27	185/185	153/153	113/113	22/22	5/5	0/10	[illegible]
Virtual Enterprise	IBS	253/291	15/25	38/38	5/5	23/23	22/27	175/185	153/153	113/113	22/22	0/5	10/10	[illegible]

Solution	Supplier/Re-seller	Accounting solution	Company profile	Consultancy, training and support services	Future projects	In-house production	Interface and customisation	Off-shore production & procurement	Reporting options & forms	Sales and Warehouse Management	Systems integration	Total cost of ownership	Quotation system	Overall
WINMAN	Systemware Services Ltd	271/291	10/25	28/38	5/5	23/23	27/27	175/185	143/153	113/113	22/22	5/5	0/10	91%
XETAL & Dynamics	XeBusiness	291/291	20/25	38/38	5/5	23/23	27/27	180/185	137/153	108/113	9/22	5/5	10/10	95%
XKO software	XKO	276/291	15/25	28/38	5/5	23/23	27/27	162/185	138/153	108/113	22/22	0/5	0/10	89%

Table 28 - List of system solutions

Requirement group	Comment
Accounting solution	Some mid-range E.R.P. solutions, like Control E.R.P., offered limited functionality in turns of the accounting modules. These systems tended to be specialist manufacturing systems offering built-in custom accounting ledgers. These modules did not offer the full range of facilities expected for financials and scored poorly by comparison with standard accounting systems. Control E.R.P. met 82% of the financial requirements as identified in Appendix 4, Table 2 while systems like Sage or SAP met all these requirements.
Company profile	Some solutions were too generic - one such example SAGE Line 500 offered an affordable E.R.P. solution. This solution met all functional elements and had an Apparel module, but the fact that a reseller with Apparel experience could not be identified meant this option did not perform well when talking with company stakeholders. Company A, with limited resources, would be dependent on any supplier to provide consultants to help with implementation, and thus placed great emphasis on finding a supplier with Apparel industry experience. Not able to demonstrate systems working adequately with other organisations like Company A – one short-listed system was Control E.R.P. which met many areas of requirements and made an excellent impression on site visits, but scored poorly in the evaluation process when Company A visited one of their existing customers. The requirements held against Company profile are weighted highly and are essential to Company A. The average weighing under this group is 5, thus all these requirements identified in Appendix 4, Table 2 must be met. Top end generic systems also scored poorly in this category e.g. Axapta and SAP could not offer suppliers with industry knowledge, or examples of similar customers already using their solution. Company A would not be a test case in this type of project.

Requirement group	Comment
Consultancy, training and support services	Another area weighted highly by Company A (average requirement weighting = 4.2). This is due to the fact that Company A are an S.M.E. looking for one supplier to provide resources for software, hardware, consultancy and on-going support. All identified solutions scored well under this category.
Future projects	The requirements under future projects looked at bar-coded warehouse management and E-commerce which Company were interested in implementing as part of a future project. The average requirement weighting was low (2.3) as the company were only interested in seeing if the suppliers could either offer existing solutions, or were looking to introduce these features at a later date. Most solutions either had these modules or were already using third-party products.
In-house production	Most systems originated from a manufacturing background thus offered in-house production. Company A were moving towards supply and distribution thus placed low importance to the requirements under this group (average requirement weighting = 2.3). The two highest scoring systems overall demonstrate the difference. XETAL offered full in-house production and scored maximum points (23/23) while STYLEman does not offer in-house production (0/23) and was more suited more to supply and distribution.
Interface and customisation	All the systems offered the Windows interface with the usual ability to configure the settings per user while offering the ability to drill down through the data. As such all systems scored highly and could not be separated.
Off-shore production and procurement	This group of requirements was valued highly (average requirement weighting 4.1) dues to the fact that company A were moving towards supply and distribution, with factories held abroad, and with the trend of other companies going the same way most of the systems were being structured to facilitate this functionality. Consequently, all the solutions scored highly under this category.

Requirement group	Comment
Reporting options and forms	Average requirement weighing = 3.8. As with the interface and customisation this is a difficult group with which to differentiate between solutions. Most systems have not only standard reports but also built in report writers and third-party products available to produce reporting needs. The systems which scored the highest (Axapta, SAP, STYLEman) offered built report writing as well as multidimensional, or pivot table style reporting.
Sales and warehouse management	Another important category (average requirement weighting of importance = 4.5) where solutions scored well. These requirements were largely standard and met by the solutions.
Systems integration	Systems integration was another important requirement group with an average requirement weighting of 3.6. Key to these requirements was the integration between the order processing and accounting modules. These requirements were particularly important if the solution was not a true E.R.P. system and offered multiple I.S. to cover the business processes. Solutions like TEMACS scored low here (0/22) because they could not offer any integration. XETAL also scored poorly here during the evaluation because they could not offer proven integration with the financials but could with payroll and E.D.I. (9/22).
Total cost of ownership	Top-end E.R.P. systems, such as Axapta, System 21 or SAP, would require detailed customisation over a long implementation period. This would incur costs greater than the available budget. The total cost of ownership is essential to Company A thus top end systems failed this criteria. E.g. Axapta and SAP scored 0/5 for T.C.O.

Requirement group	Comment
Quotation system	Many systems failed to offer a working quotation system to the company. This be-spoke element is essential to Company and given an average requirement weighting of 5. Any systems failing to demonstrate this solution was removed from the process. STYLEman was one of the few solutions to demonstrate a fully working solution to this during the tendering stage.

Table 29 – Key rejection reasons

8.6.1) XETAL and Dynamics upgraded

The easiest option for the organisation, in relation to changing its information systems, would be to upgrade the existing applications. Upgrading would be less problematic and intrusive as opposed to implementing a completely new system, in terms of data transfer, user training and available organisational resources. This is also the lowest cost option as the suppliers would only charge for implementation, as opposed to purchasing the software licenses (Tables 32 & 33).

Over the years the relationship between the suppliers and Company A has deteriorated, with morale between the users and the system very low. The original implementation did not complete the installation in terms of systems integration and warehouse management, and led to ongoing frustration and a lack of faith in what the system can do. The upgrade to the XETAL and Dynamics systems, with additional modules, namely C.M.T. and warehouse management would broadly meet the requirements.

Factors which go against this selection are the lack of ability to show a working solution to the integration issues, along with an inability to offer multiple levels of analysis in terms of sales reports by product hierarchy. The relationship between the organisation and suppliers has deteriorated over the years and also goes against this selection.

8.6.2) STYLEman and Open Accounts

Aside from upgrading the existing systems Company A are left with one other option, to implement a new solution. The most viable of these is another combination of applications in the form of STYLEman & Open Accounts. Together these packages offer the company a solution to cover all departments and functions.

STYLEman and Open Accounts are also separate systems thus cannot be considered true E.R.P. but are written in the same computer language, with the same underlying database, and have a long history of being successfully integrated together. Organisations (similar to Company A) are using both systems, integrated, and this can be demonstrated. Unlike the XETAL option, it is clear and documented how STYLEman and Open Accounts would integrate and what this would offer.

Installing a new system within Company A would be the more difficult implementation option. Data would need to be transferred into new databases, the learning curve for end users would be steeper with the implementation period longer, and a new system would be more expensive in terms of total cost of ownership.

STYLEman has been developed for the Apparel industry, in particular supply and distribution, thus third party software would be required for in house production. Company A no longer see internal manufacturing modules as important, due to the shrinking capacity in house. Internal production/purchase orders to include a full bill of materials would be required, as well as a means of monitoring key production stages.

8.6.3) System comparison

Table 30 summarises the final two short listed options against the requirement groups identified in the requirements catalogue.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Accounting options	See systems integration. Open Pay would offer payroll services and integrates easily with Open Accounts, and has been demonstrated successfully to the accounts department. In terms of functionality, Open Accounts offers all the functionality you would expect from an accounting system. STYLEman could also integrate with other accounting packages, including Dynamics, although Open Accounts would offer superior functionality when used in combination with STYLEman.	In terms of upgrading Dynamics it would make sense to move to the Sequel server database as opposed to staying with Pervasive S.Q.L. In terms of functionality Dynamics offers all the functionality you would expect from an accounting system. If XETAL and Dynamics is upgraded the current payroll is adequate.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Company profile	Formed in 1991, O.S.L. (Option Systems Limited) is a privately owned, specialist software company dedicated exclusively to the design, development, installation and support of systems for the Apparel and Footwear sector. Existing customer include Nike, Hi-Tec Sports (U.K.), Ben Sherman, Pepe Europe, and Levi Strauss. Open Accounts financials has been an ICAEW IT Accredited product since 1994 and has won the 'Accountancy Age Award 2003' for Accounting Software: Enterprise Systems. Provided by Grampian software it is a widely recognised and respected financials package. O.S.L. would act as a reseller for this package and would be the first line of support if this option was taken. If selected the solution can offer advice with regard to hardware solutions and data communications between sites. They can offer examples of existing customers successfully using their solution over multiple geographical sites.	The Company, previously traded as Kewill-Xetal Systems Ltd, was formed in December 1999 following a management buy out from Kewill Systems, Plc. All members of the original team supported the M.B.O. and came over into the new company, with software products developed for Apparel suppliers. **Clients include Apparel suppliers like Henri-Lloyd, Burberry, Dewhirst, Bentwood and leading third party logistics providers like Tibbett and Britten, Joint Retail Logistics and Transcare Distribution.** According to published accounts XeBusiness is a small company but has been profitable since its formation following the M.B.O. from Kewill. Dynamics is a bigger player in the software market, with the original software house Great Plains purchased by Microsoft to form part of their business solutions. Dynamics has a strong customer base. If selected the solution can offer advice with regard to hardware solutions and data communications between sites. They can offer examples of existing customers successfully using their solution over multiple geographical sites.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Consultancy, training & support services	Fully provided.	
Future projects	Both systems cab provide bar-coded warehouse management and ecommerce technologies if required for future projects.	
In-house production	Limited functionality. Would require third party product for shop floor data capture which is available if required.	Fully provided.
Interface and customisation	Windows G.U.I. able to be customised. STYLEman appears to have all the drill downs and audit trails you would expect with this type of system.	Windows G.U.I. able to be customised. The XETAL upgrade offers extensive drill down facilities. All Sales Orders or Contracts can be traced through the system whether they are manufactured internally, sourced as completed garments or manufactured on a C.M.T. basis provided that relations are established between sourcing orders and sales orders.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Off-shore production & procurement	STYLEman supports all types of apparel products and sourcing types – including finished products (F.O.B., C.I.F. etc), C.M.T., part-manufacturing and full manufacturing. Complete stock control of all work in progress and materials, trims and components is also available. A host of functionality supports the entire C.M.T. cycle from raw material management, R.M. costing, forecasting, bill of materials, material utilisation, M.R.P., R.M. procurement, stock control and costing, critical path management through to shipping, receipt and dispatch of the finished goods.	The C.M.T. module would assist with this control as it is designed for use by companies that have items manufactured by third parties, to whom they supply some or all of the raw materials.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Reporting options & forms	STYLEman provides a number of data export routines in the key areas of the application that provide data in a comma separated value list format, which is a default import format for Microsoft Excel. STYLEman have developed, over these C.S.V. files, a number of Pivot Table and Reports within MS Excel that provide flexibility in the reporting capabilities. Standard reports are available as well as an S.Q.L. report writer. STYLEman integrates with DB forms for form control, pre-printed forms are not required. DbForm is fully integrated to STYLEman and allows the production of business documents such as invoices, statements, picking tickets, export documentation etc. DbMail links automatically to the core email system and allows the automatic emailing of business documents and/or alerts.	Good standard system reports & standard S.Q.L. based report writer built into the client application. If the company requires multidimensional analysis than another report writer, such as Business Objects, would be required. The upgraded XETAL option offers the ability to move away from pre-printed forms to custom designed forms. There are options within the XETAL upgrade to allow email alerts to be sent out. For example the production order print will trigger an email alert if any item on the materials listing has s stock shortage. Email options provide the facility to email reports, invoices or purchase orders.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Sales and Warehouse Management	STYLEman delivers the ability to manage the events that are necessary for dealing with major multiples. STYLEman supports the contract life cycle from derivations of quotations for sampling and negotiation through to the purchasing of raw materials, production order processing, and sales order processing and eventual dispatch of finished goods to the customer. Costs and margins can be monitored straight from the start of the contract process at the quotation stage, and throughout; multiple costs can be trapped and cost variances between budgeted and actual right the way through the process. STYLEman enables customer specific product, stroke numbers and bar Codes to be held. Multiple stock types and status enable demarcation, identification and categorisation of stock. Multiple warehouses, multiple locations, reconciliation and month end movement analysis all provided. STYLEman maintains a complete audit trail with all stock movements recorded, and may be viewed, and reported using stock reconciliation routines.	XETAL facilitates contract sales control allowing orders to be entered with a delivery flow. Products can also be held and referenced with both internal and customer unique identifiers. Integration is also possible with the existing EDI package to allow call off and dispatch details to be updated on the system. Contains good warehouse management software. In particular the C.M.T. module facilitates the control of raw materials at multiple suppliers' locations.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Systems integration	The STYLEman system incorporates its own inherent sales ledger. This delivers some advantages – particularly in the areas of credit control, sales order processing and customer service. For the rest of the accounting functionality including the general ledger, and purchase ledger, STYLEman is fully integrated with the Open Accounts financials package. This integration extends to full linking between the two systems including links to both the purchase and nominal ledgers allowing for full invoice matching and reconciliation. E.D.I. is fully supported and STYLEman works with a number of proprietary third party communication and mapping products. EDI-tie is the package usually used.	Both suppliers indicate that integration would be possible although they cannot provide a successful example. After investigation, integration would be labour intensive to maintain, not seamless and difficult for full invoice matching and reconciliation. The documented history of failed integration attempts and workaround solutions does not inspire confidence.
Total cost of ownership	Meets budget requirements.	Cost for upgrade only which comfortably meets budget requirements.

Requirement group	STYLEman and Open Accounts	XETAL and Dynamics
Quotation system	STYLEman have provided a mock up of the quotation or proposals system which was demonstrated successfully, albeit with some minor modifications. The system allows the entry and monitoring of Contracts. Contracts can be entered with a flow and sales/purchase information can be created directly from this. The Contract information can also be used to drive the purchase of raw materials.	The XETAL upgrade deals with contracts and has been used extensively with M&S and other major retail suppliers. The system allows the entry and monitoring of contracts. Contracts can be entered with a flow and production information can be created from this. The contract information can also be used to drive the purchase of raw materials, covering fabric and trim. In terms of the quotation system this would be entirely possible.

Table 30 - Final systems comparison

8.6.4) Solution selected

In terms of deciding between the final two documented solutions the following should be noted:

- Both solutions averaged the highest points total with STYLEman and Open Accounts scoring the highest overall. This solution scored highest in categories which were given more importance by the company, namely systems integration and reporting options & forms. While XETAL scored highest in areas of less importance, such as in-house manufacturing (Table 31).

- Company profile – O.S.L. made the better impression in terms of visiting, speaking and presenting to the company. They also made the most effort in terms of demonstrating their solution in areas of doubt, and where bespoke work was required, namely the quotation system.

- Existing customer site visit – The Company visited existing customers of both solutions. Both visits went well although the visit to a STYLEman customer was more reassuring in terms of meeting a likeminded organisation with a similar history and experience.

- Morale – O.S.L. (STYLEman & Open Accounts supplier) was starting with a fresh approach and was new. XeBusiness did not have this, as Company A had a long turbulent history with the supplier. Although, they were the most cost effective option to implement (Table 32 and 33), the relationship between the organisations and the morale with the end users ultimately went against the solution.

Because of the above reasons STYLEman and Open Accounts was selected.

Requirement group	Average req. weighting	XETAL and Dynamics	Fit %	STYLEman and Open Accounts	Fit %
Accounting solution	4.4	291/291	100%	291/291	100%
Company profile	5	20/25	80%	25/25	100%
Consultancy, training and support services	4.2	38/38	100%	38/38	100%
Future projects	2.3	5/5	100%	5/5	100%
In-house production	2.3	23/23	100%	0/23	0%
Interface and customisation	3.8	27/27	100%	27/27	100%
Off-shore production & procurement	4.1	180/185	97%	185/185	100%
Reporting options & forms	3.8	137/153	92%	151/153	98%
Sales and Warehouse Management	4.5	108/113	91%	113/113	100%
Systems integration	3.6	9/22	40%	22/22	100%
Total cost of ownership	5	5/5	100%	5/5	100%
Quotation system	5	10/10	100%	10/10	100%
Total fit		**857/897**	**95%**	**872/897**	**97%**

Table 31 - Solution scorecard

Investment	Year 0	Year 1	Year 2	Year 3	Year 4	Total costs
STYLEMAN AND OPEN ACCOUNTS						
Hardware upgrades	£31,207.00					£31,207.00
Initial software	£85,657.99					£85,657.99
Be-spoke development	£5,000.00					£5,000.00
Initial training and support	£38,500.00					£38,500.00
Subsequent software upgrades and support	£20,042.00	£20,042.00	£20,042.00	£20,042.00	£20,042.00	£100,210.00
Subsequent training or support days		£2,100.00	£5,600.00	£2,100.00	£2,100.00	£11,900.00
Maintenance and operations	£12,000.00	£12,000.00				£24,000.00
Future projects – bar coded warehouse			£30,000.00			£30,000.00
Total costs	£192,406.99	£34,142.00	£55,642.00	£22,142.00	£22,142.00	£326,474.99

Table 32 – STYLEman solution total cost of ownership

Investment	Year 0	Year 1	Year 2	Year 3	Year 4	Total costs
XETAL AND DYNAMICS						
Hardware upgrades	£31,207.00					£31,207.00
Initial software.	£10,000.00					£10,000.00
Bespoke development						
Initial training and support	£7,500.00					£7,500.00
Subsequent software upgrades and support	£20,000.00	£20,000.00	£20,000.00	£20,000.00	£20,000.00	£100,000.00
Subsequent training or support days		£2,250.00	£6,000.00	£2,250.00	£2,250.00	£12,750.00
Maintenance and operations	£12,000	£12,000				£24,000.00
Future projects – bar coded warehouse			£30,000.00			£30,000.00
Total costs	£80,707.00	£34,250.00	£56,000.00	£22,250.00	£22,250.00	£215,457.00

Table 33 - XETAL solution total cost of ownership

Total cost of ownership is used to describe the comparison of full costs of the two main competing alternatives reflecting the full cost of taking one course of action rather than another. It therefore reflects not only the initial purchase price of the assets, but also initial costs of training users, the costs of upgrades over a five year period, which is the expected lifetime of the new systems. Also included in the costs is the anticipated introduction of bar-coded warehouse management in year 2.

From the cost comparison XETAL and Dynamics would be more cost effective as they would only charge a one off fee of £10,000 for the licenses for the upgrade as Company A are an existing customer, compared with STYLEman which would charge a standard price for the new system licenses. XETAL have also offered to carry out the bespoke work on the quotation system free of charge.

It is anticipated that fewer consultancy days would be required from the XETAL supplier, in terms of support and training due to the fact that Company A would be upgrading an existing system, which it is expected would be a more comfortable transition in terms of data transfer and training.

The cost of maintenance and operations via in-house I.T. support is expected to be outsourced to the supplier in year 2. It is expected that XETAL and Dynamics would be cheaper by £111,017.99 over a five year period.

8.7) Chapter conclusions

The weighted statements of requirement documentation define the company's needs and were used to shortlist and evaluate potential suppliers. Potential suppliers were identified from various sources.

There were various solutions types available to the company including upgrading existing systems, introducing new separate systems to cover the various functions or to introduce an E.R.P. system to cover all departmental functions in one system.

The principle objective for the eventual I.T. supplier was to provide a complete solution for the organisation. The solution had to improve on the existing information systems and controls by providing an integrated management information system.

During the tendering process it became apparent that there were differences in the approaches adopted by different suppliers. Some covered every point raised while some omitted large areas of requirements.

After much iteration the final two solutions were XETAL and Dynamics and STYLEman and Open Accounts. Ultimately STYLEman and Open Accounts was selected, as it met the requirements more closely, and made the better impression during various site and off-site visits. The E.R.P. solution did not offer a solution to Company A. They were either too expensive, or generic, in the sense that they did not offer a supplier with industry specific knowledge, and a working solution to offer as a case study, or they were mid-range and offered poor financial modules due to the fact that they originating from a manufacturing background.

This hybrid solution, which, cannot be classified a true E.R.P. due to the multiple systems required to cover the business process, offered a solution which meets all the requirements as stated.

The selection process adopted was inclusive, in terms of user and stakeholder participation, and geared to the S.M.E. in terms of identifying, not only technical requirements, but non technical requirements offering protection against generic, or expensive, solutions which lack the experience and industry knowledge required when implementing information systems in the SME environment.

8.8) Chapter summary

Chapter eight has specified the requirements, and demonstrated how the evaluation and selection process took place. Chapter nine will look at the implementation of the selected solution and the decisions made therein.

Chapter 9

COMPANY A – IMPLEMENTATION STAGE

"It's been a long time coming, but I know a change is gonna come"

- Cook, S. 1964. "*A change is gonna come*" (Song) on the album Ain't That Good News.

9.1) Chapter overview

The previous chapters moved the project to the stage where it was appropriate to commence the final stage of the project life cycle, that of implementation of the software and hardware solution. The hardware decisions were left until the software was selected, because part of the requirements involved the software supplier being able to make recommendations as to the ideal infrastructure for their system.

This chapter will look at how the overall solution was implemented in terms of software, hardware, user training and also look at how the project was managed during this phase. The critical success factors, derived from the experience, will be stated from the S.M.E. perspective.

9.2) Implementing change

Following the evaluation and selection process the organisation now required to plan for:

- Training the users.
- Setting up all the files of information, static, non-static and data transfer.
- Setting up the hardware.
- Parallel running the new system to ensure that it works as well as the existing system.

9.2.1) Training the users

Introducing user training was important for the organisation, because users had not been trained on the existing systems, and consequently the systems were not used as intended. Training was also an important aspect of the action research method with users retaining knowledge learned during the project.

The following points were decided during initial meetings:

- Training would be provided by the supplier. Occasionally, training could be provided by somebody in-house who had the relevant knowledge but this would be the exception.
- Training would be undertaken on-site, in terms of the main applications, and off-site, in terms of Windows applications. Off-site had the advantage of fewer distractions but would be more expensive.
- "Train the trainer", or the adoption of departmental super users, was the preferred methodology during the system implementation. This approach develops a cadre of experienced personnel, familiar with the business and the applications, which can then provide ongoing training and support once the immediate implementation phase is complete. The intention being that these super users would offer 1st line support to other users going forward, and provide the link to the in-house I.T. professional.

- Strategic training would take the form of initial focus groups to determine how senior staff would use the application, and represented each functional area of the business. During these meetings the use of the application was extensively modelled to best fit the requirements of the organisation. The output of this was a document describing how the application would be used for each business process, and how data would be coded and established within the application to support the business processes *(9.2.6 Implementation kick off meeting)*.
- Tactical training was orientated towards the end user and was intended to impart appropriate knowledge to enable the user to fulfil their individual roles. The training was based on the output of the strategic training and was delivered immediately prior to the point of use.

Overall training needs and requirements were developed in consultation with the users to provide a tailored, user specific schedule that addressed the points of each implementation. Appendix 6, Table 11 incorporates application training in the overall implementation plan.

9.2.1.1) General Windows training

As well as training on the new applications, users also required training on general Windows applications from the Operating System to Excel and Word. The users were at different levels of competency with these applications and the requirement was to bring all users up to a minimum standard.

The following was decided with regard to general I.T. training:

- Training would be provided on general Windows use, Word and Excel. Staff tended to already use these applications, but their ability of the more useful features was (in some cases) limited.
- Users would be assessed to ascertain I.T. literacy. Some users were more advanced than others, while some older members of staff needed more help.
- Courses would be held off site and run by approved trainers.
- Three levels of difficulty would be available, depending on user ability, beginners, intermediate and advanced.
- Users would be divided into groups, depending on ability, so that courses could be tailored as required.

Appendix 7, Tables 12 and 13 lists the general training requirements of users and a schedule of training dates with users grouped by I.T. ability.

9.2.2) Data transfer

Because of the volume of the data, this was a big task. It was co-ordinated with training to ensure that staff was trained to do something, and then put into immediate use to ensure that they had learnt it properly.

Some data, such as the financial ledgers, were exported from the old system, cleaned and then automatically transferred into the new system while other data needed to be cleaned and then manually entered.

The fundamental aim was that the data should be set up by people who would have to add the same data later, but, as there was just too much work, some of it was passed to other people. Table 34 provides further details.

Data input task	Size of task	Source	Comment
Sales ledger.	Hundreds of lines.	Dynamics.	The ledgers were cleaned and totals carried over into the new system. Dynamics was maintained for historical data. This process was automated by way of exporting data into a predefined spreadsheet, formatting the text and importing into the appropriate ledger.
Purchase ledger.	Hundreds of lines.	Dynamics.	
Products.	14,000.	XETAL.	A spreadsheet was created of all products required for data input. Only products with stock held were incorporated and priority was given to stock which had moved in the previous year.
Finished stock.	14,000 by up to 6 colour ways made for around 84,000 lines to be entered.	XETAL.	The biggest task as the company held around 14,000 product codes, defined by up to 6 colour ways, and was holding over £1 million units of stock. Computerised brand stock was not seen as accurate but the organisation did not have the resources to facilitate a stock take prior to data input. Lists of finished stock records was compiled from XETAL and entered into STYLEman, by way of perpetual stock-tack routines, which allowed different people to set up different stock ranges at the same time, before being reconciled and committed to stock. Contract stock was less of a problem because of its fast moving nature. This was committed to STYLEman over a weekend and was compiled from up-to-date manual stock cards.

Data input task	Size of task	Source	Comment
Raw materials.	1,000.	XETAL.	Raw material stock was entered for production orders that had not yet had raw materials allocated in XETAL. Where stock had already been allocated on XETAL this was consumed on that system. Up-to-date China R.M. stock was also set up on STYLEman in a separate warehouse.
Sales & production orders.	Hundreds.	XETAL.	Active production orders were left on XETAL to be progressed as normal. New production orders, which would go into work after the go live date, were identified and the associated Sales Orders loaded onto STYLEman, so that the associated Production Orders could be created. Old production orders would be adjusted into STYLEman stock.
Customers.	1,400 customers.	Dynamics & XETAL.	Dynamics records were used as opposed to XETAL due to the fact that the records were used and updated more regularly.
Suppliers.	Hundreds.	Dynamics & XETAL.	Open Accounts was updated first and then the records for STYLEman related suppliers were automatically transferred across.
Purchase orders.		XETAL.	Active purchase orders which would be received into stock after the go live date were flagged for entry into the new system. Old orders would be adjusted into STYLEman stock.

Data input task	Size of task	Source	Comment
Colours.	20,000.	XETAL.	Basic colours were entered onto STYLEman and then defined later against the product. E.g. Blue could be selected from a list when setting up a product and then renamed sky-blue against that particular product.

Table 34 - Data input tasks

9.2.3) Setting up the hardware

Hardware will be discussed later in the chapter (9.4), however, in terms of implementation; decisions were made as to the following;

- Client configurations required.
- Server configurations required.
- Operating systems to utilise.
- Network configuration.
- Data communications between company sites.
- Anti-virus/firewall configuration.

The hardware set up needed to be scheduled and decisions were made prior to the contract being agreed with the software supplier. In the end it was decided to source the hardware separate, mainly due to scheduling concerns. Recommendations were given from the software supplier as to the appropriate hardware specifications for their system.

9.2.4) Parallel running

Parallel running of the systems was an important phase of the project, designed as a last test to ensure that the new system worked, and users were familiar as to how they were to do their job in a live environment. Parallel running would be undertaken once all testing, training and data set-up was complete and consisted of:

- Ensuring that all files in the new system reflected all files in the existing system.
- Running the same data through both systems for a period of time.
- Comparing the state of files, printed reports, etc., throughout the period and at the end, identify any differences and explain them or, if necessary, correct them.

At the end of this process, the system would be said to be running live. The usual practice, however would be that dependence on the new system gradually increases so that there is no sudden point at which this can be said to have occurred. Using this process the transition between systems would be smoother and easier for the organisation and staff to manage.

9.2.5) Implementation plan

An overall schedule was produced which incorporated all these elements, identifying responsibilities and key dates. This was referred to as the implementation plan, and was widely circulated within the organisation. (Appendix 6, Table 11).

9.2.6) Implementation kick off meeting

At the start of the implementation stage of the project an initial meeting was held over three days to discuss the project. Emphasis was placed on meeting key personnel on both sides, to allocate key roles and the procedures to be followed. From the organisation, all identified stakeholders were present, and from the supplier, all project management personnel were present.

The implementation plan was discussed at length and a key objective identified in that the system had to go live within five months, as the license agreement on the existing system would be due for renewal. This impacted on the time available to go live and resulted in the implementation plan being condensed and a big bang approach to implementation adopted.

The structure of the file types was discussed at length and the format for all static data structures was determined. This meeting clarified what was required going forward and in what order. It was determined that the hardware set up would not be completed in time for data input and training to start, so an interim small network would be set up to allow this to happen as scheduled.

In nature with the action research method adopted for this stage of the project regular formal and informal meetings would be held with key stakeholders, the researcher and the software supplier. These meetings would assess progress, against the plan, identify resources required and make any changes required to the plan going forward. These meetings would be documented and occur every month. More informal meetings would be held every week between the internal project team and key stakeholder to assess progress, resources required and identify any problems.

Appendix 8, lists general system parameters which were required to be set up so that data entry could begin.

9.2.7) Big bang strategy

As discussed in Chapter 2 the appeal of the big bang implementation strategy is that it would focus Company A for an intense and shorter period of time than if the project were phased (Kimberling, 2006). This would help address, not only the license problems with the existing systems, but potential resource shortages and condense the transition into a shorter period of time. Using this strategy Company A would be reliant on the implementation team, including the software supplier, to provide the resources required for both training and the handover to the new systems, as required, on both organisational sites. It would be crucial for hardware decisions, and lead times, to be identified quickly as the new systems would need to be set up for training, and data input, which would be ongoing from the start right up to the go live date.

According to the literature review the potential problems of the big bang implementation are that the project could be rushed and changes to business processes may not be the best ones for the organisation, in reality, compared to how they looked on paper (Kimberling, 2006). The pain of transition would be more acute, due to the fast paced nature of this approach. By its nature this approach is high risk, and can result in less satisfaction with the system's abilities to meet business requirements (Kimberling, 2006).

The opposite of the big bang approach would be to follow a slower, phased approach to implementation either by functional departmental area or geography (Kimberling, 2006). For example, Company A could implement the system in London at a later date to Cwmbran. The advantage of this would be that it would allow the project team more time in terms of planning, customisation, and parallel running of the systems while continuing with normal business (Kimberling, 2006). Company A have limited resources in-house and the big bang approach would mean intense pressure on users to keep up with their normal jobs while learning new systems and performing implementation tasks.

Company A stakeholders felt that the phased approach would lack the inherent urgency and focus of a big-bang project. It could lead to analysis paralysis which could cause employees to become disillusioned with the lack of progress, or realisation of promised benefits, instead of completing the project within a shorter period of time. As discussed in the literature review the phased approach involves constant change over longer periods, which is often seen as draining to project workers (Kimberling, 2006).

In the end the decision was made to follow the big bang approach. The project implementation was scheduled for five months with both sites (Cwmbran and London) expected to go live in the same week. This meant that little slippage was available and a number of activities, such as hardware procurement, user training and data input needed to be carefully planed and scheduled, as for example, the new hardware would be required for both user training and data input tasks.

9.2.8) Conclusions

It was now appropriate to commence implementation of both the software and hardware solution. The company planned for training the users, setting up all the files of information, setting up the hardware and parallel running the system to ensure that it worked as well as the existing system. A big bang implementation strategy was adopted due to set deadlines.

An overall implementation plan was produced which incorporated all these elements, identifying responsibilities and key dates. Initial implementation meetings were held to discuss the project between the key stakeholders from within the organisation and the project team from the software supplier.

9.3) Implementing software

This section will reference business process diagrams in Appendix 3.2 and discuss key decisions taken under the requirement groups identified in the requirements catalogue (Appendix 4, Table 2).

In terms of user training, and data input, a temporary network consisting of a new server and six networked pc's was configured and set up. The new network would not be ready until later in the schedule, due to supplier lead times, however data input, and user training needed to start because of the overall time available until the go live date.

STYLEman and Open Accounts were set up on a temporary network along with Windows 2000 server edition. The client machines were set up with Windows 2000.

9.3.1) Data input

When implementing the new system key factors were taken into account:

- Team members, in all departments, needed to be involved straight away. They were trained on the temporary network on key aspects of the system specific to their role, and then given tasks relating to data input to get used to the system.

- Feedback was taken from these sessions to allow the system to be customised to the user needs, and standard reports were configured as required.

- System performance – these sessions also allowed the system, for the first time, to be viewed with real data and this allowed further customisation in terms of the interface and data conventions documented from the initial meetings.

- The structure of the data – In order to provide the organisation with the required sales order reports, analysis codes needed to be set up against each product, or style, entered into the system. Each product would be assigned a five point hierarchical analysis structure consisting of Division, Brand, Style Class, Style Group and Style Type. Figure 18 illustrates the STYLEman product creation screen, while Appendix 11, Table 27 lists examples of product analysis codes.

- Where possible, existing data structures were cleaned and then imported directly into the new system.

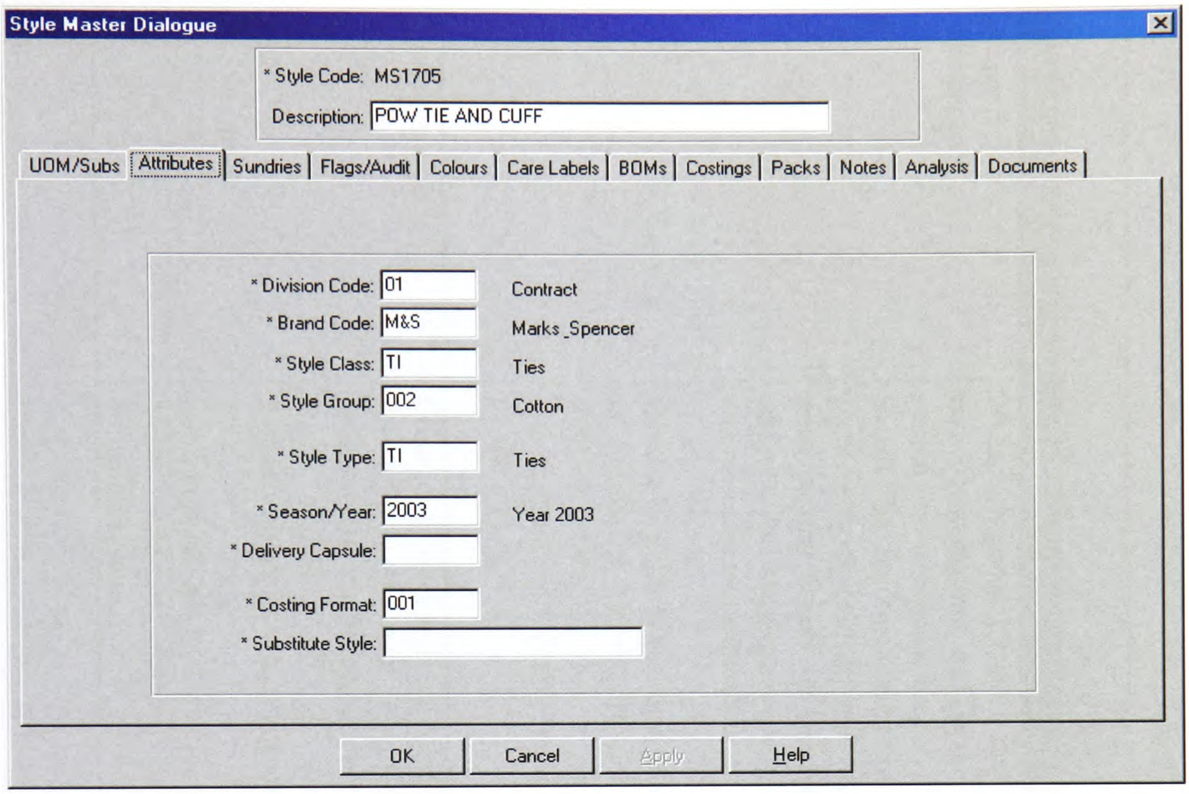


Figure 18 - Style master dialogue - attributes

9.3.2) Departmental decisions

The detailed decisions made with each department during the implementation phase are summarised in Table 35, with reference made to various sections of the appendix in terms of data flow diagrams of the new processes. *Appendix 9 – Implementing the software* also contains a detailed commentary of the key decision taken.

Requirement group	Comment	Appendix reference
Sales and warehouse management	Multiple warehouses and locations were created and computerised and perpetual stock-takes started on a regular basis. These decisions meant that the organisation could start to build accurate stock records, and for the first time, print picking tickets by location and dispatch and receive stock correctly via computerised and traceable stock transactions. Greater visibility is possible of goods in transit, as production orders are now booked onto shipping notes, so that at any one time the organisation can identify, track and value stock on the high seas.	*Appendix 3.2.1 Brand sales reengineered analysis and 3.2.5 Warehouse management and E.D.I. reengineered analysis details the new processes*
Quotation system	Contract stock has been computerised for the first time, as the new system allows customer codes to be held against internal identifiers. Stock records and all associated stock transactions are now fully automated. London users are now able to enter their own orders onto the system via the be-spoke quotation system.	*Appendix 10.1 Proposals process details the proposals process Appendix 3.2.2 Contract sales reengineered details the key decisions made with regard to contract sales*

<table>
<tr><th>Requirement group</th><th>Comment</th><th>Appendix reference</th></tr>
<tr><td>Off-shore production and procurement</td><td rowspan="2">The organisation did not require detailed capacity planning, W.I.P. control or labour cost centres but did require a high level view of key stages of production, home and abroad in terms of being able to monitor and identify the progress of a production order in order to identify any slippage or problems. The new processes put into place the control and monitoring of off-shore production.

The boundaries between the traditional roles of procurement, production and planning are becoming blurred into one and in a short period of time there will be little difference between a production and a purchase order.</td><td rowspan="2">(Appendix 3.2.3 Procurement reengineered analysis and 3.2.4 Production reengineered analysis details the new processes)

(See Appendix 10.2 Bundle ticket generator for further details)</td></tr>
<tr><td>In-house production</td></tr>
</table>

Requirement group	Comment	Appendix reference
Accounting solution	Financial systems are well established and have largely been standardised between specialist packages such as Dynamics, Sage and Open Accounts. However in order to solve the integration issues the decision was taken to utilise the STYLEman sales ledger and the Open Accounts purchase and general ledger. This facilitates the integration options that are required but also means that, unlike in standard financial systems, the sales and purchase ledgers will not be mirror images of each other but live in separate systems.	*(See Appendix 3.2.6 Accounts analysis – sales ledger reengineered and 3.2.7 Accounts analysis – purchase ledger reengineered for further details)*
Systems integration	With the new systems the integration options freed two members of staff from data input tasks, in terms of, re-entering sales invoices into the sales ledger and the reconciliation of purchase invoices to purchase orders.	

Requirement group	Comment	Appendix reference
Reporting options and forms	Various standard reports were set up from day one of the new systems going online. These reports included sales order and invoice margin reports, stock valuation reports and agent commission statements offering summary and detailed information. These reports were automated using O.D.B.C. connections to the systems database, via Microsoft Access and exported STYLEman batch files. DbForm was fully integrated with STYLEman and allows the production of business documents such as invoices, statements and picking tickets.	*Appendix 13 lists the main reports created.*

Table 35 - Software decisions made

9.3.3) Conclusions

In terms of user training and data input a temporary network consisting of the new server and six networked pc's was configured and set up as the new network would not be ready until later in the schedule. Both static and non-static data items needed to be set up and all company departments were involved in this process.

During the selection phase there were two areas of the system where be-spoke work would be required, the quotation system and bundle ticket generation. The organisation did not require low level in-house production modules but did require a high level view of key stages of production, home and abroad in terms of being able to monitor and identify the progress of a production order.

Multiple warehouses and locations were created and computerised and perpetual stock-takes started on a regular basis. These decisions meant that the organisation could start to build accurate stock records, and for the first time print picking tickets by location and dispatch and receive stock correctly.

Contract stock was computerised for the first time, as the new systems allowed customer codes to be held against internal identifiers. All stock transactions are now automated. Greater visibility is possible of goods in transit, as production orders are now booked onto shipping notes, so that at any one time the organisation can identify, track and value stock on the high seas.

The organisation now had costing data set up and maintained so that standard reports can be made automatically available, for example, stock valuation and sales margin reports, which both require knowing the standard cost of a product.

With the new systems the integration options have freed two members of staff from data input tasks, in terms of, re-entering sales invoices into the sales ledger and the reconciliation of purchase invoices to purchase orders.

Integrating E.D.I. with the warehouse management system was discarded due to the desire to be able to manually declare finished stock to contract customers. DbForms was fully integrated with STYLEman and allows the production of business documents such as invoices, statements and picking tickets.

Various standard reports have been set up from day one of the new systems going online. These reports include sales order and invoice margin reports, stock valuation reports and agent commission statements offering summary and detailed information. These reports have been automated using O.D.B.C. connections to the systems database, via Microsoft Access and exported STYLEman batch files.

9.4) Implementing hardware

After the software selection the main hardware requirements had to be identified. Decisions were required as to the network infrastructure over two sites, the server and client specifications, as well as which supplier would provide the equipment.

The preferred option was for the software supplier to recommend a vendor for the hardware; however, three suppliers were short-listed in order to gain an appreciation of different costs:

- Montal – recommended by software supplier.
- Redstone Communications.
- C.C.E. – Existing supplier.

The company decided to go with Redstone, as they provided the most cost effective quote, and could handle not only the hardware requirements, but also act as an Internet Service Provider and domain hosting company.

More importantly, they could meet the project plan milestones more effectively than the other suppliers and made the best impression at pre-sale meetings.

9.4.1) Server specification

Depending on in-house strategic preferences, skills and existing set up, the systems could be deployed on Windows, UNIX or Linux.

When making these decisions, many factors would come into play. In terms of acquisition cost, an Intel-based server running Linux was an attractive option. Alternatively, the company could have moved forward on a commercial open systems offering.

If Windows was the preferred platform then there were a number of choices through providers such as Dell, up to the top-line offerings from the likes of IBM and HP. Because of the size of the company, and the fact that after the project there may be no in-house I.T. expertise Windows 2000 Advanced Server was the preferred Operating System for the Server and Windows 2000, or XP for the clients. All computers were brought up the minimum standard. See Appendix 14 for further details.

9.4.2) Network layout

Based on the analysis carried out in Chapter Six the network infrastructure needed to be simplified, and in deciding on the changes required, the following was decided:

- Cwmbran to be re-wired with CAT5 cabling.
- All Hubs to be replaced with one 100mbit switch on each site. Cwmbran with a 48port switch and London with a 24 port switch.
- London to have a 2M.B. A.D.S.L. line configured. A.D.S.L. is not available in Cwmbran, thus a 256K leased line will be configured until A.D.S.L. becomes available.
- A private V.P.N. to be set up between sites to connect the network and enable Internet access.
- Two routers to be set up, one on each site to provide routing and firewall security.
- Each department will gain a networked laser printer for form printing.
- The main application server will be housed in Cwmbran, in a central secure room with a ventilated cabinet. The email server will remain in London, while the old accounting server will provide historical information, and act as a fileserver. All servers would be backed up direct from the machine using tape drives.
- Redstone will host the domain names and route external email.
- D.H.C.P. would be used to dynamically assign I.P. addresses.
- Novel will be removed from the network and the I.P.X. protocol removed from all clients.
- Each network location (Cwmbran & London) will be put onto different subnets to restrict network traffic.

- Norton anti-virus will be installed on all clients and updates provided through the application Server.
- All users will have individual network/email/application accounts and directory space dependent on their requirements.
- Technical and user documentation will be available relating to the network, applications, systems, data protection, security policy and procedure and disaster recovery.
- The decision was made to replace the existing I.S.D.N. Internet access at the offices at Cwmbran and London. These were replaced with a 2M.B. A.D.S.L. Circuit in London, and with a 256K leased line at Cwmbran. A Cisco router, at each end will provide both a connection to the Internet and a V.P.N. connection (see Appendix 14 for further details).

Figure 19 shows the new network.

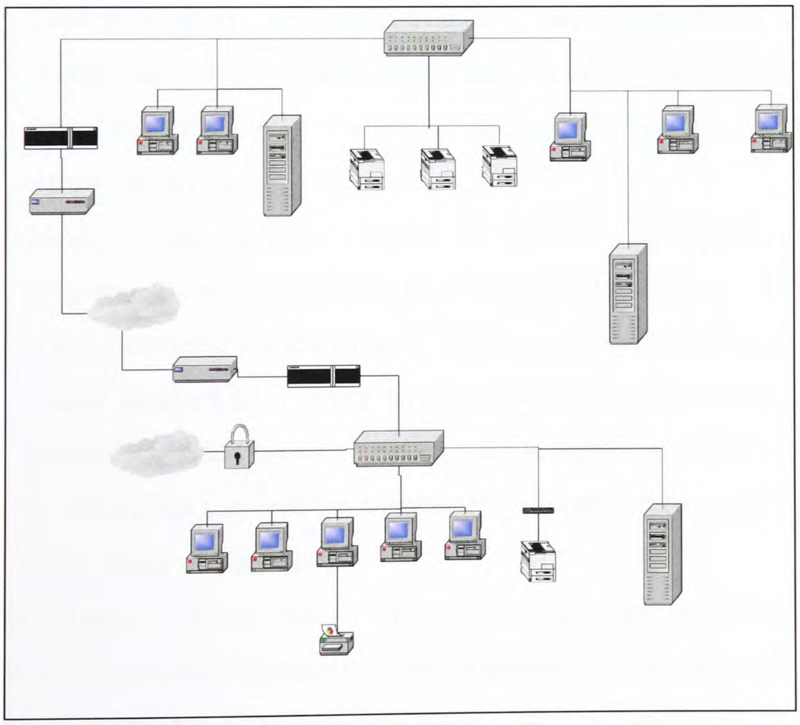


Figure 19 - Proposed network

9.4.3) I.T. support

Many of the existing problems within Company A had been caused by the lack of available I.T. support. Going forward, it was important to establish a support strategy so that users knew the procedure to follow when dealing with problems with I.T. systems. During the implementation phase of the project, and in particular go live, numerous support issues would be expected in terms of teething problems and users getting used to new systems. The following was adopted:

1) Departmental super users would provide 1st line systems support. If these users could not deal with the problem it would be sent to the in-house I.T. professional. Likewise the I.T. professional would be the main contact for the I.T. suppliers. Support issues will be filtered to the appropriate person.
2) Support jobs filtered to the I.T. professional will be logged into a spreadsheet and prioritised as to its severity, for example:
    a. Critical support job – When an I.T. issue is stopping users from doing their job it requires immediate attention, and possibly support, from the software or hardware supplier. Users will be kept up-to-date as to progress being made.
    b. Moderate support job – When an I.T issue is stopping users from accessing parts of the network, or from using various I.T. services, it will be assessed for importance and resources scheduled as required.
    c. Minor support job - Minor support jobs, preventing users performing part of their day to day activities, will be logged and users informed as to when the job will be completed. Super users should be able to solve many of these jobs.
3) Remote support, via the Virtual Private Network, will enable I.T. support services to be provided remotely to all computers on the network. Thus the majority of support jobs should be resolved without the need for expensive support days off site.

4) Access will be provided to an online forum, set up by the software supplier, to allow their customers to access a knowledge base of systems information.
5) The software supplier will provide support with regard data backups, disaster recovery and current I.T. legislation.

9.4.4) Conclusions

After the software selection decisions were made the main hardware requirements had to be identified. Decisions were required as to the network infrastructure, over two sites, and which supplier would provide the equipment.

The company decided to go with Redstone as a hardware supplier as they provided the most cost effective quote and could handle not only the hardware requirements but also act as an I.S.P. and domain hosting company. Windows 2000 Advanced Server was the preferred operating system for the Server and Windows 2000 or XP for the Client. All computers were brought up to the minimum standard as prescribed by the software supplier.

The network infrastructure needed to be simplified in terms of centralising network components in secure and ventilated locations, replacing multiple hubs with switches and installing CAT5 cabling. The decision was made to replace the existing I.S.D.N. Internet Access, at the offices at Cwmbran and London. These were replaced with a 2M.B. A.D.S.L. Circuit in London and with a 256K leased line at Cwmbran. A Cisco router at each end provides a connection to the Internet and a V.P.N. connection between the offices allows access to the servers on either end of the network.

A new I.T. systems support procedure was set up to enable user's access to appropriate technical support with all new systems.

9.5) Project constraints and S.M.E. critical success factors

During the lifetime of the project there were factors which influenced, or directed the decisions made prior to the selection process, and during the implementation phase of the project. These constraints but had to be taken into account and managed at the time. They originated either from the management, or board level of the company, and will be discussed here along with how they were managed. The intention here is to provide critical success factors for similar sized companies who are looking to implement new I.S.

9.5.1) Selection choice

From the short-listed options available the possibility of upgrading the existing systems was very attractive. They broadly met the user requirements, were the most cost-effective, and least intrusive option.

The main reason this option was ultimately eliminated was that the relationship between the supplier and the organisation had deteriorated, and it became clear that they could no longer work together. The bad feeling could be traced to the original implementation, where parts of the system had not been implemented as intended, and had grown through the years because of ongoing support issues and strong personalities on either side.

Company A, and the researcher, also placed conditions on the eventual system (Table 27) in that the system had to be targeted at Apparel customers, with proven Apparel experience. This was understandable for a S.M.E. with limited resources and there is much evidence of the S.M.E. selecting industry specific systems, along with evidence, of the difficulties implementing E.R.P. into the S.M.E. environment. Both of these conditions narrowed down the options available to the organisation in terms of new systems.

9.5.2) Changes to the project plan

During the implementation stage of the project the project plan was changed for various reasons. The most important of these will be listed here.

1) The original implementation period was five months, and this was seen as ambitious, with many similar projects taking eight months to a year to complete in similar organisations. Because the organisation did not want to pay license fees to retain the existing systems for another year, the new system's had to go live five months after selection was made. This resulted in the original project plan being reduced and key stages, such as the parallel running of the systems, being condensed.

2) The software supplier was going live with another organisation at the same time; this meant that the organisation went live with fewer resources than expected, and as a result, the London office went live two weeks later than intended.

3) Financing was delayed with regard to the ordered hardware; this caused delays, and as a result, more emphasis was placed on the temporary network in terms of training and data input. This was not ideal as only six computers were available for large periods during implementation.

The biggest overall impact during implementation was that of the parallel running of systems. This ultimately meant that the new systems went live without a full walk through being carried out with the users. The first time this happened was in a live environment, with no adequate backup, and this resulted in the following:

1) Extra pressure on all organisational resources – changes were still being made to the system in a live environment.
2) Delays in invoices being printed and sent to customers.
3) Delays in cash being allocated against customer accounts and statements being sent out.
4) Teething problems with systems integration meant that invoices were not immediately being posted to the sales ledger.
5) Not all system reports available from day one of go live.
6) Backlog of normal day to day jobs during the last two months of the implementation plan took several months to return to normal.

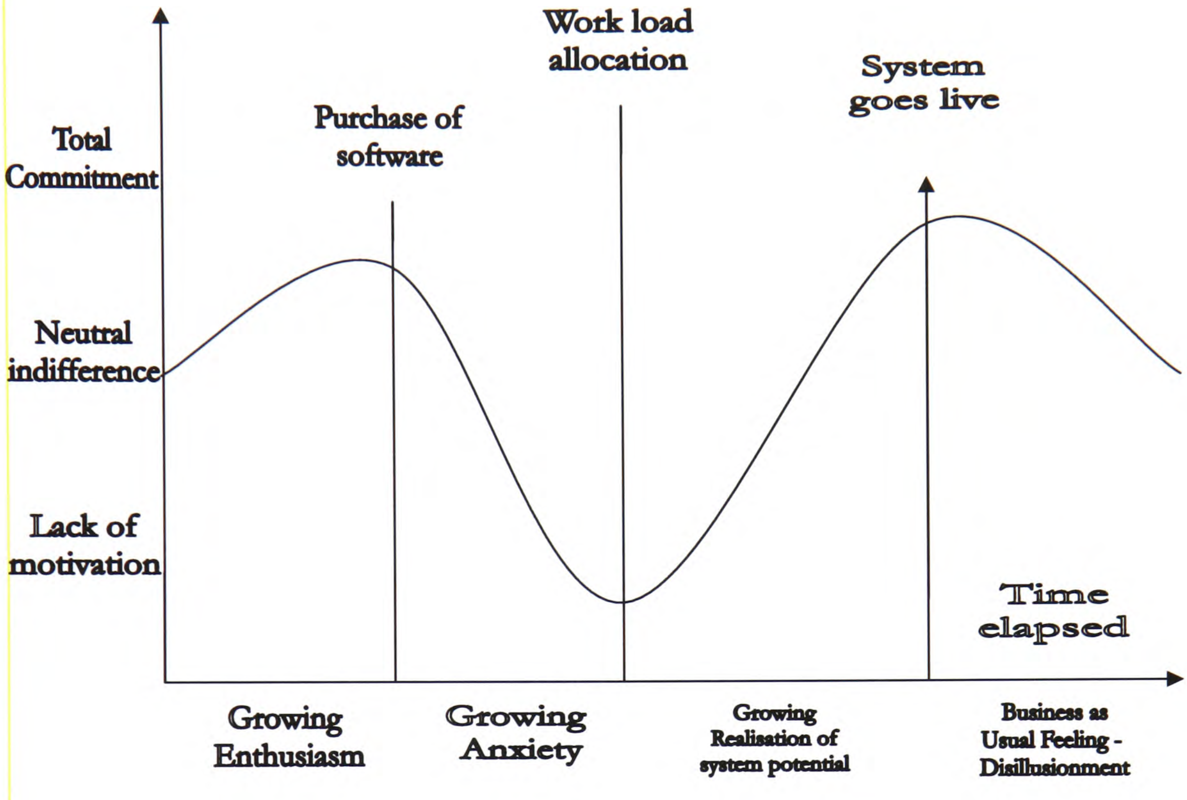
These problems were managed by adhering to appropriate critical success factors, as identified in Chapter 2, Table 7 for example:

1) Progress meeting to keep all stakeholders up to date.
2) Top management support – making extra resources available, for example, temporary staff.
3) Staff putting in extra hours.
4) Distributing the workload and not overloading any one area of the company.
5) Effective project management and clear lines of communication.
6) A clear vision of what was required and by whom in order to manage the situation.

Problems were identified, managed and worked through, however they did have a financial implication to the organisation which is difficult to qualify. Temporary staff can be measured in terms of cost, while delays in processing and normal activities are difficult to quantify.

The obvious indicator of user morale during this period is the fact that no employees left the organisation during the implementation phase, or immediately after. Similar to research by Adam & O'Doherty (2000) the gradually realisation of the benefits being gained provided a boost to morale, and the culture of the organisation meant that users were resilient and used to working long hours, in order to work through difficult periods (Figure 20). The consultative nature of the analysis meant that users were brought on board, consulted and involved throughout the project lifecycle. They were aware of the difficulties associated with introducing this level of change in a short period of time and believed in the project. When implementation became difficult they were prepared to work through and support the project team. However, it was important that progress was seen to be made during this time as people needed to see, and believe, that their work was moving the organisation and project in the right direction.

During this period experience was gained as to what ultimately proved successful in implementing a new information system in the S.M.E. environment. Table 36 lists new critical success factors, unique to this project, which adds to the research.


Work load allocation
System goes live
Total Commitment
Purchase of software
Neutral indifference
Lack of motivation
Time elapsed
Growing Enthusiasm
Growing Anxiety
Growing Realisation of system potential
Business as Usual Feeling - Disillusionment

9.5.3) Company A – critical success factors

Company A – critical success factor	Comment
Combination approach to business analysis.	An approach to business analysis that is built on the qualitative research paradigm, in using a combination of S.S.M. and standard business process modelling. This allows a flexible and fast approach to understanding the users, culture, business processes and information flows in a project not involving software development.
I.S. identification and selection process which allows stakeholders to buy into the project.	A consultative approach to the identification and selection of appropriate systems for consideration. This method allows key stakeholders to play their part, and sign off on the project. In the S.M.E. this is crucial as stakeholder, and user support is required during the implementation process, when normal day to day activities, as well as implementation tasks need to be performed. This creates pressure and extra workload on all users.

Company A – critical success factor	Comment
The presence of strategically placed super users.	Within the S.M.E. environment limited I.T. expertise is usually available. Consequently, during projects of this nature external consultants have an important role to play during the implementation stage. These consultants are expensive and therefore often limited in the amount of days they are available on sight. The S.M.E. has many social groups, or subcultures, that follow departmental structures, and are well established. Organisational culture can influence the success of change related projects and must therefore be taken into account. For example, within Company A there is a culture where key individuals are highly valued and viewed as being indispensable to the organisation; this is often due to a lack of centralised information, with key users containing important information and knowledge, and being the only person who understands how they do their job in a fragmented environment. These users are wary of change for fear of losing this status in the organisation and may resist the project. Within Company A, this threat was turned into an advantage by using these key individuals as super users to act as a bridge between their department and the project team, filtering information relating to training, support and the progress of implementation tasks. This maintained their previous status, while allowing them to play a key role during the implementation of the new systems.

Company A – critical success factor	Comment
Organisational acceptance of the internal change manager, or consultant. The completion of early goals.	Within the literature the presence of the internal consultant is typically listed as a critical success factor. However, the experience of this project suggests that simply the presence is not enough. In the S.M.E. environment the change manager, or consultant, needs to be accepted by the stakeholders, and users, especially during the implementation stage. Within Company A this was accomplished by the change manager adopting the role of I.T. support and achieving early goals. For example, the organisation had many I.T. support issues during the early days of the project, and time was taken to fix some of these problems. By simply writing several S.Q.L. based reports, many reporting tasks, which had been time-consuming and problematic, were suddenly automated. These relatively simply tasks proved to the users that improvements could be made, allowing them to buy into the project, and the principle change maker, early on. In an organisation where the previous software project had been the ongoing cause of many problems this was important in terms of selling the project to the users.

Company A – critical success factor	Comment
Parallel running of old and new systems. The migration of clean data.	Whichever implementation strategy was adopted key tasks were the parallel running of systems, user training and the migration of data between systems. During the implementation at Company A the parallel running stage was condensed, due to time restrictions, and this caused problems. Time must be prioritised to the transition between systems so that the first time users are actually processing their own data, it is not in a live environment. Problems invariably occur, and when the system is live, the pressure is that much greater. Implementation needs to be balanced, especially in relation to the first time the new systems are processing live organisational data. In terms of data migration, clean data must be transferred, and were where possible automated. For Company A, this was the biggest task of the project and involved all users, as well as temporary staff. Consideration was given as to which data could be archived, and how much needed to be transferred. Particular attention was given to setting up file structures, in terms of management reporting.

Company A – critical success factor	Comment
Proven integrated systems	A common C.S.F. in the literature is the adoption of technology. For organisations this technology is typically E.R.P. systems which offer integrated information systems. The literature suggests that E.R.P. is now being offered to the S.M.E., however Company A, which sits at the lower end of the S.M.E. market, could not afford true E.R.P. and in this sense the hybrid solution offered a balance between affordability, integration and suppliers who understand the S.M.E., industry and users. Integration would prove to be of the utmost importance due to the failing of the previous systems to successfully integrate the order processing modules, to the accounting system. This caused numerous labour intensive manual processes which were never improved upon. Therefore a critical success factor of such projects is to understand how separate systems can be integrated as many S.M.E. allocate numerous resources to bridge the gaps (manual processes) between fragmented systems.

Company A – critical success factor	Comment
Software supplier knowledge and experience of industry sector.	For the S.M.E. the role of the software supplier in the implementation process is crucial. They will supply resources for user training, as well as all other aspects of implementation. It is critical that they understand the industry sector of the S.M.E. This is not necessarily the case, with many modern suppliers offering largely generic, albeit integrated solutions able to be adapted to many different industry types. The researcher talked with many software suppliers who had solutions which were well matched to Company A, but could not provide a project manager with experience in the S.M.E. manufacturing Apparel industry. For Company A the fact that the selected software supplier has many years experience in the S.M.E. manufacturing Apparel industry meant that they were able to talk the same language as the users, and understand many of the problems and solutions, that would arise and be required. This saved time, and meant the users and stakeholders had an instant understanding with the supplier.

Table 36 - Company A – Critical success factors

9.5.4) Conclusions

During the implementation stage of the project the schedule was changed for various reasons, resources not yet available, political decisions or due to a change of requirements. Problems were identified, managed and worked though; however, they did have a financial implication which is difficult to qualify.

Employment of the critical success factors identified in the literature review meant that despite the pressure and problems encountered, many were solved during the first few weeks of the new systems going live. Tasks were prioritised and worked through, and despite the painful process the systems were soon printing invoices and processing orders as planned.

The process of implementation has also identified additional critical success factor which could be used for similar project in the S.M.E. environment and these are listed in Table 36.

9.6) Chapter conclusions

During the implementation phase of the project the company had to plan for training the users, setting up all the files of information, transferring data, Setting up the hardware and parallel running the systems to ensure that it worked as well as the existing system. An overall schedule was produced which incorporated all these elements, identifying responsibilities and key dates. Initial implementation meetings were held over three days to discuss the project between the key stakeholders from within the company and the project team from the supplier.

During the selection phase there were two areas of the system where be-spoke work would be required, namely the quotation/proposals system and bundle ticket generation. With the new systems the integration options freed two staff from data input tasks in terms of re-entering sales invoices into the sales ledger and the reconciliation of purchase invoices and goods receipt notes to purchase orders

Multiple warehouses and locations were created and computerised and perpetual stock-takes started on a regular basis. These decisions meant that the company could start to build accurate stock records, and for the first time print picking tickets with stock by location and dispatch and receive stock correctly.

Contract stock was computerised for the first time, as the new systems allowed customer codes to be held against internal identifiers and stock records, and all associated stock transactions were now automated.

Greater visibility was possible of goods in transit as production orders were now booked onto shipping notes so that, at any one time, the organisation could identify, track and value stock on the high seas.

Various reports were set up and included invoice margin reports, stock valuation reports and agent commission statements offering summary and detailed information. Previously, two people spent much of their time creating various reports and management information which was now automated.

The network infrastructure was simplified in terms of centralising network components in secure and ventilated locations, replacing multiple hubs with one switch on either site, and by installing CAT5 cabling.

"Train the trainer" was the preferred methodology during the system implementation. Experience has shown that this approach develops a cadre of experienced personnel, familiar with the business and the application that can then provide ongoing training and support once the immediate implementation phase is complete. The training itself was segmented into strategic and tactical sessions. As well as training on the new applications, users also received training on general Windows applications. The users were at different levels of competency and the requirement was to bring all users up to a minimum standard.

During the implementation stage of the project the schedule was changed for various reasons e.g. resources not yet available, political decisions or due to a change of requirements. Adherence to the critical success factors, highlighted in Chapter 2, in terms of effective project management, as well as continued support from users and project stakeholders, ensured that the project stayed on course, allowing the organisation to realise the benefits. Various new critical success factors were identified during the research and add to the literature.

9.7) Chapter summary

The following chapter will look at the post implementation side of the project and attempt to measure the success of the project against the original project aims specified in Chapter 4.

Chapter 10

COMPANY A – COST BENEFIT ANALYSIS

"It's the same each time with progress. First they ignore you, then they say you're mad, then dangerous, then there's a pause and you can't find anyone who disagrees with you."

- Quoted in the Observer Newspaper (1991)

10.1) Chapter overview

Chapter ten aims to assess the overall impact of the changes made during the implementation stage of the project. An assessment will be made in terms of changes realised and where possible, benefits will be quantified in terms of financial savings.

This chapter will also look at future opportunities leading on from the progress made during the project.

10.2) Project deliverables

Chapter four explains the reasons for the project and what was to be delivered, while Chapters 5, 6 & 7 discuss the issues the organisations were facing. In summary, the organisation were looking to improve the business processes by the strategic utilisation of an integrated I.S. and to increase cost effectiveness, principally, through a lower manufacturing cost base in China.

A highly efficient up to date supply chain management I.S. would play a central role in achieving the company's objectives.

10.3) Measuring the progress made

After the completion of the project it was appropriate to discuss the benefits realised against the original objectives. Table 37 lists the main benefits (against the requirement groups) after speaking with users after implementation. These are directly comparable to the requirements as defined in Table 26 and 27 in Chapter eight.

The following three points were stated in the original project brief, (Chapter 4) and the response in italics is the response after implementation by the managing director of Company A.

1) Reduced penalties for incorrect/late deliveries. Currently this is running at 0.5% of turnover which will effectively result in a reduction of £60,000.

This can only be assessed in the months and years after completion of the project. The company now has a warehouse management system which holds stock records by individual warehouse and location and all goods are now received and dispatched off the computer system.

2) Increase efficiency of administration e.g. reduce duplication, transcription errors etc by saving on clerical staff estimated at two staff at £12,500 pa x2 = £25,000.

STYLEman has integrated various functions which were previously the job of two people. Various reports and order logs have also been automated and this can account for two further positions.

3) Further efficiency gains in Inventory management and distribution, telecommunications savings, computer consultancy & support will further contribute to the savings at an expected figure of £45,000 pa.

Ongoing use of the improvements to supply chain control should allow the company to consolidate/improve its market share within a highly competitive commercial sector. The planned extension of the new system to cover control of the company's key offshore manufacturing sources should further enhance this position. The introduction of broadband, over I.S.D.N., is saving the company £15,000 per annum.

Requirement group	Benefit 1	Benefit 2	Benefit 3	Benefit 4
Accounting solution	Use of specialist software Open Accounts for purchase and general ledger functions.	Meets all accounting requirements set out.	See systems integration.	
Company profile	Supplier has in-depth knowledge and experience of the S.M.E. Apparel manufacturing industry.	Access to knowledge base of similar organisations using the same product.	Able to provide project manager with extensive experience of the industry.	Strong financial history.
Consultancy, training and support services (1)	All users trained on the new system and Windows applications meaning systems are used as intended with workaround solutions removed.	More secure and reliable network through networked firewall and anti-virus software.	Server and client operating systems standardised.	Data communications now more efficient and £15,000 per year cheaper by using A.D.S.L. with Internet activity centralised through the network.

Requirement group	Benefit 1	Benefit 2	Benefit 3	Benefit 4
Consultancy, training and support services (2)	All systems regularly backed up.	User data stored centrally on network server.	Company A compliant with the Data Protection Act	I.T. Security policy document provided.
Consultancy, training and support services (3)	I.T. asset list available for insurance and auditing purposes.			
Future projects	Foundation in place for bar-coded warehouse management which is available.	Foundation in place for E-commerce which is available.		
In house production	High level view of production for capacity planning.	Visibility of internal production by way of bundle ticket generation.	Definable and reportable progress points for sourcing routes.	
Interface and customisation	All users correctly assigned individual system/network passwords and privileges.	Windows style graphical user interface.	Drill downs ability linking production/purchase orders to associated sales orders etc.	

Requirement group	Benefit 1	Benefit 2	Benefit 3	Benefit 4
Off-shore production & procurement	Greater control of external Production orders through cut make and trim control.	Goods in transit monitored and costed by way of shipping notes.	Automatic allocation, issuing, down dating and actual usage of raw materials against production orders.	M.R.P. available for suggestive and the automatic raising of purchase orders.
Reporting options & forms (1)	Automated sales listing report by year, period sorted by division, brand, class and group.	Accessible sales margin summary and detailed report by customer.	Accessible stock valuation by year, period sorted by division, brand, class and group.	Automated royalty and commission reports and statements.
Reporting options & forms (2)	Removal of expensive pre-printed forms.	Company terms and conditions now printed on invoice and statements.	Forms able to be emailed to suppliers and/or customers.	All products set up by product matrix – division, customer, product range, product group and product type.

Requirement group	Benefit 1	Benefit 2	Benefit 3	Benefit 4
Sales & warehouse management	All brand and contract stock now fully computerised and costed. Returned goods processed and retuned to stock.	Finished and raw material stock now fully auditable by way of recognised stock transactions (receipts and issues) and/or stock taking procedures.	Picking tickets now printed with stock locations. Agent stock monitored through traceable stock transfers to concession stock locations.	Contract stock able to be held and referenced by company and customer product code.
Systems integration	Sales invoices posted directly to the sales ledger on dispatch.	Automated credit checking new orders to customer debt.	Automated reconciliation between purchase invoices, G.R.N. and purchase orders.	Automated debt letter processing.
Total cost of ownership	Comfortably meets budget requirements.			

Requirement group	Benefit 1	Benefit 2	Benefit 3	Benefit 4
Quotation system	London users able to access the system and place their own bulk orders.	Products and material costs automatically captured and written away.	Data entered into the system in real time, as orders are taken.	Product, bill of material and costing templates speed up the data entry task.

Table 37 - Benefits realised

10.3.1) Quantifiable benefits

Quantifying the benefits gained by Company A was never going to be an easy job because many of these benefits are soft benefits to what were soft problems. For example, many of the cost savings are from the ability to make decisions and respond more quickly from data and information that was not previously available. Likewise, the old system used to crash regularly, and it is difficult to quantify eight hours of downtime or a new more reliable system which rarely breaks down. Trained users, disaster recovery procedures & automated credit control all benefit the organisation but are also difficult to qualify in terms of financial benefit.

Whilst many of the benefits are soft, a monetary value can be placed against the integration options now available to the organisation, which makes the jobs of four clerical positions redundant.

Likewise the use of new technology, such as A.D.S.L., for the data communications, is cheaper than the method previously employed, as is the ability to move away from pre-printed forms.

10.3.2) Financial appraisal

The purpose of this section is to attempt to quantify the financial benefits of the project, in terms of expense incurred and the benefits gained. The typical and expected life of an I.S. is five years so all calculations are based over that time frame. These figures have not been approved by the organisation but Table 38 and 39 forecast savings of **£501,325.01** over a five year period.

Financial figures – five year period

CASH OUTFLOWS	£
Capital Investment.	
Hardware upgrades	£31,207.00
Software costs	£85,657.99
Bespoke development	£5,000.00
Initial training and support.	£38,500.00
Subsequent software updates and support.	£100,210.00
Subsequent training or support days.	£11,900.00
Maintenance and operations.	£24,000.00
Future projects – bar coded warehouse.	£30,000.00
Total costs.	£326,474.99

Table 38 - Financial figures – outflows

Investment – in-flows	Year 0	Year 1	Year 2	Year 3	Year 4	Total costs
STYLEMAN AND OPEN ACCOUNTS.						
Salary savings	£50,000.00	£50,000.00	£50,000.00	£50,000.00	£50,000.00	£250,000.00
Reduction of late deliveries	£60,000.00	£60,000.00	£60,000.00	£60,000.00	£60,000.00	£300,000.00
Inventory efficiency gains			£30,000.00	£30,000.00	£30,000.00	£90,000.00
Grant funding	£100,000.00					£100,000.00
Data communications savings	£15,000.00	£15,000.00	£15,000.00	£15,000.00	£15,000.00	£75,000.00
Training grant	£8,000.00					£8,000.00
Stationery savings	£960.00	£960.00	£960.00	£960.00	£960.00	£4,800.00
Total savings	£233,960.00	£125,960.00	£155,960.00	£155,960.00	£155,960.00	**£827,800.00**
Net cash flow						**£501,325.01**

Table 39 - Financial in-flows

10.3.3) Overall progress

The achievements and organisational benefits stated within this chapter explain the changes that have occurred throughout the course of the project, and these broadly reflect the original recommendations made by Williams (2001). The new information system is geared specifically towards a supply and distribution operation by providing a shared database. The new shared database allows for improved control of the organisations supply chain performance offering a much greater control of individual sales and production orders.

The new strategic direction of the organisation has resulted in a change to its operations by outsourcing its manufacturing capability to China. The network improvements have made this possible by making data communications with London and China viable. It would now be possible for example to access STYLEman, over the Internet via a virtual private network, (V.P.N.) in the China factory so that they could book raw materials into stock, and allocate and issue raw materials against raised production orders in the Cwmbran factory. This would improve the current process whereby Cwmbran use a packing list, which China issue on a weekly basis, which results in delays in processing orders and valuing stock. Company A decided not to use China to perform these tasks because they would soon be sourcing all the raw materials themselves, as they would have 100% of the production capacity. Company A would no longer be concerned with the raw materials process, as they would simply be raising sales purchase orders for finished goods.

What was desirable, and now possible, was the ability to track and cost production orders when they leave the China factory and before they are booked into the U.K. warehouse. As a result shipping notes are now being used to track and cost these orders and, unlike on the previous system, all production orders are now being booked correctly into finished stock via traceable stock transactions (Appendix 3.2).

The network changes also mean that the London sales office can now place their own sales and fabric purchase orders, directly onto the system via the V.P.N. and the be-spoke Proposals system. These are picked up in the Cwmbran factory where associated production and ancillary purchase orders can be raised. This has removed the labour intensive paper based approach between the London sales and Cwmbran procurement offices which used to be a cause of conflict.

Advances in integrated software and the increase in Internet bandwidth are becoming important tools for organisations like Company A. As increasing production capacity is moved overseas the need to access, process and value various sources of information is crucial. The use of virtual private networks and mean that joint venture partners can now update home based systems in real time. For Company A this is proving to be important in terms of being able to track and update stock movements, value goods whilst in transit and provide timely management information. This was previously accomplished via paper based methods which were labour intensive, prone to error and time delays.

10.3.4) Conclusions

The implementation programme has completely changed the way the organisation operates. As a direct result of the programme all key commercial transactions have been fully computerised. This includes sales invoicing, component purchasing, goods received, purchase ledger and finished stock. All orders are now processed on the new system. Savings of £501,325.01 are estimated over a five year period

Changes have been made to the network infrastructure to allow the London office to access the network and place orders on the system. This completes the supply chain for automatic stock and order processing which was previously carried out on a manual basis.

The new system provides the company with the ability to rapidly update key management information and reports e.g. sales, margins, stock etc. The new network arrangements have provided the organisation with much faster system response times and substantially improved communications reliability.

The re-engineering of the business processes carried out as part of the new hardware and software installation has resulted in a direct labour saving of four full time clerical jobs.

All existing staff have benefited from a programme of I.T. training that formed part of the project. Dependent on individual's job needs, they were given both basic computer and system specific training.

10.4) Future projects

With the foundations of a solid I.T. infrastructure including high speed Internet access and the set up of a virtual private network, enabling remote access to the network, the organisation is interested in two further areas of functionality to further aid the users, these are:

10.4.1) Material requirement planning

During the implementation phase it took time to get data ready and users trained on how to use certain aspects of the system, and in order to utilise M.R.P., users have to first be correctly allocating, issuing and down dating raw material stock against production orders. This allows for accurate and powerful M.R.P., which will assist the procurement department in terms of suggesting material requirements and automatically raising purchase orders.

Because of these reasons, and because of the ongoing changes in sourcing routes, this area of the system is not initially being used. It is intended that once raw material stock records in China are being updated real-time, stock routes & procurement transactions have stabilised, M.R.P. will be introduced. However, with the movement towards sourcing only finished goods as opposed to raw materials it is now unlikely that this functionality will be required.

10.4.2) Bar-coded warehouse management

During the project, warehouse management was of particular concern. The organisation only had one warehouse computerised and within that warehouse only half of the finished goods stock was on file. Finished goods were not counted, or correctly booked into or dispatched from computerised stock, meaning accurate stock records and stock reconciliation was not possible.

These problems have been addressed, and from the new system, both finished goods and raw material stock are being booked into, transferred between and dispatched from computerised warehouses by location. Regular and perpetual stock counts are taking place, with items fully costed on the system. Shipping notes now track overseas production orders with all associated costs captured, meaning stock can be traced and valued wherever they may be.

Going forward, the organisation would like to use barcode technology in order to be able to scan goods in and out of the warehouse. This would speed up the processing of stock transactions.

STYLEman can incorporate bar-coded tickets, and labels, to enhance the progression routine by reducing the time taken to manually input the movements, therefore increasing the speed and accuracy by which new movement information is available. This was not considered initially because of the need to set up the warehouses correctly in terms of location and introducing computerised stock transactions.

Bar code technology would also be required for China, where the bulk of finished stock is manufactured. Chinese finished stock is now booked onto shipping notes and booked into the Cwmbran warehouse on arrival, and against a shipping reference. However, this still relies on Cwmbran staff receiving the packing list from China and creating the shipping note in the first instance. By purchasing the STYLEman bar code solution, this routine could be simplified, and automated, by scanning finished goods in and out of the various warehouses. This is of increasing importance due to the high volume of stock shipping in and out of China and the costs incurred by Company A in terms of incorrect or late deliveries.

10.4.3) Conclusions

Work ongoing from the project includes M.R.P., which has not yet been used because of ongoing delays and inaccuracies as to the way raw material stock information arrives from China.

The organisation would also like to use barcode technology in order to scan goods in and out of the warehouse. This would speed up the processing of stock transactions and reduce penalties for incorrect/late deliveries. The foundations are in place for this technology.

10.5) Chapter conclusions

The I.T. project has completely changed the way the organisation operates. As a direct result all key commercial transactions are now fully computerised. This includes sales invoicing, component purchasing, goods received, purchase ledger and finished stock. All orders are now processed on the new system. Estimated savings of £501,325.01 are estimated over a five year period.

Changes have been made to the network infrastructure to allow the London office to access the network and place orders on the system. This completes the supply chain for automatic stock and order processing which was previously carried out on a manual basis.

Work ongoing from the project includes M.R.P. and the initial investigations into the possibility of looking into introducing bar-coded warehouse management.

10.6) Chapter overview

Chapter eleven will summarise the conclusions of the thesis and address its original aims and objectives.

Chapter 11

THESIS CONCLUSIONS

"The end may justify the means as long as there is something that justifies the end"

- Attributed to Leon Trotsky (1879-1940)

11.1) Chapter overview

This chapter completes the thesis by summarising the key findings. A response to the thesis aims and objectives will be provided in section 11.2, while 11.3 will provide recommendations that can be drawn from the work completed. 11.4 will state future directions for business analysis work in relation to information systems.

11.2) Key findings

The research focused on the need and best practice when implementing an information system, in order to determine how effective they are and what quantifiable benefits are realised. Emphasis was placed on a systems review and implementation project within an S.M.E. called Company A. Key findings of this study were derived from the initial analysis of the problem area, which involved the researcher utilising various research methods and data analysis techniques in order to understand the scope of the problem area (Chapter 3). These fed into the business analysis methods adopted, a literature review conducted on published documents and a systems selection and implementation stage, in which the researcher played a leading role.

The literature review gave evidence of the typical business analysis methods adopted when undertaking projects of this nature, with increasingly integrated information systems being adopted. New technology is playing an important and increasing role in aiding these organisations meet their objectives, while the adopted business analysis methods and critical success factors, are crucial to the marrying and success of the solution with regard to the inherent business processes.

The research established that several factors are influencing the need for the S.M.E. to reengineer their business processes and adopt new technology. These factors were identified as increased global competition, changing customer requirements, down sizing and new technology in the form of more integrated enterprise wide information systems.

Key findings of the research are based around the business analysis techniques utilised, the technological solution adopted, the software selection process, critical success factors engineered throughout the research, and the benefits gained by Company A.

11.2.1) Business analysis contribution

During the research a combination of approaches was taken to the business analysis in terms of understanding the environment, organisation, culture, stakeholders and business processes. Throughout the business analysis the conceptual model, as well as the data flow diagram, was used to document the activities of a particular system. As discussed in Chapter 2, 3 and 5 a contribution of this research was to place increased resolution onto each of the activities of the high level conceptual model by converting them into more detailed data flow diagram, each representing a particular organisational activity.

The conceptual model represented the minimum set of activities that the system must do as defined by the root definition, while the data flow diagram represented the set, or sequence, of actions required to perform each of the identified activities. The project at Company A was not one of systems development, but one of understanding, and deriving the requirements, for the purchase of an off the shelf system. This combination approach to the business analysis allowed a consultative and inclusive process to the understanding of the whole environment, systems, process and users.

The research is not about the technology in itself; new technology is a key enabler of the business processes and not a separate and distinct provider of value. Organisational operations can be improved by the introduction of new technology, and in particular more integrated information systems, but this should be driven by the business processes and not simply by automation. In the example of Company A, the new software system was geared specifically towards supply and distribution and allowed improved control of the companies supply chain performance.

11.2.2) Technological solutions

Because of the maturing top-end of the market, E.R.P. vendors have been looking to make the software easier to use and deploy in smaller organisations. The increased attention on the E.R.P. middle-market has accelerated as Microsoft entered the market by acquiring two large mid-market vendors in Great Plains and Navision. This move led to a flurry of acquisitions among high-profile E.R.P. vendors in order to support product base in an effort to fill the middle market void. This has made E.R.P. more affordable for the S.M.E. that has traditionally been supplied by smaller software vendors supplying industry specific departmental solutions.

E.R.P. is an important, and significant, step to take and a problem for most organisations to manage. Implementation problems are generally caused by the project being viewed in the short term of automating business processes, and going live, while the wider business issues concerning user education and training, supply chain management and the overall impact of the business process reengineering that takes place are not always appreciated.

The literature review discovered that S.M.E.s are unlikely to take up E.R.P. systems due to the difficulties associated with implementation, the costs, and lack of industry knowledge provided by generic E.R.P. vendors. This research identified another option available to the S.M.E. in terms of a hybrid solution. The hybrid solution is a selection of mid-range niche based systems, able to be integrated with a history of successful implementations. These systems should cover the major departmental requirements of the S.M.E. Within Company A STYLEman and Open Accounts demonstrated that disparate commercially available off the shelf systems can be successfully integrated, offering an affordable solution from suppliers who specialise in the S.M.E. industry, offering consultants with specific industry knowledge and experience.

As well as advances in integrated systems the increase in available Internet bandwidth, is also becoming an important tool for organisations like Company A. As increasing production capacity is moved overseas the need to access, process and value various sources of information is crucial. The use of virtual private networks and increased Internet bandwidth mean that joint venture partners can now update home based systems in real time in terms of being able to track and update stock movements, value goods whilst in transit and provide timely management information.

11.2.3) Selection process

In terms of the I.S. short-listing, and the selection process adopted, the literature offers generic processes which are not specific to the S.M.E. This thesis adds to this literature by offering a filtering process as illustrated in Chapter 8, Figure 17. The aim of this process is to identify, and filter, the most appropriate solutions for consideration. This process aims to defend the S.M.E. by identifying and removing solutions which do not meet certain criteria. The successful solution should pass all key stages in order to be considered, with the research indicating that at most, three solutions should be presented to the key decision makers for consideration.

11.2.4) Company A critical success factors

During the implementation stage of the project the schedule changed for various reasons, changing priorities, resources not yet available, conflicts, political decisions or due to a change of requirements. These are not unusual in projects of this nature. However, when adopting the big bang approach in the S.M.E. environment these can quickly become bigger problems with limited resources available to maintain normal business. Problems must be identified, managed and worked though; however, they can have a financial implication which is often difficult to qualify. Company employees can be expected to put in extra hours in order to solve these problems with tasks prioritised.

The main reason these problems are solved is because of the identification and adoption of critical success factors of like minded projects in the literature. From the experience of Company A, and the research carried out, the main critical success factors of such projects are as follows: Top management support, presence of a project champion, stakeholder and user involvement, effective project management, presence of a business analyst and/or external consultants, technical capabilities, minimum software customisation, effective communication and a clear business plan.

Based on the research at Company A, additional, and more specific, critical success factors have been identified (Chapter 9, Table 36).

- Combination approach to business analysis – S.S.M. and process analysis. An approach to business analysis that is built on the qualitative research paradigm, in using a combination of S.S.M. and standard business process modelling (data flow diagrams). This allows a flexible and fast approach to understanding the users, culture, business processes and information flows in a project not involving software development.

- I.S. identification and selection process which allows stakeholders to buy into the project. This method allows key stakeholders to play their part, and sign off on the project as well as agree to the weighted requirements catalogue. In the S.M.E. this is crucial as stakeholder, and user support is required during the implementation process, when normal day to day activities, as well as implementation tasks need to be performed. This creates pressure and extra workload on all users.

- Organisational acceptance of the internal change manager or consultant. Within the literature the presence of the internal consultant is typically listed as a critical success factor. However, the experience of this project suggests that simply the presence is not enough. In the S.M.E. environment the change manager, or consultant, needs to be accepted by the stakeholders, and users, especially during the implementation stage. Within Company A this was accomplished by the change manager adopting the role of I.T. support technician and achieving early goals. In an organisation where the previous software project had been the ongoing cause of many problems this was important in terms of selling the project to the users.

- The presence of strategically placed super users. Within the S.M.E. environment limited I.T. expertise is usually available. Consequently, during projects of this nature external consultants have an important role to play during the implementation stage. These consultants are expensive and therefore often limited in the amount of days they are available on sight.

The S.M.E. has many social groups, or subcultures, that follow departmental structures, and are well established. Organisational culture can influence the success of change related projects and must therefore be taken into account. For example, within Company A there is a culture where key individuals are highly valued and viewed as being indispensable to the organisation; this is often due to a lack of centralised information, with key users containing important information and knowledge, and being the only person who understands how they do their job in a fragmented environment. These users are wary of change for fear of losing this status in the organisation and may resist the project.

Within Company A, this threat was turned into an advantage by using these key individuals as super users to act as a bridge between their department and the project team, filtering information relating to training, support and the progress of implementation tasks. This maintained their previous status, while allowing them to play a key role during the implementation of the new systems.

- Parallel running of old and new systems and the migration of clean data. Whichever implementation strategy is adopted key tasks will be the parallel running of systems, user training and the migration of data between systems. During the implementation at Company A the parallel running stage was condensed, due to time restrictions, and this caused problems. Time must be prioritised to the transition between systems so that the first time users are actually processing their own data, it is not in a live environment. Problems invariably occur, and when the system is live the pressure is that much greater. Implementation needs to be balanced, especially in relation to the first time the new systems are processing live organisational data. In terms of data migration, clean data must be transferred, and were where possible automated. For Company A this was the biggest task of the project and involved all users, as well as temporary staff. Consideration was given as to which data could be archived, and how much needed to be transferred.

- Integrated systems. A common C.S.F. in the literature is the adoption of technology. For organisations this technology is typically E.R.P. systems which offer integrated information systems. The literature suggests that E.R.P. is now being offered to the S.M.E., however Company A, which sits at the lower end of the S.M.E. market, could not afford true E.R.P. and the hybrid solution offered a balance between affordability, integration and suppliers who understand the S.M.E., industry and users. Integration would prove to be of the utmost importance due to the failing of the previous systems to successfully integrate the order processing modules to the accounting system. This caused numerous labour intensive manual processes which were never improved upon.

Therefore a critical success factor of such projects is to understand, in advance, how separate systems will be integrated as many S.M.E.s allocate numerous resources to bridge the gaps (manual processes) between fragmented systems.

- Software supplier knowledge and experiences of industry sector. For the S.M.E. the role of the software supplier in the implementation process is crucial. They will supply resources for user training, as well as all other aspects of implementation. It is critical that they understand the industry sector of the S.M.E. This is not necessarily the case, with many modern suppliers offering largely generic, albeit integrated solutions able to be adapted to many different industry types. The researcher talked with many software suppliers who had solutions which were well matched to Company A, but could not provide a project manager with experience in the S.M.E. manufacturing Apparel industry.

  For Company A the fact that the selected software supplier has many years experience in the S.M.E. manufacturing Apparel industry meant that they were able to talk the same language as the users, and understand many of the problems and solutions, that would arise and be required. This saved time, and meant the users and stakeholders had an instant understanding with the supplier.

11.2.5) Identifying the benefits

Chapter 10 documents the benefits Company A gained from the project, and attempts to qualify these in terms of a cost-benefits analysis. From the research carried out the general reasons why organisations adopt such a project, are as follows.

- Improved service – internal and external.
- Lower costs through restructuring.
- Enhanced product quality and faster turnaround.
- Increased Staff motivation.
- More flexible response.
- Integrated Information System.
- Improved management information.

Measuring the benefits gained is never an easy job because many of the benefits are soft benefits to what are soft problems. For example, many of the cost savings are made from the ability to make decisions from information that was not previously available, or in providing a more efficient service to customers and this is always difficult to quantify and attribute to a new system. Changes to business processes in terms of staff redundancies, or cost savings from using a more cost effective infrastructure can be measured and should be documented over the life time of the new system.

11.3) Recommendations and guidelines derived from the research

This section discusses the relevance of the thesis and its recommendations for future implementation efforts of integrated information systems within the S.M.E. environment.

The author would recommend that an emphasis should be placed on informing the users of the change and gaining stakeholder support and participation throughout the business analysis and eventual implementation of the information system. This ensures that throughout the process, users and stakeholders receive and share technical and business knowledge. If the project involves introducing new business processes it is critical that users of the system be made aware of these changes and why they have to occur. Involving users throughout the process is critical to the eventual success of the system as they will not only be asked to take on greater workload but are also the eventual users of the new system. Setting achievable goals early in the project is recommended in order to gain user trust and demonstrate that positive change is possible.

In terms of identifying potential solutions for the organisation, the use of the requirements catalogue is well supported by the literature, and should evolve and be derived from the business analysis carried out. This document should be able to be mapped back to the business analysis and provide a checklist of functionality that the organisation requires, in each department, from any potential system. Any potential system supplier should provide a formal written response to these requirements in order to enter the selection process. The requirements document can also be used as a weapon with which to use against the supplier if it fails to meet agreed standards, and this document should be agreed by company stakeholders before tenders are sought.

With the exception of the requirements document limited literature was available as to how best to both identify and shortlist potential solutions, in the Apparel industry, for an S.M.E. As a result the researcher created and adopted a new process which was used successfully in the selection process. This approach tapped into the knowledge available in the organisation, both in terms of identifying potential systems and assessing their suitability, the focus being, to give each key department, or project stakeholder, a chance to assess the suitability of any short listed system. This was important as it was critical that stakeholders supported the selection process, as their support and participation would be crucial to the success of implementation.

Planning for user training, data input and the parallel running of systems are all key activities which should form part of the implementation plan. In terms of data input, data should be cleaned and where possible, automatically transferred into the new system. All new systems and business processes should be documented at the technical and user level, documenting what was agreed and providing documentation explaining the current situation. Management support is critical in change projects and management should also be made aware of the importance, and risk, of making changes to an agreed project plan based on political motives.

With regard to the S.M.E., the rate of change they are expected to make in the modern environment means that reengineering activities have to be able to respond to many factors, such as, global competition, joint ventures and various other restructuring events. The S.M.E. must not be solely concerned with automation, the latest application, niche based systems or even the latest management theory but focus on what they do, and manage the lifecycle of improvement in a way that translates directly to the operation.

Emphasis must be placed on managing the business processes, and not treating the technology as a commodity, which in itself will deliver the business value.

11.4) Future research

The author identifies several research areas for this thesis covering business analysis methods, such as B.P.R. and S.S.M., through to I.S. and E.R.P. systems in the S.M.E. environment. The one striking element from the research is that there is no unified approach to business and systems analysis work, while B.P.R. does not offer a path to execution; therefore, when undertaking a project such as the one at Company A, the techniques and tools adopted are taken from various different methodologies in order to cover the work required. It would be useful and beneficial to have one unified approach that covers both business and systems analysis through to software engineering.

Much has been written about management theory, and regardless of whether we are discussing total quality management or business process reengineering, the one aspect common to all is the focus on the business process. Organisations do what they have always done and that is buy, make and sell goods and try to do it cheaper, faster and with better service than anyone else.

Technology, such as integrated systems is seen as a key enabler with which to integrate departments and streamline work, but despite achieving progress, reengineering initiatives associated with these solutions have been predominantly concerned with internal processes in a competitive and interconnected world. Further research is required to look at how complex and often unforeseen external factors are increasing the need for new and dynamics business processes within and outside the organisation.

Business process management, in the modern scenario, means the ability to (on an ongoing basis) manipulate universal and complex business processes, and in this sense B.P.R. with its clean slate and radical approach, is not sufficient. Managing business processes, in the modern environment, needs to be an ongoing function of any competitive organisation, involving, not only high level processes but also the sub processes that support organisational activities.

11.5) Chapter conclusions

The aim of the research has been to determine the need, best practice and critical success factors when implementing information systems in the SME environment, in order to determine how effective they, are and what quantifiable benefits are realised. Emphasis will be placed on a systems review and implementation project through the use of a single company in-depth case study approach.

This research project has helped bridge the gap between information systems implementations, critical success factors and the S.M.E.

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