Information Systems Failure: A Business-led Knowledge Requirements Framework for Modelling Business Requirements

A Thesis Submitted for the Degree of Doctor of Philosophy

By

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With Much Love For

My families in Baghdad and in England

Without your tremendous love and support this difficult task would not be accomplished. Sorry for the sleepless nights I gave you.

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Declarations

Elements from this manuscript have appeared in, or are about to appear in the following publications.

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- Al- Karaghouli W., AlShawi S., and Fitzgerald G. (2003) *A Framework for Managing Knowledge in Requirements Identification: Bridging the Knowledge Gap Between Business and System Developers*-Ch.13. Knowledge and Business Process Management. Idea Group Publishing. London.

- Al- Karaghouli W., Fitzgerald G., and AlShawi S. (2002) *Knowledge Requirement System (KRS): An Approach to Improving and Understanding Requirements*-Ch.14. Knowledge Management in the Sociotechnical World: The Graffiti Continues. The Computer Supported Cooperative Work (CSCW) Series. Springer.

- Al-Karaghouli W., AlShawi S., and Fitzgerald G. (2000) Negotiating and Understanding Information Systems Requirement: The Use of Set Diagram. *Requirements Engineering Journal* 5: pp.93-102.

- Al-Karaghouli W., AlShawi S., and Elstob M. (2000) *KRS: A Strategic Elicitation and a Systemic Approach to Customer Requirements.* Paper presented at **OR42** -Operational Research Society Annual Conference, OR in the 21st Century: Communications and Knowledge Management, 12-14th September, Swansea, UK.

• Al-Karaghouli W., Elstob M., and AlShawi S. (1999) *An OR Approach to Establishing Software Engineering Requirements.* Paper presented at **OR41** -Operational Research Society Annual Conference, 14-16th September, Edinburgh, UK.

• Al-Karaghouli W. (1999) *Understanding the €uro and the Year 2000 Problem: Their Impact on the UK.* Paper presented at Research Seminar Series, University of Westminster, 9th February.

• Al-Karaghouli W., AlShawi S., and Elstob M. (1999) *Enhancing the Understanding of Customer Requirements in Business Software Engineering.* Paper presented at Academy of Business & Administrative Science **(ABAS)** International conference, Barcelona-Spain, 12-14th July, electronic proceedings at- http://www.sba.muohio.edu/abas.

• Al-Karaghouli W. (1998) *Failures of Software Engineering in Retail: The Story So Far.* Paper presented at Research Seminar Series, University of Westminster, 24th February.

• Al-Karaghouli W. (1997) *Millions of Pounds Lost on Software Engineering: A myth or reality.* Paper presented at Research Seminar Series, University of Westminster, 11th June.

• Al-Karaghouli W. (1996) *Management Information for Academics and Professional Practitioners.* Paper presented at Research Seminar Series, University of Westminster, 28th May.

• Al-Karaghouli W. (1995) *Management of Information for Professional Practitioners and Engineers.* Paper presented at Research Seminar Series, Department of Electrical Engineering Brunel University, 13th December.

• AlShawi S., and Al-Karaghouli W. (2003) Managing Knowledge in Business Requirements Identification. *Journal of Logistics and Information Management*, **16** (5): pp.341-349.

Abstract

Our work will be mainly concerned with improving the crucial first stage (the requirements stage) of any system development methodology in order to improve requirements. A framework has been developed, called "knowledge requirements framework (KRF)" to help customers and system developers bridge the knowledge and understanding gaps at the initial requirements stage of the Information Technology System (ITS) development process. Unclear business requirements, mismatch of knowledge and understanding are among the major factors that contributes to some ITS failures worldwide. The aim is to capture functional requirements at the initial stage of the system development process and to integrate systems and people use them in the development process.

Multi-surveys are conducted, capture and highlight the criteria of initial requirements exactness and executability. Knowledge and understanding gaps, which occur in the development process, are described. These gaps constitute the problem at the invisible architecture in the initial requirements stage, as they expose mismatch of both knowledge and understanding problems (Requirements≠Specifications). A notation to describe this framework is elaborated, novel techniques and tools for the construction and application of customer requirements in systems development are developed and used in KRF to facilitate bridging these gaps. The resulting prototype KRF is developed and used against some example problems in retail organisations, and so shown to be sufficient in principle of handling all the negotiation problems at the initial requirements stage, singly and in combination. Also, it is shown how KRF sub-process can be combined and used to elicit information and knowledge mining between both the customer and the system developer using human communication and interaction capture as an example. Systems these days are living systems, changeable, in business and the human factor in developing them cannot be excluded. It is further shown how these techniques and tools can be augmented with established methodologies rather than inventing new ones and to enable management to react as quickly as possible to global changing market conditions.

This proposed framework is also evaluated and tested against the original criteria of initial requirements, exactness and executability.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Chapter 1 – Introduction: What is it About?

Summary

This chapter provides a roadmap to this thesis and reflects on the PhD process in addressing the problem of large information technology system (ITS) development and many of e-government initiative fail due to poor requirements, implementation and project mismanagement. For example, these include the Passport Office and the Inland Tax systems which have overrun on both cost and time. Our research examines how to improve our understanding in stating and managing successfully requirements for such systems as a way to reduce the rate of failures. We argue that the current concept of an information technology system requirement is ill suited to develop true requirements for large systems. The received concept follows a technical rationality, which regards requirements as a goal to be discovered and a possible solution to ITS developments. In contrast, we advocate a view where a requirement specifies a set of mappings between problem and solution spaces (see Chapter 6 on Venn diagrams and KRF) which both are socially constructed and negotiated.

To summarise, the aims of this research study will be achieved through the following objectives:

• To critically investigate the IS failure process.

• To identify the drivers for the use of quality IS in the UK retail sector in making business requirements functional.

• To study application examples of IS failures in order to determine the possibilities of using approaches, methods and tools in the establishment of feasible framework, i.e. Knowledge Requirements Framework (KRF).

• To investigate the implementation of successful IS in the UK retail sector, especially on the sociotechnical issues in system developments.

1.1 Scene Setting

The aim of this chapter is to introduce the reader to the research study of this thesis, and then goes on to provide a brief overview of the major issues that will be covered in more detail in the coming chapters. This research study aims to critically investigate the high rate of IS failures especially in the UK retail sector (Rigby, 2004a). The research will mainly focus on two areas: IS failures and requirements to bridging the gaps between the customers and the IS developers. The research addresses a pressing real-world ITS problems (IS failures) that require further research. Our modest attempt is to establish and discuss a strategy of recommended system development framework taking into consideration other factors such as project size, budget and time constraints.

The research begins with nature and scope of the study. This involves research literature background, objectives, and data collection process. This includes a review of the historical and contemporary background of the retailing sector, their use of information technology systems (ITS) and the problem of ITS failures. Also explain why it was chosen as the subject of this research study. These issues are expanded upon further in Chapter 3. An outline of the theoretical framework from which the thesis was derived is then described. A number of possible explanations of the IT failures have been put forward by earlier authors, and these theories are detailed in Chapter 2. Finally, the reasons why the particular research method pursued was chosen as the most appropriate for this study are explained. Full details of the methodological discussions and arguments are described in Chapter 4. The following section is involves with identifying the needs for better understanding of IS development process, which will cover three main areas: advantage of quality IT/IS, competition and retail organisations, and current problems in developing IT/IS. A set of techniques have been used such as Venn diagrams, set diagrams, brainstorming, fishbone, and "rich picture" (SSM).

1.2 Motivation of the Research Study

This study seek to establish the reasons for what can best be described as a disappointing track record with the development of new ITS projects in the public and the retail sectors and assessing the field research; and identifying the problem domain. Therefore, from published literature and observing the system failure situation (see appendices A and B), a hypothesis put forward to establish the existing of (gaps of knowledge and understanding during the crucial requirements stage of the system development lifecycle), an idea developed to research deeper this topic, and the causes behind it, see Figure 1.1. The topics (system failures and requirements, Gubbins, 2001) are of interest to the researcher for many years. These topics were observed and are part of my teaching areas. In addition to the above, my interest shared by other academics and practitioners within the BCS-Requirements Engineering Specialist Group (RESG).

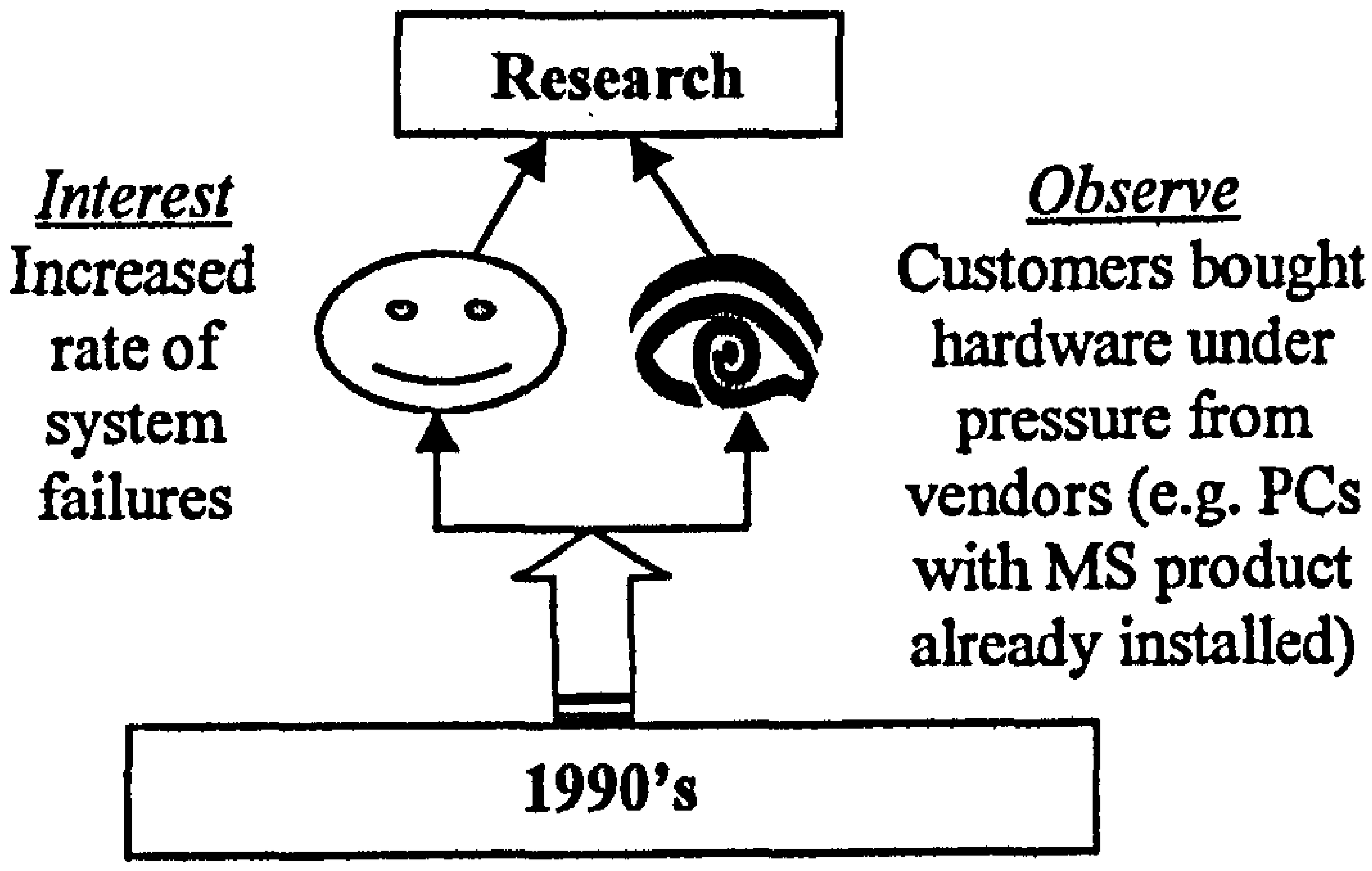


Figure 1.1: Motivation of the Research

To understand the contribution of system failures, requirements and diversity of knowledge to the efficiency of future ITS, efforts were made to establish primary sources and find secondary sources that would help. Contacts were made via e-mail with appropriate well known authors and 'gurus' in these areas, and questionnaires followed up by phone calls were used to fill gaps in some of these. Secondary sources such as textbooks, journals and articles of professional publications such as Computing, Computer Weekly, IT Week, press releases and the Financial Times-IT surveys have also been searched and consulted.

Based on the researcher observation a hypothesis has been established in the view that the problem of system failures might be caused by defect or non-functional requirements. The system features could be improved by the capture of functional requirements (smart requirements) is valid area of research. The basic hypothesis that Requirements are different from Specifications (Kelly, 1999), i.e. they are not the same, is true. This relationship is shown in chapter 4. It will be shown in this thesis that the technology by itself is not the answer. The human-machine relation is still the answer especially when it comes to establishing the smart requirements of the proposed future system to a retail organisation. It is the sociotechnical approach that counts and not the technical approach by itself!

To summarise the arguments made so far, historical evidence shows that exaggerated claims of the impact of technology including e-technologies have been made in the past fifteen years, and the recent events of glitches and failures of many ITS projects have revealed different outcome (Arnott, 2003d; Gonsalves, 2004; Samuels, 2004b; Watson, 2004b). This is despite the dominant market position enjoyed by the retail organisations and the vast investment they devoted to technological advancement over a long period of time (Foremski, 2004a & 2004b). Such reticence also offers significant opportunity for new market entrants to challenge the traditional retail structure in the UK.

1.3 Background

Traditionally retailers have focused upon their internal ITS in order to improve performance and gain competitive advantage. Accordingly they have failed to respond to global changes and customer (internal and external) requirements. This is because that there is little chance of the lessons learned from successful ITS projects being adopted in other parts of the retail organisation. According to Watson (2005), the Banking and the Financial services worldwide are expected to spend \$362bn (£187bn) on ITS in 2006.

The retail sector is an important area for study as it plays a major role in the changing UK economy. It is the largest investor in new technology in the service sector that is rapidly becoming dominant. The retail and the banking regard ITS investment as the key to generating competitive advantage and maintaining their domination of the market sectors (we will refer to the retail and the banks as the retail sector from now on). According to OASIG (1996) survey on the eventual outcomes from projects involving investment in IT 80 to 90% do not meet their goals, 80% are delivered late and over budget, 40% fail or are abandoned, more than 75% do not integrate business and technological objectives properly and only 10 to 20% meet all success criteria. The UK retail as a whole was expected to spend £5.28 billion on ITS in that year alone. The figure represents an increase of 12% over total spending in 1995. More recently, an information technology survey by the Financial Times (1998) estimated that total expenditure on information technology systems by European banks was likely to exceed \$21 Billion (£14bn) in 1997 alone. Billions of pounds have been invested in ITS in many government, private, military, universities, hospitals, and police departments (see Willcocks et al., 1997; Martinez, 1995; Orlikowski and Broudi, 1991; Venkatraman, 1994). About 28% of ITS projects are cancelled before they are delivered (Smith et al., 2001). Another study by Levinson (2001) claims that faulty software costs business $78 billion (£52bn) per year. Information technology developers (hardware and software) have made handsome profits by encouraging the service sectors and especially retail organisations to invest more money on the ever-changeable technological innovation, but the benefits are often elusive due to the extravagant predictions the retailers have been promised by (Rahman, 2004). Morgan (2003) inducts that according to the Office of National Statistics (ONS) £4.2bn has been invested on software alone in 2002, compared with £4.7 spent in 2001. £6bn was spent on IT equipment last year (2002), compared with £7.8bn in 2001. The figures above show a 10% fall on software investment on last year. Spending on hardware also fell. But lately, Computing Staff (2005) and Samuels (2005) reported that companies across Western Europe rose their spending on IT by 3.4 per cent in 2004.

Aggressive and progressive approaches in the retailing sector, and the availability of new technological tools/devices, has meant that many traditional barriers to market entry have now been removed and borders become blurred. It has also resulted in greatly increased levels of competition in the global market. For example, Marks & Spencer, Tesco, Sainsbury and others are among the major retailers now offering home-shopping and banking services. They also offer their customers higher rates of interest than any other traditional bank or building society. The Internet and the Intranet networks are used extensively to introduce new forms of financial transmission, unlike the major market players. But these aggressive policies did not help some of the dotcom to escape the failures era (Glass, 2001).

1.4 Justifications of The Research Study of Requirements

Our thesis presents and discusses up-to-date business based results for improvement of ITS projects in retail, focussing on the benefits gained and the criteria for success. Leading UK retailers participated and contributed to this study. The participants in our study ranged from different areas such as, systems engineers, business analysts, management consultants, IT managers/strategists, project managers, and business/operations managers. The information and computing technology revolution continues to accelerate. Indeed the convergence of computing, media and communication technologies (Nuttall and Pesola, 2004) has meant that each day we become more and more dependant on technology at work, at home, in travel, in learning and in communicating. Information systems based on computing technology are powerful change agents.

To improve our understanding in stating and managing successfully functional (smart) requirements for such systems, we argue that the current concept of a system requirement is ill suited to develop true requirements for large systems. The received concept follows a technical rationality, which regards requirements as goals to be discovered and solutions as separate technical elements. In contrast, we advocate a view where a requirement specifies a set of mappings between problem and solution spaces, which both are socially constructed and negotiated (Figure 1.2).

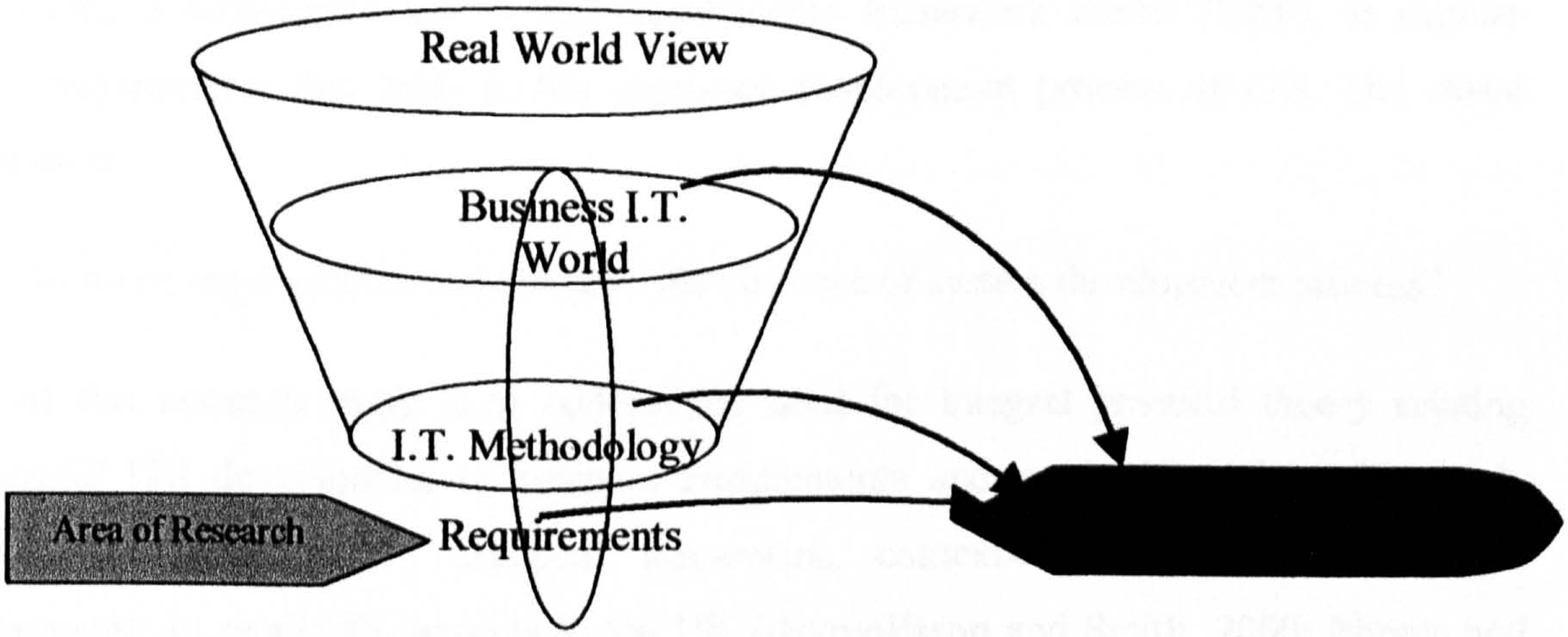


Figure 1.2: Area of Research

The process of identifying requirements is not a technical process. Requirement is a sociotechnical process (see chapter 14 in Al-Karaghouli et al., 2002). Therefore, our view of requirements is a journey towards becoming a knowledge-driven process to establish agreed requirements (Wood-Harper et al., 1985). The requirements has been recognised as an important area in the ITS development process as a change approach in managing ITS. Smart business requirements, is a critical first step in the system information technology development process, involves the generation of a description of the goals of the envisioned system, leading to a description of the artefacts that must be built to achieve such goals. Given that engineering requirements (ER) is a critical determinant of the quality of the final system, and given the size and complexity of the current generation of computer system development projects, the area has attracted increasing research attention from both academics and practitioners. Smart business requirements, by nature are, emergent and need to be discovered and made it functional through a complicated and contracted process, which likens a garbage-can decision-making process. Large scale system requirements thereby embrace an emergent functional ecology of requirements. In addition, we see all requirements specifications to be inherently political due to the need to establish stable networks involving both social and technical elements through successful engineering (if the network is not stable the system fails!). This research work based on a practical experience and makes an original contribution to understanding how information technologies support large retail strategic systems.

1.5 Research Study Aims and Objectives

The thesis focuses on investigating inhibitors of improvement in RE process towards developing a business/IT knowledge requirements framework model (KRF), to capture smart requirements that leads to the improved development process of ITS. The stated question is:

How do smart requirements contribute to the outcome of system development process?

Part of this research study is to address the need for integral practical theory relating successful ITS development to business requirements and needs. Therefore, this study focuses on developing a practical framework, context-based and explanation of requirements in retail ITS projects in the UK (Brynjolfsson and Smith, 2000; Ehrens and Markus, 2000). In doing so, the research study strive to develop an integrated framework. To describe and explain the process of adopting and achieving smart requirements. We foresee that the availability of such framework (approach) is a modest contribution in improving the success rate of ITS projects and presents available contribution to knowledge that provides principles for retail organisations and others to undertake such initiatives. This research study is to develop an approach to enhance other system methodologies in developing ITS projects, which consists of business and system developer cultures; and the outcome of smart requirement initiatives. The study is based on describing and explaining the process of adopting and implementing KRF initiatives in two retail organisations in the UK in terms of interaction conditions, actions and consequences. The structure of KRF approach derived from existing theories in the areas of IT and management science, and empirically tested in a new context. Also, to further understanding business and technology cultures that need to be taken into consideration when developing new ITS and understand what causes the success or failure of ITS projects in terms of business and technology cultures (intellectual and professional culture clash). The theoretical background that forms the construction and the development of this framework is extracted from previous research which validates those constructs in an easy and practical context. The research study reports intermediate results as an important contribution to the UK's ITS area in systems engineering methodologies.

1.6 The Research Methodology

The apparent problem of system glitches and failures in the UK retail sector, warrants further investigation and analysis which will be undertaken in the study of 119 retail organisations (see Appendix E), in particularly one retail organisation (a large departmental store) and one major bank both, based in London. The research methodology focuses on the conducting case studies as a rigorous and effective method of research. The aim of the empirical research is thus to establish the need to claim that improvement of the current system development process in general and in the retail sector in particular is actually borne out in practice.

The research methodology of this study is based mainly on two steps. First the researcher analyses and reviews the existing literature of system failures, requirements, total quality management and system developments, focusing particularly on the requirements and identified dimensions of its components. To develop a number related propositions which constitute the necessary conditions to ensure successful implementation of future ITS projects. These propositions, which are based on the researcher's mutual understanding, are derived from existing theories, are tested by conducting empirical case studies testing. In addition, the researcher's interpretation from the case subject's view is taken into account to validate this level of understanding. The case study research within this perspective is designed and evaluated according to the criteria of the practical science research which involves controlled observation, controlled deduction. Second, propositions that are deductively invalidated using empirical data from the subject case studies are formulated using interpretative analysis of data from the same case studies, and a fresh interpretation of the cases' data is conducted. This involves revisiting some of the results from the questionnaires/interviews and followed up by telephone calls, meetings and audio recording the specified cases that caused the rejection of the propositions and seek to understand the disparity in the researcher's positiveness understanding of ITS development process and the researcher's interpretation of the case subjects' understanding.

Through the use of primary sources, two types of questionnaires have been designed and sent to which includes customers and system developers (builders) -see Appendix D; D1-

D2. These questionnaires were followed up by telephone calls to the relevant parties and through contact via e-mails and during the participation in workshops. The research strategy is to conduct quantitative and qualitative investigation and obtain required information from the two main case studies on retail organisations in the UK that have implemented ITS projects. Quantitative research is chosen because it is suitable for studying individuals, groups and organisational behaviour (Anderson et al., 1995; Wisniewski, 2002). The quantitative methods of collecting data used in this research are associated with observations, telephone calls and face-to-face interviews techniques (Cavaye, 1996). The empirical result of the questionnaires will be analysed using the "Sphinx" software in conjunction with the findings of earlier researchers in the areas of system developments, system failures, and requirement engineering in retail. Particular attention will be paid to the relationship between the customer and the system developer in the early stage of the system life cycle development process, i.e. initial requirements.

A case research approach is chosen, which has its roots in business studies, because it provides a practical and real feeling that can be measured and analysed to construct upon a validate models through collection of data. On-site meeting have been held, typical instance of such events was performed in a large organisation by Alavi (1993). Trauth and O'Conner (1991) applied the interview-based research study to analyse the effects of culture, economic and political factors on the establishment and evolution of information technology firms. The case research approach is well established in the information technology and information systems areas. There are some case studies in requirements but very few researchers critically analyse and point-out in details the problems behind ITS failures. Most of the problems discussed are from a theoretical perspective with very few applications. Previous work in retail, for example, Datamonitor, 1996; Morris and Westbrook, 1996; Pennings and Harianto, 1992, has concentrated upon individual cases and specific results obtained, e.g. why in some ITS projects one certain approach was favoured over others, which is the approach taken in this thesis.

1.7 Our Contributions

Our study aims to raise the profile the professional development of people who can understand and translate the needs of both sides business and IT. In short there is a gap or gaps of knowledge, understanding and culture between "Customer's Requirement" and "system developer's specification". As a result, specific framework solution (KRF) is developed to bridge this gap and to eliminate the mismatch of knowledge and understanding problems. The primary objectives of KRF approach are for the business and IT people to collaborate, to be partners, to fulfil both the organisation's business and ITS strategies, to improve productivity, efficiency, competitiveness and to deliver quality service through their trouble-free ITS. The reasons put forward by earlier authors for the disappointing findings outlined above are expanded upon in Chapter 3, but can be summarised here as follows:

• The focus of the thesis is that a gap exists between the customer requirements and the system developer specifications. Our objective is to bridge or reduce the existing gap. We believe that this gap plays an important role in getting the right systems. In order to match the business requirements (customer requirements) with the technology specifications (systems developer specifications) to achieve common knowledge (CK) and common understanding, this gap needs to be reduced or even better closed to match requirements and specifications. This has been achieved using the Knowledge Requirements Framework (KRF) model and other techniques and tools within KRF which will be discussed in later chapters.

• The requirements process is a human issue rather than technology issue (Andreou, 2003). Initial requirements conducted in the first place by two humans, that is the customer and the system developer. In brief, aligning and amalgamating technology with business issues through the sociotechnical approach. The technology issues should not take precedence over business issues. We firmly believe that the filtering process of defect requirements (non-functional) in the initial (requirements) stage of the system development lifecycle is a major factor to reduce glitches and improve the success factor of the development of ITS projects.

Eliminating the defects in requirement will lead to quality requirements (which in later chapters will be addressed as "smart requirements"). Those smart requirements is the result of agreed requirements between the customer and the system developer as the gap between the two getting smaller and the overlapping between the customer requirements and the system developer specification getting larger due to the agreed requirements/specifications as it will be shown in a later chapter. Incomplete and inadequate requirements cause many problems in information technology systems and in software products in particular.

1.8 The Thesis Focus and Research Areas

The importance of the retail in the UK as a whole (Etheridge, 2001); and the system development industries in the UK as a leading investor in the new technologies, make it particularly important area in which to study this phenomenon.

The thesis loosely covers the following three related areas of research:

• ITS project failures.

• The role of initial requirements in ITS successes and failures.

• Bridging the gap: Knowledge diversity, understanding, and professional culture gaps in the requirements stage.

This research study starts by investigating why the large investment by the public and the private sectors (in particular the retail and the banking sector) in information technology systems (ITS) did not deliver business objectives (Computing, 2002b, Rigby, 2004b), given that the successful implementation of new technologies is necessary for survival in the ever-increasingly competitive "national-UK-market" and the global "e-market". It will be argued that the high rate of troubled systems (systems suffer from glitches, delay or failed systems), overrun budgets are areas worth further investigation. The following hypotheses have been tested throughout this research study and will be addressed in later chapters:

H1: Requirement plays a core role in the success or the failure of an ITS.

H2: Customer's (business) requirement is different from system developer's specification.

H3: Tacit business knowledge (TBK) and tacit technical knowledge (TTK) are different and need to evolve to 'explicit requirement knowledge'. Hence the development of knowledge requirements framework (KRF) model.

By developing the KRF, we believe that KRF is an adequate to provide insight into the problem of system failure. Hence convergence rather than diverse of communications between the two parties is a critical issue. For the purpose of this thesis the pragmatic assumption will be made that the design, building and implementation of ITS is influenced by both business requirements (customer) and technology specifications (system developer). Therefore the idea of Clark et al mentioned above that technology could be regarded as a combination of technical and social influences will be used and developed throughout.

1.9 Thesis Outline and Structure

This PhD thesis is composed of seven chapters with each of the chapters providing an understanding to different issues viewed to be of critical importance for this study research. The structure of this thesis aligns with the methodology described by Phillips and Pugh (2001) and consists of four navigation elements namely; (1) background theory (Chapter 2- system failures and requirements); (2) focal theory; (3) data theory and (4) novel contribution. Background theory focuses on the field of research and identifying the problem domain (see Chapter 2). The second element of the thesis deals with generating conceptual models. This is explained and discussed in Chapter 3. Data theory addresses topics such as: (i) the most appropriate epistemological way to adopt; (ii) the development of a suitable research methodology and; (iii) the conditions affecting the choice of research strategy. These issues are discussed in Chapter 4 of this thesis. In addition data theory deals with data collection process and analysis is reported in Chapter 5. The fourth element - novel contribution is concerned with aligning the importance of the thesis, to the development of the discipline being research, in Chapter 6.

Chapter 1: Introduction: What is it about?

Chapter 1 introduces the reader to the thesis and discusses the three main sections research study objective, the research methodology, finally the outline and structure of the thesis.

Chapter 2 – Looking Out: The Relevance of System Failures, Requirements, Knowledge and the UK Retail Sector

Chapter 2 provides reviews and understanding of the existing literature on the broad issue of the information technology system failure projects, the requirements that contributes to the success or the failure on an ITS, focusing on the retail sector in the UK. The aim is to provide a practical framework of requirements within the empirical study of the development of new ITS project in the retail sector. Because of the nature of the study and the time scale involves. For example, the issues of Y2K which the Cabinet Office claims was “a huge success” cost £380 millions (Computing, 2003a; August, 2000; Computing, 1999a; Computing, 1999b; Pettitt, 1997), Euro, ‘retail loyalty card’ schemes and the different ISs used in retail are frequently raised in the case research study. It is not possible to review in full previous work in all of the related areas, and indication is given in the text where brief summaries of existing literature only provided for the sake of clarity, but it is beyond the scope of this thesis to explore in detail the many factors of this corporate structure.

Chapter 3 - Setting Out: Conceptualising ITS Models Using the UK Retail Sector as an Example

Chapter 3 reviews the history of the retail sector in the UK, and describe how ITS has evolved into an integral part of the current and future retailers activities. It then compares innovative developments by established retail organisations with the activities of newcomers, and speculates upon the potential impact that successful relationship between the customer and the system developer of new ITS innovations may have on the success of a future system. Also, this chapter introduces and describes the conceptual model.

Chapter 4 – Research Methodology: Finding Out

Chapter 4 describes the research methodology and the research methods used in conducting this work, the reasoning behind the research methods (questionnaires, interviews and workshops) and the principles of theoretical and practical analysis that were applied to the data collected from the case study of retails. Also, this involves discussions of the types of theories and different approaches in requirements engineering (Jackson, 1995; Hooper and Hsia, 1982), knowledge management (Epple et al., 1991; Hall, 2001; Hansen, 1999), and quantitative methods (Anderson, et al., 1995; Wisniewski, 2002), wherein the rationale behind choosing to express results of this research study as a process framework and the adoption of emergent perspective are detailed. Then, the research methodology of this research study is presented. The chapter proceeds by presenting the research framework followed by the research strategy. A number of theoretical proposition studies related to the research framework are postulated based on the commonly principles of system development. The chapter concludes by detailing this research study approach to test those proposition studies and addressing the needed requirements for methodological approach of this research study. Also, describes the methods which were followed in conducting the research, and also the principles of ground theoretical analysis that were applied to the primary data collected from the case study retail organisations and banks.

Chapter 5 – Data Analysis: Making Out

Chapter 5 provides analysis of 119 retail organisations. A detailed analysis of the two case studies (retail and financial organisations) has helped the author to understand and identify research issues of this thesis and tests the proposed framework derived in chapter 3. The chapter starts by conducting an evaluation of the outcome of system development's (especially the requirements stage) implementation of the two case studies. The chapter introduces knowledge, tacit business knowledge (TBK), tacit technical knowledge (TTK), tacit knowledge, and tacit requirements. Also, the diversity of knowledge and understanding of requirements will be explored leading to the construction of KRF model. The use of Venn diagrams (Cameron, 1983; Young, 1964) implemented in bridging the gap between the customer requirements and the system developer specifications. The different approach of our model in solving the high rate of failure of software projects is described. Then, the derived proposed approaches and techniques are deductively tested in the context of those case studies. We have tried to describe the techniques used and the difficulties encountered in these studies for different approaches of software engineering. The chapter introduces the reader to the framework of knowledge requirements framework (KRF), this involves the usage of different tools and techniques such as Brainstorming, fishbone, and Soft System methodology-"Rich Pictures". To facilitate and share knowledge and understanding. The aim of KRF is to establish collaboration (Glick, 2002; Fielding, 2002c) and partnership in developing ITS at the early stage of the system development lifecycle (requirements). Also, this chapter takes a realistic, real-world, and look at the business requirements needed in developing future ITS. The chapter also discusses and evaluates the quality of this study and implications of findings for practice. The chapter presents the validity, reliability and the implications of the findings of this research case study by presenting a practical, user-friendly and operational framework that serves for achieving rigour and smart requirements.

Chapter 6 - Out Comes: KRF Adoption

Chapter 6 provides detailed in-depth narratives of the requirements stage of two cases in two retail organisations. The chapter starts by detailing the approach followed in the presentation of the cases. Then, detailed description of the requirements propositions in each of the two cases is presented. The chapter also contains a discussion of the results obtained from our survey to major U.K. retail and software organisations. The model is tested, showing how important the role of such analysis is in modern software houses. The chapter concludes by attempt to formulate proposed approaches and techniques that are deductively invalidated using interpretive and scenario analysis of data from the same case studies. The model identification and definition are developed. The chapter is investigating whether recent research developments in sociotechnical systems and scenario analysis can help major retail ITS uncertainty, requirements identification and conformance. One of the main objectives is to provide a framework that integrates the above approaches and complements the satisfaction of both business requirements and system specifications.

Chapter 7 – Conclusion: Way Out and Thinking About

Chapter 7 discusses potential areas for further research. The chapter starts by providing the findings and a statement of contributions made during this research study. Limitations and implications of this research study are presented. The chapter concludes by outlining potential directions for future research work on the importance of the development of modern business software engineering and its use in the business as a tool to support business goals. The main conclusion of our work and suggestion for future studies are summarised in the final part of this chapter. The results of a further analysis of these chapters which highlights a lack of organisational learning and understanding of both parties (the customers and the system developer) from each other. This finding was common theme to emerge from the analysis process. The concluding chapter considers whether the specific research questions detailed at the end of chapter 3 have been fully addressed, and identifies areas where further research is necessary. The implications of the findings are considered in the context of future success prospects for both the retail organisations and system developer industries. Finally, we take a critical look and suggest how the model might be extended.

1.10 Conclusions

Experience in developing systems has shown that an inadequate understanding of system requirements is the single most crucial and important cause of user dissatisfaction and system failure. This has led to our research in the area of engineering and managing requirements to make the non-functional requirements functional. The following chapters present and discuss practical results from improvement projects in industry, focussing on the benefits gained and the criteria for success. It will be argued in this thesis that despite massive investment, many cases of recent system glitches and failures occurred, there is a lack of lessons learnt from past mistakes. ITS should to be more flexible and more maintainable in order to meet the business needs of emergent, and rapidly changing in the retail organisations. The current ITS industry is much too focused on the needs of the ITS supply industry instead of being customer focused. The new scenario raises a number of issues, such as: many of the problems are not technical, but lie at the boundary of technical, business and social issues (like trust between customers and system developers in the requirements stage). In addition to the pessimistic view of the problem of system failures painted in section 1.3, examples can also be found of research that is more optimistic about the contribution offered by ITS to different parts of the UK economy. Flexibility and adaptability are seen as key properties of ITS which cannot yet be achieved. On more positive view, the KRF approach could be also be explained as follows:

• The developed IT/IS will align to business strategy and fit business needs through the contribution of all parties involved as mentioned above.

• The quality of the system will improve using the KRF approach, cost and time of an ITS project will be cut by getting smart requirements right first time.

• Retail organisations are using ITS to facilitate their business with new marketing opportunities and to focus upon improving their quality of service (which is difficult to quantify in terms of measurement). KRF will help speeding the process of ITS developments by getting the smart requirements right first time and through the implementation of such functional requirements.

Some of these problems are not unique to ITS and in particular to software engineering, and it would be appropriate to study other engineering disciplines. The recommendations in this research study will enable us to put our modernising vision into practice. They are a vital part of turning strategy into real improvements in retail and public services.

Chapter 2 – Looking Out: The Relevance of System Failures, Requirements, Knowledge and the UK Retail Sector

Summary

The aim of this chapter is to present a critical review of the literature of system failures, business requirements, knowledge, and the retail sector in the UK. The chapter begins by explaining cases of big ITS failures, the contribution of misunderstanding requirements as a main factor in the initial stage of the development of an ITS. We view the requirements as a functional architecture or structure that plays an important role in any system methodology, due to its involvement at the initial stage of any system development methodologies. Requirements considered non-functional because a few people pay close attention to real requirements. Our aim is to make it functional.

The study is organised with the aim to bring together researchers and practitioners from various disciplines such as Information Systems (IS), Software Engineering (SE), Business Process Reengineering (BPR), Total Quality Management (TQM) and Human Computer Interfaces (HCI). To advance understanding of how techniques from various disciplines can empower the engineering requirements process in organisations. It also aims at discussing the lessons learned from large scale RE projects and investigate approaches to keep track of good and bad experiences of project failures.

2.1 Introduction

Before we investigate into other aspects and issues of IS failures, the author perceive that it is necessary to identify the needs and driver for the UK retailers to adopt IS. Changes in technology, performance and capacity have changed drastically over the last five to ten years. These changes have introduced new challenges in retail organisations throughout the world. Computer systems are becoming more accessible with the popularity of access through telecommunications using high speed bandwidth and the internet.

The roadmap of this chapter will include review relevant literature in the important areas of the following:

- Information technology system (ITS) failures, why do they fail?
- Position of requirements, the requirements that initiate the building of a successful system development process.
- The knowledge which contributes to the establishing of clear functional requirements.
- The UK retail sector.

The above issues present motivation to clarify the important role in determining the right requirements and the relevant business and technical knowledge in building an ITS that satisfy business needs (Irani, 1998, Divanna, 2002; Habbel, 2002; Ody, 2003). To better understanding the reasons that leads to the failure of an ITS. As mentioned in Chapter 1, the aim of this research study is to provide a practical and user-friendly framework that will inform subsequent analysis of the actual influence of requirement in ITS developments in specific organisations within the retail sector. The chapter begins by considering the importance of requirements, knowledge, and their effect to system failures (Nairn, 2003) and technological change throughout the retail sector in the context of continued competitive advantage, economic growth in the UK and prosperity (Ranger, 2002c; London, 2003; Ody, 2003; Voyle, 2003b). This somewhat utopian scenario is then compared with the reality of technological change in practice. The research study concerns only with the initial requirements stage. It is contended here (and developed further in chapter 5) that detailed examination of individual ITS projects can provide valuable insight into a problem which appears to be endemic. In recent years there has been a movement in system development, and requirements engineering (Kotonya and Sommerville, 1998; Sommerville and Sawyer, 1999; Robertson and Robertson, 1999; Macaulay, 1996) that recognises the need for methods and models for studying work practice in order to inform the process of requirements gathering and the design of workplace technology. This move has been reflected in the development and application of a number of theories such as distributed cognition, activity theory and situated action theory, and also in the development of methodological approaches such as contextual design, scenario-based design and participatory design. This study is concerned with establishing functional (smart) requirements, which is a crucial area of the system development discipline. In the last three years a plethora of literature in the filed of IS failures exists (see Appendices A, B and C), therefore this chapter provides a critical review of available literature on the three mentioned topics. First, a general review of various reasons for success and failures of ITS projects are discussed in section 2.3. Second, an overview of the views of requirements is given in section 2.4. Third, a review of the knowledge in determining smart requirements in section 2.5. Fourth, the chapter provides a snapshot of directions of the current research on requirements at the time of finalising this thesis in section 2.7. Finally, the implementation of ITS, its impact and technology advantage has been addressed in section 2.8.

The *requirements* stage is a *human-human* process, it is by no means a technology process as indicated by Checkland, 1978; Kelly, 1999; Macaulay, 1996; Checkland and Scholes, 1999. Mumford (1995b), Davenport, 1996, and Kelly (1999) recognise that most of the problems in ITS have their roots not just in technical issues but also in managerial, organisation and social issues. Determining requirements involve two experts, namely the customer (the business expert) and the system developer (the technology expert).

2.1.1 Information Technology System (ITS) Failures

There is no single, simple solution to the problems we have seen. Our research is based on evidence from extensive research undertaken in the UK public (Ranger, 2001; Parker, 2000; Thomas, 2004c) and private sectors (Busby, 2002; Computing, 2003; Neal, 2002; Holland, 2001; Waters, 2004b) and abroad, which shows that there are a great many reasons why failures occur. These cannot be addressed by one or two catch-all measures and, accordingly, we have made many recommendations. Many business organisations are failing to put usability first when developing their systems (Arnott, 2003b), too often the content is controlled by rival departments. Internal politics can mean that their interests are represented and not the needs of customers.

To inform the subsequent debate about the nature and the extent of ITS implemented by the retail organisations, the chapter goes on to examine the various definitions of failures and requirements that have been put forward by authors in this field (see sections 2.2 and 2.3, for more details). According to the Concise English Dictionary (1998), failure defined as *"coming short, an omission, non-performance, breaking down, insolvency, unsuccessful person or thing"*. These terminologies (words) occur in many IS and IT literatures. For example ITS failures, Macaulay (1996), referred to Lyytinen and Hirschheim (1987) model on ITS failures of which they *classified failures into, correspondence failures, process failure, interaction failures, and expectation failures.* Saucer (1993) has criticised the model proposed by Lyytinen and Hirschheim for its plurality. Sauer's model posits a more conservative definition of ITS failures. He defines ITS failure as *" an information system should only be deemed a failure when development or operation ceases, leaving supporters dissatisfied with the extent to which the system has served their interest"*. This definition of termination failure is stricter than Lyytinen and Hirschheim's concept of expectation failure. Also, Macaulay (1996) refers to Pohl's definition of requirement engineering (1993) as "the systematic process of developing requirements through an iterative co-operative process of analysing the problem, documenting the resulting observations in a variety of representation formats, and checking the accuracy of the understanding gained". For more rigorous definition, see the RESG's definition in section 2.4.5. Flowers (1996) stated that an ITS can be termed a failure if, *"on implementation, it does not perform as originally intended or if it is so user-hostile that it is rejected by users and is under-utilised"*. Flowers, also regarded an ITS as a failure if technically or the cost of development exceeds the benefit. According to Laudon and Laudon (2000) failure is *"an information system that either does not perform as expected, is not operational at a specific time, or cannot be used in the way it was intended"*. Also Bocij et al (1999 and 2003) referred to a failure of an ITS as *"failure in IS not being adaptable to a changing business environment (often rapid change occurs), or a system not coping with the volume and speed of the underlying business transactions"*.

We can see from above that there is a match of different author's definitions of failure with the definition of the Concise English Dictionary (1998). On the other hand requirements defined in the Concise English Dictionary (1998), as "that which is required, an essential condition, the act of requiring, a requisition". A number of theories are then discussed in relation to the issues of failures and requirements which have been developed from these ideas as to influence of ITS in retail organisations. This chapter includes a review of published literature on ITS failures, requirements, and knowledge, which assigns a positive and prescriptive role to the actual ITS itself in the search for competitive advantage. The merits of alternative viewpoints which claim that the nature of a new ITS is shaped to a varying degree by organisational attitudes and practices are considered. The chapter ends by explaining the position that will be taken in this thesis towards the definition and influence of ITS development and in particular the requirements stage, and why this particular viewpoint and chosen methodology were considered to be the most appropriate in the context of the research study of the ITS failure paradox. Many different approaches of ITS developments exist in the market such as the System Development Life Cycle (SDLC), Rapid Application Protocol (RAD), prototyping, and recently Object-Orientation (OO). Many organisations jumped on the bandwagon and are still experimenting with the later.

2.2 Background and Scope of ITS

There have been many impressive ITS successes (Cash et al., 1992; Earl, 1992; Thomas, 2003). Some retail organisations have flourished because of the competitive advantages derived from the implementation of ITS that they have developed in-house. Others have used ITS to improve the efficiency and the effectiveness of their organisation's operation. But in the same time there has also been a plethora of ITS failures (Rigby, 2004a & 2004b: Knights, 2005e & 2005f). But over the past years governments and business organisations have suffered huge financial losses as a result of inadequate ITS developing strategies. Arnott (2003c) reports on the UK government ITS deals that £1.5bn has been wasted on cancelled and overrun budget projects since 1997. Even with this high figure many researchers believe the figure is greater than reported because of the sensitive nature of the issue results in many public and private organisations not reporting the occurrence of ITS cancellations and failures (Arnott, 2003d).

In 1950, the first ITS (computer) was born (Gubbins, 2001). Many business organisations world-wide including retail organisations have conducted their business with the aid of ITS and IS (Davenport, 1993) to achieve productivity improvements, competitive advantage, cost savings, and to provide better customer focus. This approach has been accepted by many businesses because many global organisations have lost their competitiveness in the market and therefore needed to respond to continuous changes in consumer habits. The dotcoms are good examples of such organisations that were forced to be more externally focused and fit with the environment that is surrounding them. The latter can be achieved by assessing their goals and strategies, reviewing their ITS and their business process; and deploying the latest ITS (Orlikowski and Baroudi, 1991). In many large and complex information technology systems projects (ITS), the need for clear understanding of customer requirements has often been underestimated, and this has led to an undermining of the success of vital and expensive projects. Just considering the UK, we have for example: the London Stock Exchange automated trading system (Taurus) which after great expenditure had to be withdrawn before ever going live (Beynon-Davies, 1996; Flowers, 1996). The London Ambulance Service (LAS) computerised despatch system which failed disastrously forcing the Service to revert to the old system (Page et al., 1993) and more recently the new UK air traffic control centre at Swanwick, which was six years behind schedule- after its planned completion and £180m over budget which is considered very greatly over budget before going into operations in January 2002 (Computing, 1998; Hatton, 1999; Watson, 2003e; Watson, 2005c). According to Jowit (2002), a few months ago public transport was the latest causality of a failed "travel smartcard" project due to incompatibility with 6,000 buses, 255 tube stations and 28 national rail stations used by the tube.

The literature of ITS failures reveals crucial factors (social, political and technical factors) that hinder the success of ITS project initiatives. These include IT and IT infrastructure (Fortune and Peters, 1995; Glass, 1996; Saucer, 1996) mismanagement of human (Remenyi, 1999, Arnott, 2003e), and the limited understanding of the social and political issues of the organisations (Allingham et al., 1992; Brightman and Moran, 2001). In general, ITS failure falls in three major categories which are:

• ***Technology failure,*** this causes by failures of hardware or software or both such as glitches and crashes of an ITS.

• ***Project management failure,*** due to the failure in managing and controlling an ITS project with leads to cost and time overrun.

• ***Business failure***, when an ITS fails to satisfy business needs and unable to deliver benefits such improve efficiency and being effective.

The research study has **identified fourth and fifth** categories of failure which are:

• Intellectual and professional cultural clash failure, due to the different knowledge and understanding between the customer and the system developer.

• Poor communications between business departments and IT department.

2.2.1 Definitions of Information Systems Failure

There is no general agreed definition to what constitute IS failure. Sauer (1993) defined failure as the failure of the information systems process, in that the IS will be deemed a failure when there is no sufficient support from the project organization and the project is terminated as the result. While Lyytinen and Harscheim's (1987) considered failure when the IS perform below expectation or fail to attract more use.

The two concepts takes a similar approach in relating IS failure to social and organisational factors. In an attempted to understand IS failure many authors in the subject developed a number of frameworks. In this research study the emphasis will be on the contribution of the following authors as follows:

1) Triangle of dependency, by Sauer, 1993.

2) Stakeholders frameworks, by P Beynon, 1997.

These frameworks will be discussed in more detail later in the following sections, also we will give definitions to the different count of IS failure.

Lyytinen and Harscheim (1987) in their analysis of the literature on IS failure identified five distinct categories of IS failures which are:

• **Correspondence Failure**

This is the most common form of IS failure, the idea is that detailed specification is set from the beginning with clear objective, and if the project did not correspond with the specification or fail to meet the objective will be consider failure.

• **Process Failure**

This is where the development process results in unsatisfactory system, it is usually occurs in two forms:

i) The development process results in unworkable system.

ii) The development process failed to produce the promised system within the budget or the time scale.

• **Interaction Failure**

This is the situation where the systems fail to attract users; the argument here is that the system did not match the user's requirements (Al-Karaghouli et al., 2002).

• **Expectation Failure**

This encompasses all the other three. They define it as 'the inability of the IS to meet a specific stakeholders group expectations'.

• **Termination Failure**

Sauer (1993) developed a model for IS failure based on the exchange relations between the system, supporters and the project organization, they all depends on the each others, and the survival of the system depend on maintaining these relationship (see Figure 2.1). He views the information system development as an innovation process which is open to flaws. One distinctive feature of the termination failure is the acceptance of the expectation failure as normal part of the information systems development, and that any discrepancies between the desired and the actual outcome are normal because of the uncertainty of the innovation process.

Sauer counts of failure is very strict, in that the project will be deemed as failure when abandoned as the result of the break down in the exchange relationship between the supporters and the project organization. Sauer (1993) view the information system in the light of the relationship between the project organization, supporters and the system, the project organization are responsible for the developing, operating and maintaining the information system.

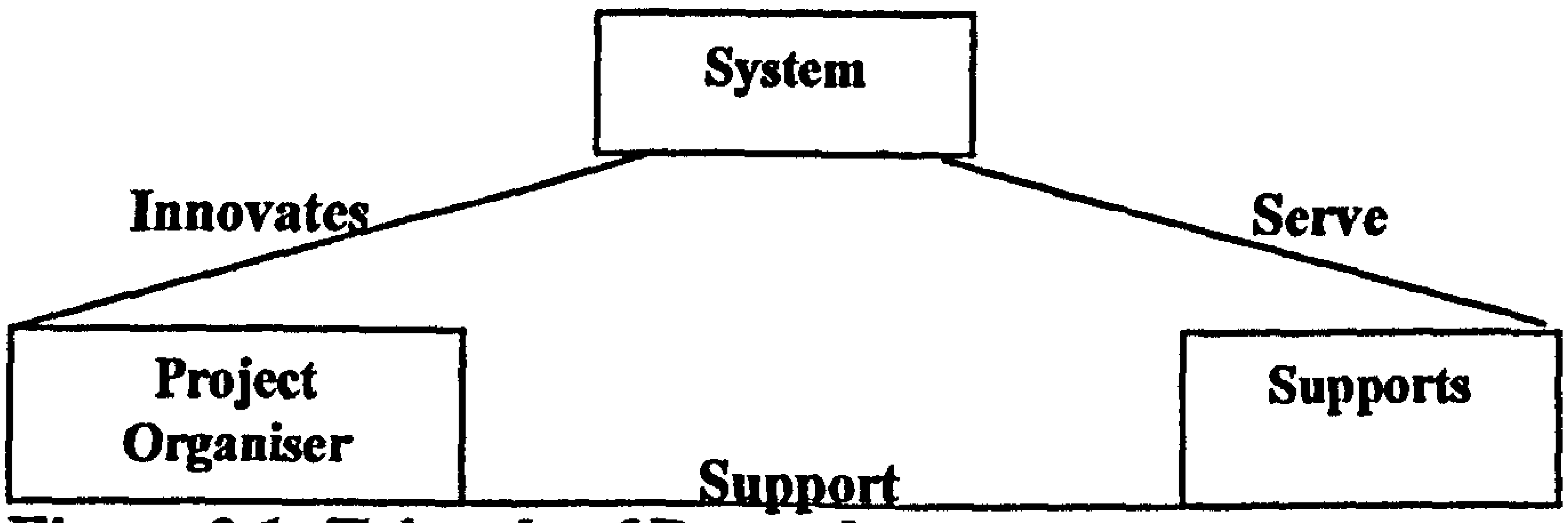


Figure 2.1: Triangle of Dependences

(Source: Sauer, 1993)

The supporters are the stakeholders whom the system serves their interest, and they offer support to the project organization. The exchange between the project organization and the supporter is important because the project organization has the technical ability and the capability to develop the system, the supporters provides the resources that are needed by the project organization to carry out their works (e.g. materials, information, decisions). Termination failure occurs when the relationship between these parties breakdown supporters are dissatisfied with the system and withdrew their supports, making it impossible for the project organization to continue with the development of the system.

2.3 The Failure Paradigm: ITS Large Scale Failures

According to Jovit (2003), the UK has a history of teething problems and failed public ITS projects such as the *Health Service, Inland Revenue, Passport Office, Child Support Agency, Air Traffic Centre at Swanwick, and the MOD* (Arnott, 2003e). Despite these problems, the UK public sector is to spend a large amount of money on technology. According to a special preview in Computing (2003b) the government is banking its own on whole-sale high-tech reform of the NHS and public services to give a big boost to the wider ITS market (Arnott, 2003).

Despite the different methodologies used in designing and acquiring ITS, the rate of ITS failures in the UK for the last five years is staggeringly high (see Appendices A and B; Gubbins, 2002). Some surveys show that nearly 90% of dominant organisations are actively involved in ITS projects (Bashein et al., 1994). However, despite the large number of organisations that are conducting reengineering, the rate of failures in the field is over 50% (Hammer and Champy, 1993; Braganza and Myers, 1997: Nasierowski, 1997). In the 1950s, when the software development process (SDP) was simply "written code and test" (Gubbins, 2001), and information technology system (ITS) projects were characterised by budget overruns, schedule delays, and time overruns, the only defect removal stage was test and debugging which sometimes takes longer than initiation of a project. In his article on design and code inspection, Fagan (1976). Whether in the public or the private sectors, IS/IT is too often the scapegoat for human error, with damaging consequences for public and business organisations confidence. Failures of large IT/IS projects, whether they are being developed for the public or private sectors, are hard for the economy. The ITS industry is not alone in contributing to the failure's arena (Hope, 2004; Spiegel, 2004; Odell and Spiegel, 2004).

In the case of the computer-aided dispatch system for the London Ambulance Service (LAS) developed between 1987 and 1993, the problem was not so much one of excessive budgets or project delays. The issue was rather the usability of the system that leads to its final failure reported as follows: "...at 2AM on Wednesday, Nov 4, 1993, the system slows down considerably and then locks up altogether. Rebooting does not solve the problem. The automatic back-up system also fails to come on-line. A decision is made to revert to purely manual methods". In early 1993, the London Stock Exchange abandoned the development of its Taurus paperless share settlement system after more than 10 years development effort was wasted. The Taurus project manager, Eliott Manley, estimates that, when the project was abandoned, it had cost the City of London over £800 million (although the Financial Time of Nov. 3, 1993 reports losses of "only" £400M - this also points out how hard it is to get accurate financial figures on IT project cost, especially failing IT Projects). Its original budget was slightly above £6 million. Taurus was eleven years late and 13,200 percent (132 times) over budget without viable solution. Prior to Christmas 2003, thousands of cash-strapped families were left out of pocket after another glitch by the IR system. The IR has admitted that some claimants went for nine days at the end of December 2003 without their benefits because of a glitch. This finding emerged recently as the problem was caused by an automated bank transfer that went wrong which resulted in several thousand families did not receive the tax credit as expected on December 29th, 2003. The problem with the bank automated payments to number of recipients was resolved and everyone received their money by January 6th, 2004. The recent IR glitch led to many families racked up by bank charges on overdrafts. December's glitch was just the latest in a long line of problems by the IR in paying the Child Tax Credit since its launch in April 2003. At the beginning of its launch, almost a million families out of 5.75 million eligible did not receive payments in the first month. Two months later, half a million were still waiting. In addition, thousands did not receive the correct amount. Also, the Inland Revenue (IR) was the latest to react to what it says are unwarranted claims of IT glitches (Parliamentary Correspondent, 2005). In the IR case, the media and politicians blamed a software problem for a five-year delay in issuing reminders about topping up National Insurance contributions. But the IR insists that the real cause is a policy decision by the former Benefit Agency. The claims that the backlogged Tax Credits system was having further problems because it was incompatible with core IR systems have been dismissed by both the department and end-users. The IR stories seem to reflect a growing trend. It is too convenient to blame technology. IS (IT) projects are not done in isolation, they are apart of wider business and organisation change projects with political deadlines as well as project deadline to be met. IS in the public sector spell out the danger of loss of public confidence, as public sector IT is not just about technology, but about convincing the people on the ground that it is worth them changing the way they work to fit in with it. In another case, Saran (2004) reported that the termination of £90m of EDS contract to develop a national e-mail system for 1.2million NHS has hit the national and professional newspapers. This coincides with the Home Office -Prison Service system problems resulted in £7m salary error (Arnott, 2004a).

Recently, Glick (2005) looked at some of the event in 2004 including the foolish mistakes of the Child Support Agency (CSA) system and the department for Work and Pension PC network crash. The e-University system is another spectacular example of system failure in the public sector (Green, 2005), most of the failures in the public ITS projects can be avoided if more thinking and planning put in it (Oates, 2005; Spiegel, 2005). Those public failures coincided with well publicised private glitch at the HSBC bank that for several hours effected its Switch and Maestro debit cards and online banking (Computing, 2005).

The same is true in the private sector, for example, the Channel tunnel was budget at $7 billion (£4.6 billion), but it entered service in the second half of 1994 with nearly double the above figure ($13 billion-£6.7 billion). In 2003 it was still heavily burdened by $9.3 billion (£6.2 billion) on debt, supported by a mere $3.7 billion (£2.5 billion) equity. Prudential Europe has terminated a $50 million (£33.3 million) contract with Unisys following the collapse of its Unite project, which aimed to deliver real-time processing of policies and pensions over the Internet. The Prudential has referred to serious concerns about Unisys' ability to deliver on its obligations. The "go live" date had been delayed to the next calendar year without commitment on a firm date. Prudential stated that this delay did not fit with its business plans and sales targets. Unisys argued that some specifications and requirements were not signed off or fully defined by Prudential (Sabbagh, 1999b; Cummings, 2002; Fielding, 2003; Jaques, 2003; John, 2003a & b; Nash, 2003c). Some cases of IS failures unheard off in the private sector due to many reasons including lose of face (Fielding, 2003), the private sector including the retail industry can learn so much from the ITS projects of the public sector (Sabbagh, 1999a: Timmins, 2004). In another case, Rigby (2004a) reported that Sainsbury has to write-off £140m against unsuccessful IT system and £120m with regard to ineffective supply chain equipment. The main reason given to the £140 write-off supply chain system was "purely a financial matter" according to Sainsbury's IT director Maggie Miller (Knights, 2005). Other factors, according to Glick (2004a) the European business organisations alone wasted £4.05bn (€6bn) on poorly outsourcing contracts in 2003. The research study carried out by Gartner of which 80 per cent of the outsourcing deals are unsuccessful including in some cases catastrophic failures due to the cancellation of the service. Customer satisfaction with outsourcing fell from 81 per cent in 2001 to 50 per cent in 2003.

2.3.1 The Sociotechnical Factor

Other researchers believe that culture issues (social and human factors) contribute majorly in the big proportion of failures. Walsham (1992) argues that the high degree of failures in organisations is due to an over-reliance on management science techniques, which are inadequate on their own. This lead to the mix techniques used in this research study. Walsham also asserts that these techniques emphasise content at the expense of culture and politics. His opinion has been seconded by Lorsch (1986) who suggested that culture affects many aspects of the organisation. It influences the decision to be made regarding the organisation's relationship with its environment and its strategy and the way mangers believe within the organisation. Likewise, organisational culture dictates the formal and informal channels of communication (Marchand and Stanford, 1995).

We argue that a sociotechnical approach, wherein a match between human (social) and technical factors is sought, is fundamental to the design and implementation of organisational change. This research study agrees with Mackenzie and Wajcman's (1985) study of the social influences upon ITS, the authors claimed that a new technology is created in the context of existing systems, and only appears radical with benefit of a historical perspective which filters out less successful alternatives. They criticised the idea that an ITS can be "invented" as a single inspiration in isolation of the influence of existing practices by noting that historical analysis allows the benefit of hindsight to trace a particular invention back to a single inspirational source. In reality, competing projects may have overlapped and been developed concurrently, but only the story of the "winner" survived the passage of time. In support of this claim, the authors cited Ogburn and Thomas (1922), who argued that technological developments were an inevitable result of the synergy created as innovators merged technological capability and contemporary artefacts within new context. They concluded that the major constituent of new ITS was the existing process, often applied in new situations and modified in an incremental fashion over time by many ITS developers working independently. A number of authors have supported this theory, notably Hughes' (1979) analysis of the development of electricity. By regarding both technological capability and human influence as central to innovation process, this viewpoint discredits more deterministic account of the impact of technology which were reviewed above. Recent examples are the growth of "e-retailing and e-banking" markets led by Tesco and Prudential (Egg). The basic retailing and banking products that are offered remain the same, but the delivery mechanism still appears radical to some business organisations.

Some practitioners consider the main reason of business failure is the misuse of ITS and others argue that the failure is because of the deficient consideration to the culture and social issues (Buday, 1992; Brightman and Moran, 2001). Some organisations view ITS as an obstacle to the success of their business, this could be attributed to many reasons such as to the poor performance of an IT Departments, the unclear role, and improper use of ITS. For example, according to Field (1997), 40% of ITS application development projects are cancelled before completion, 35% of remaining projects are challenged by cost and time overruns or change in scope, and failed ITS projects cost the US roughly $145 billion a year (£97 billion). Many of those non-functional ITS projects, which includes a growing number of change initiatives (OR Newsletter, 1996; Ranger, 2001), fail due to the improper ITS project management. Poor management practices include not clearly determining users' (customers) needs, not seeking tangible benefits, not defining a project's scope accurately and underestimate the complexity of a project (Flowers, 1996). There are few published cases attributing the reasons of ITS failures to the insufficient availability of resources or unrealistic expectations (Drew, 1994; Flood, 2000; Mumford, 1985; Mirl, 1998). Undesirable change leads to mistrust and pessimism and sometimes accompanied by passive-aggression behaviour, which make positive group work creativity and team spirit impossible. A key barrier to change is the lack of commitment from executive management (Bennett, 1998) and the resistance of middle mangers (Hammer and Champy, 1993). They resist because they believe that change leads to the loss of their control, authority and increase their workload. The lack of knowledge and skills is another barrier to make an ITS a success. Another reason which contributed to the failure of ITS projects is the conflict between the organisational culture (business Departments) and IT Department (which is the core of this thesis) which may weaken the effort to bring about organisational change (Cooper, 1994; Kavanagh, 1998; Kelly, 1999). The three experiences of modernising the air traffic control systems of the Federal Aviation Administration (FAA)-America (Clemons et al., 1995; Coleman et al., 1996; Coleman, 1997), the air traffic control at Swanwick-UK (Collins, 2002; Computer Weekly, 2002; Computing, 1998; Hatton, 1999; Parker, 2000, also see Salabert and Newman (1995) reported on the Spanish air traffic control (are examples of publicly shared case of failures abroad). In these cases many processes that have been engineered, reengineered and optimised but still failed because the culture was not changed in alignment with the technology and redesigned process. This has been stated by the FAA General Accounting Office and summarised in the executive report as follows:

"*Over the past 15 years, FAA's modernisation program has experienced substantial cost overruns, lengthy schedule delays, and shortfalls in performance. The FAA's organisational culture has been an underlying cause of the agency's acquisition problems and processes*".

In the following sections, the concept of ITS as a major enabler in business organisations will be discussed. Also, theoretical, technological advances and application areas of ITS that are usually proposed in conjunction with retail and business organisations will be briefly addressed. Then, the concept of ITS as being a constraint in business organisations will be discussed.

2.3.2 ITS as a Business Restrictive

Many ITSs fail, as they did not align business, human and technical requirements/specifications capabilities within the requirements process. Design, development, build process, then tracking and checking performance as progression through the system development lifecycle, and for many business organisations still a nightmare (Johnson and Kaplan, 1987). There should be a consideration for balance and alignment between ITS and business ingredients to the need of a successful IT/business strategy, rather than imposing ITS blindly without considering other factors that should lead to having the business functions rotating around the technology side and consequently limit the outcome. Hammer and Champy (1993) emphasise the need to align business with technology rather than to adopt IT to business processes. Moreover, ITS can not succeed without the change and empowerment of users which involves making the appropriate decisions (Liebowitz, 1998; Davenport and Prusak, 1998). Many researchers had different reasons for ITS failures (Lyytinen, 1988 and 1985; Whyte and Bytheway, 1996; Dean, 2000). Some of these reasons as stated in the case studies include: lack of involvement and support of top management (Flowers, 1996), insufficient resources, employees working under constant pressure due to unrealistic timeframes for change (Sauer, 1993; Benjamin and Levinson, 1993; Macaulay, 1996).

Those studies try to analyse reasons and evidences of the potential for failures of ITS, but for most of these studies, a specific explanation for possible reasons that have caused the failure is not provided. Existing research has not explained how a certain mix of conditions and factors prevent failure, instead there are few researchers who have discussed the factors hindering ITS-enabled change. There have been very few attempts that systematically analyse and understand the limits and constraints of ITS and clarifying other fundamental factors such as methodology choice, testing and implementation. Below are two examples of two case studies that discuss other fundamental factors that are important to the success of an ITS. The cases reported by Glass (1998), Remenyi et al. (2000) and Glass (2001), on how system implementation disregarded the existing political ordering of an internally competitive organisation, which caused as ITS deployment to be reconsidered. In Remenyi et al (2002) case, highly collaborative system architecture based on sharing information was imposed on users who consider this information as intellectual property and believe that their professional progress depended upon unshared informational advantage. The conflict between user's incentive and use of the system ultimately ruined the successful deployment of the original ITS. These examples of case studies highlight the importance of the human (social), and organisational influences shaping ITS deployment. They present the difficulties encountered by organisations trying to change through the deliberate and sometimes forceful redeployment of ITS infrastructure. However, findings from such case studies are difficult to apply to comparable situation, either because they lack a theoretical grounding or provide only a descriptive recounting of a uniquely situation. There is no substantive systematic guidance to be found in the research literature as how and when IT can enable or restrict business organisational advancements.

2.3.3 ITS as a Business Enabler

The right design and implementations of ITS could result in tremendous benefits (Venkatraman, 1994). ITS provides strategic choices for the business organisation to be able to manage effectively their factors such as quality of both products and services, cost, customer (internal and external) satisfaction, and allowing organisational learning. By employing ITS effectively, the potential will allow greater flexibility to being about different types of products and services which will result in more precise business control to achieve objectives. Also, to give support to non-IT departments, improve skills of system users, efficient operational process, provide reduction in time and cost, accuracy in information received and delivered, therefore ITS should be part of a business organisation's strategy (Laudon and Laudon, 2002). In order to have an effective utilisation of ITS, it requires the knowledge and understanding of the business, their current, future capabilities and relevance to business applications. Implementing ITS creatively plays a crucial role in shaping and restructuring the business organisation provided that the professional culture issues (see Chapter 5) are taken into account to utilise the returns of the ever-increasing capabilities of ITS (Al-Karaghouli et al., 2003).

2.3.4 Lack of Accountability

Surveys on ITS in the retail and the banking sector by the Economist (1992 & 1996) showed few successful new technology implementations. Despite the high levels of investment, most retailers and banks expressed disappointment with their new ITS. At the time of the research study 80% still involved the use of paper (a figure that was predicted to fall only to 60-70% by the year 2005. Given the importance of both retails and banks to the economy as a whole, and the extent the investments, it is not unreasonable to presume that the retailers and the banks themselves would be concerned about the lack of added-value they might gain. On the contrary, as described in Chapter 1, previous research has shown that few UK organisations attempted to measure the effectiveness of their ITS projects, and many have no idea whether their new ITS delivers good value in terms of their financial investments.

2.3.5 Legacy and Patching of Obsolescent Information Technology Systems

A survey by Morton (1996) reported that retail organisations tended to patch together inefficient and legacy ITSs to maintain existing business practices, and hence avoid the uncertainty associated with the introduction of new ITS. Fincham et al. (1994) also supported this finding in their study of the Scottish retail organisations (p.156):

"The sector is handicapped by ageing and inflexible information systems. Often data is inefficiently structured for applications not anticipated when the database were first designed, and their piecemeal uptake means that organisationally the data is seldom well integrated".

2.4 The Business Requirements Paradigm

Business requirements is a major issue in developing the right ITS that satisfies business needs. The ITS industry seems at times to have more in common with the fashion industry than it does with science or engineering. We are invited to adopt each new ITS fad as it appears in the market, and like the dedicated follower of fashion that we are, we embrace it- and sometimes organisations do not think about the consequences. Requirements engineering (RE) is the process of determining a complete, correct and clear specification of a future software-intensive system from the incomplete, inconsistent and ambiguous statements of need from stakeholders as diverse as end-users, managers and members of the public. Whereas conventional RE approaches focus on models and languages to express system specifications, there has been a recent shift towards a focus on requirement engineering processes (REPs). The prevalent view is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. Requirements evolve with time. This necessitates managing requirements (MR) evolution and aligning requirements to organisational changes.

One of the goals of this research is to improve our understanding of the RE process. This study shall provide a clear forum for future discussions of:

• Innovative ideas for REP.

• Industrial problem statements.

• Evaluation of approaches to REP.

2.4.1 Problem Definition: Requirements and ITS

An inadequate understanding of system requirements architecture is the single most important cause of user dissatisfaction and system failure (Mumford, 1995b; Macaulay, 1996; Kelly, 1999; Mactaggart, 2002; Arnott, 2003c). It is worthwhile mentioning here that we consider the development of the requirements process as a human and social process rather than a technology process, as will be detailed later in the relevant chapters since this thesis takes into consideration the human, social and technology issues as integral parts of the requirements stage and the final goal of the system development process. The field of ITS development and ITS failures has been adorned by such outstanding innovators as Checkland (1978), Pressman (1992), Sauer (1993), Flowers (1996), Sommerville (2000 & 2004), Bingley (2001) and many others that have followed in their footsteps throughout the world. The failure issue is exciting and challenging. The recent cases of glitches and failures (Arnott, 2003d; Arnott, 2004b; Computing, 2004b; Samuel, 2004) of ITS in the U.K. caused us to think and brood for a long time. According to research conducted by Barker (2002), 79% of big web services projects in 2002 are still in a "pilot" stage. This case study will not attempt to enumerate the many contributions of the various approaches to the field of ITS, but it will recognise some questions and new discoveries in the applied ITS field as a whole.

The common theme running through the research described above is either explicit or implicit criticism of the way in which new ITS projects are managed and implemented, leading to disappointing results. This suggests that a mix business and technology viewpoint focusing upon business needs (requirements) sheds little light on the reason why poor results are obtained and many ITS still failing. It will be argued in Chapters 4 and 5 that the quantitative and qualitative methodology adopted in this thesis allows the business requirements issue surrounding new ITS implementation to be investigated in depth. By focusing upon detailed contemporary management, IT, and TQM cases, study of the "smart requirements" can be taken a step further than is permitted by quantitative and qualitative approaches.

However, no work in the applied ITS subject area can ever be completely comprehensive. Therefore, we have chosen to highlight two topics of the field; one, the *factors* that have been contributed to the ITS glitches/failures. Two, *the role of business requirements* and its contribution to ITS developments including some questions that remain unanswered for the future ITS researchers. Several reasons exist for such failures, for example cost and overruns due to poor initial specification, inadequate requirements analysis and problem definition, and obsolescence due to rapidly changing work environment (Juran, 1988). The focus for our research is, however, the first stage in any project that is the establishment and agreement of customer requirements. IS projects should be managed to deliver a high quality results within agreed timescales and budgets. Project managers should take responsibility for definition, documentation, and execution of allocated process and tasks through all phases. Many project managers fail to estimate the costs, schedules and resource requirements for each stage of the entire project which lead to inaccurate progress reports to senior management (Watson, 1992; Flood, 1993). Attempting to explain information systems success and failure is a complex task. To measure it is perhaps more complex, compounded by difficulties related to the concept of measurement in a social context. The prevalent approach taken to date revolves around the concept of 'fit', as defined by the contingency approach in organisational theory (Beynon-Davies, 2002). In reviewing this, a proposal is made for an interpretive approach to measurement.

As it can be seen from the paragraphs above, many ITS projects/products did not see the light, not because they were badly designed or they did not finish on time, but due to the fact that the end-users keep changing their mind even in some cases at the final stage of testing and implementation. End-users fantasy (not need) sometimes override their needs. They like the product to do this and that, just because they like the product to do that, not that they need it for their business. A big percentage of quality products suffered from *"The like" symptoms* (Al-Karaghouli et al., 1999b). Poor quality designed software has contributed to the failure of some systems. Quality software is essential today if a company wants to maintain its competitive advantage; it is crucial to stay a head in technology by using easy and reliable software. In certain cases, quality software on its own is not good enough if it is not backed-up by training. Training is essential today if a company wants to maintain its competitive advantage. Therefore, it is imperative to make use of this technology to train end-users to gain the optimum value. Naisbitt and Abudene, 1990 argue that companies capable of acting aggressively on information will gain market advantage.

This is highlighted by (Bailey and Cotlar, 1993) that training must increase the awareness, skill and knowledge necessary to function successfully in the computer-oriented world of global markets. The high rate of failure is not due only to the inexperienced system developer but to the inexperienced customer (end-user) of what the system is capable of doing rather than what a customer would like the system to do. These and other important issues of system development issues will be discussed in future chapters. To maintain the competitive advantage in system development houses, the system developer and customers (end-users) must make the full use of new technology; it is essential that all participants receive effective training.

It is a matter of great satisfaction to us that the applied ITS area has been enriched both in theory and in practice by the contributions of those in the fields of hard and soft system methodologies, and by experiments to improve the quality of designed systems (Oakland, 2003; Oakland, 2002; Oakland, 2001). We quote Lewin's dictum that "the most practical thing in the world is a good theory" which has been practised in its fullest sense by sociotechnical system innovations. The soft system methodology (see the Ambulance case study in Checkland, 1998) is so full of success stories that continues to generate enthusiasm among both academics and business practitioners.

2.4.2 Position of Requirements

There are many factors contributed to IS failures but we believe that defect requirements is a major factor which contributes to IS failures. The reason for this, is that the requirements stage is the start and common stage in all IS methodologies. The conceptual form of the initial requirements in most methodologies is presented diagrammatically in Figure 2.2.

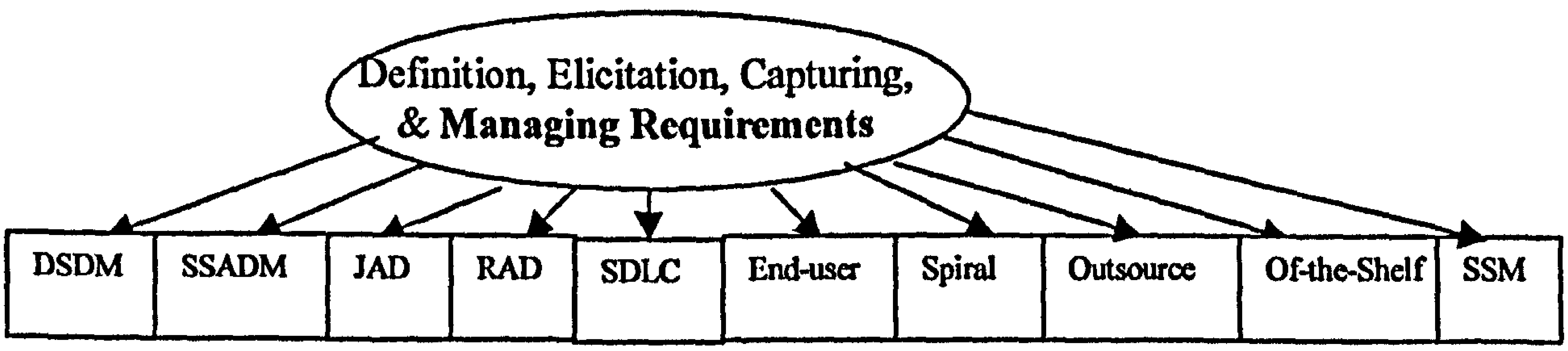


Figure 2.2: The Role of Requirements

Capturing functional (smart) requirements will reduce the rate of IS failures. The overall aim of our work has been to make recommendations that will raise the standards of all our projects to the level of the best, and provide mechanisms to underpin the process of improvement.

According to the National Audit Office reports (2000a and 200b) on improving the delivery of government IT Projects and by tackling the requirements issue. In February 2000, five recommendations from the review were released early and action has already begun on putting them into practice. These original recommendations have been incorporated into new recommendation. In a more recent special report published in computing edited by Gubbins (2002) revealed that £1bn of UK taxpayers' money had been wasted on failed or overran ITS projects. The report also reveals interesting statistics, such as the IT services market of the public sector was worth £3.4bn in 2001 with forecast of £4.7bn in 2004. The IT services market of the public sector is growing two-and-a-half times faster than the private sector market. Also, the public sector will increase its investment on software by 46.3% to £1.5bn from 1999/00 to 2001/04 at a compound annual growth rate of 10%. In 2000, EDS alone benefited £800m from the UK public sector IT services.

2.4.3 Background: Requirements and Total Quality

The research study sought to address the issue of the professional culture gap on the premise that the destructive effects stemmed from negative attitudes and preconception developed and perfected over time between the customer and the system developer. The research study borrowed perspectives from literature on IT and management science, in an effort to develop a **richer understanding** of the issue. By viewing ITS in retail organisations based on two metaphors - business requirements and system developer. The relevance of these two metaphors to the study of ITS failures has been emerging as a consistent them in the literature (for example, Lucas, 1975; Ginzberg, 1981; Robey and Markus, 1984; Willcocks and Mason, 1987; Galliers et al., 1992).

Another relevant area to this research is Total Quality Management (TQM), the work by March and Garvin, 1989; Deming, 1993; Juran, 1982, and Ishikawa, 1985a, 1985b; Ishikawa, K. 1983 into the causes of Japanese success in recent years, accorded a primary role to get things right first time in both products and services in order to pursuit of economic growth to IT innovation, which facilitated cost reductions, quality improvements, and customer satisfaction. With the different methodologies and approaches, they showed how these changes were themselves based upon a combination of deeply rooted and organisational cultures. They also noted the increasing importance of service industries, especially Oakland (1989, 1999; Oakland and Followell, 1999) highlighted the importance of such service industries to the UK economy because of their massive investment in ITS to develop and enhance their business. Deming's work therefore seems to imply a major role for the service industry in the process of technological change.

Throughout the thesis, which deals with requirements engineering, we prefer the shorter term of referring to requirement stage over the domain system development lifecycle model. Use cases and models, however, are based on different modelling techniques and aim at different levels of outcome, such that consistency and completeness problems are induced. The difference between requirement-related defects and complete, adequate, and agreed (smart requirements) in the system development process is often debated. In this thesis we will use this distinction. Requirement defects (non-conformed) can be defined as a requirement defect if the information technology system works as intended by the system developer, but does not match the business requirements. One example is that customer and the user are not satisfied with it. They may find it not easy to use, unable to support certain customer tasks, etc. Another example is that the system developers does not co-operate properly with existing ITS. Unstated customer business needs (tacit requirements), and expectations, misunderstood requirements and misunderstood existing ITS especially software are typical causes of requirement defects. The requirement defects can relate to functional as well as non-functional requirements. Non-conformed requirement may creep in at any stage of development. That is why, it is important to get the requirements right first time (Deming, 1986 & 1993). Many of the incomplete (defects) creep in at the analysis/ elicitation stage, others are caused by system developers making wrong assumptions during design or coding, and some may even be revealed by testing.

Non-conformed requirements may be detected at various stages of system development process. The earlier they are detected, the easier they are to repair, i.e. zero defects (Oakland, 1999; Crosby, 1984a; Crosby, P. 1985; Crosby, 1989). Ideally, they should be prevented from creeping in. However, detection as well as prevention requires some effort in addition to usual development. The question is whether it pays to spend this additional effort. In this chapter we discuss only non-conformed requirements. Compared to implementation defects they are more costly to repair. And due to their nature, we need other techniques namely brainstorming (Laudon and Laudon, 2000), and fishbone

(Ishikawa, 1983, 1985a, 1985b) and soft system methodology-rich picture (Checkland, 1999) -which will be discussed in more details in Chapter 5- to prevent or detect them than we need for implementation defects. System developers can, for instance, end implementation defects through testing or inspection of each other's software, but they can rarely end requirement defects that way due to continuous change in customer requirements. Usually the business peoples (customers and users) and current software in usage (to prevent legacy problem) must be involved to end these non-conformable requirements. Analyse the non-conformable requirements in present systems, identify techniques that could prevent them, and try the best of them in new ITS projects (Crosby, 1989; Crosby et aL, 2000). The eliminating defects approach is widely used in the TQM area, but we could see no guarantee that the improved processes are cost- effective. Finding the most cost-effective processes within the model's nine processes was even more elusive. The model/approach tends to measure its success as conformance to the whole system development process, and as improvement on the bottom line. Also, the other methodologies used in system development models have few specific guidelines for better requirement processes. So we decided to try the defect-driven approach. However, there are few reports on such experiments in industrial settings. Shingo, 1986; Sutcliffe et aL, 1999; March and Garvin, 1989; have investigated an ITS project where they first identified requirement-related defects, weaknesses in the written requirements, and weaknesses in the requirement processes. Next they suggested many improvements to the requirement processes, pointing out that they most likely would have avoided the problems. We see this as a hybrid between the approach and the defect-driven approach. In our research study we wanted to narrow down the necessary new processes within the model, estimate their benefits and costs, and try them out in practice.

In the retail organisations, IT directors should concentrate on using ITS to reduce costs rather than pretending that IT can increase profitability. According to Crosby (1989, 1985, 1979a, and1979b) "It is always cheaper to do it right first time". Get the right requirements right first time will contribute to cost and time saving in developing an ITS. Thus the purpose of our research study was to find cost-effective ways to avoid requirement defects in the ITS. Getting the business requirements (smart requirements) right first time, which will lead to reduction in time testing and implementation, this in turns will enable the system developer to meet budget and avoid time overrun. We could see two basically different approaches to this: Compare the existing system development processes against the KRF model of the requirements stage and identify weaknesses. Then improve the weak processes (see Sutcliffe et al., 1999 and Oakland, 1989).

2.4.4 Understanding Requirements

Sommerville and Sawyer (1997), Sommerville (2004) and Maciaszek et al. (2004) report that requirements engineering is a relatively new term which has be invented to cover all of the activities involved in discovering, documenting, and maintaining a set of requirements for a computer-based system. The use of terminology "engineering" indicates that repeatable techniques should be used to ensure that system requirements are complete, consistent, and relevant. This research study takes the issue of requirements a step further, i.e. business requirements should be complete consistent and relevant to the development of an ITS that satisfy business needs, objectives and goals.

Business requirements define what service the ITS should provide and set out constraints on the system's delivery. The requirements should reflect the real needs of the business (customer) for the ITS. Inconsistent and incomplete requirements lead to probable system failure. Requirements engineering and requirements management are arguably the most critical single phase in information technology system. Requirement defect or bad requirements are cited as a main cause of large systems engineering project failures (Morris, 1994). Too little investment in requirements is proven as a cause for software projects and systems engineering projects, e.g. NASA, IT survey (Burke, 1999).

The research study would argue that the theory and application of requirements today is in bad shape. There are several signs of this. Most so-called requirements are actually design for unstated requirements! Most requirements are a nice sounding set of words with no testable or quantified structure and very little information about the requirements and its relation to all other requirements, designs, and plans. This research study will open up a radically new approach to requirements that will rectify many of these problems. It is based on the ideas in planguage a specifically invented and evolved language for requirements specification. Fundamentals are re-examined, what is a function requirement? All quantitative and qualitative requirements are quantified richly (Sommerville and Sawyer, 1997- Chapter 6). Requirements are related directly and individually to stakeholders (Sommerville and Sawyer, 1997- Chapters 4 & 7; Sharp et al., 1999). Requirements are looked at in the wider systems development context of design, testing, project management, and engineering-work quality control.

2.4.5 Definition of RE (RESG)

The Requirements Engineering Specialist Group (RESG) of the British Computer Society has defined Requirements Engineering (RE) as:

"Requirements Engineering (RE) is the elicitation, definition, modelling, analysis, specification and validation of what customers need from a computer system. It is a process which draws on techniques from software engineering, information systems, **knowledge** acquisition, cognitive science and the social science to improve software engineering practice." *(www.bcs.org/Groups/SpecialstGroups).* The aim of the group (RESG) is to bring together ideas and innovations, particularly with respect to the question of how work study methods can be used to inform systems design. Also, in 2001 a new specialist group has been established with the BCS called "The Bridgers Group". Its aim is to bridge the gap between the users and the system developers, which is the core work of our research.

Requirements Engineering (RE) lies at the heart of software development. RE is concerned with identifying the purpose of a software system, and the contexts in which it will be used in the real-world. Hence, RE acts as the bridge between the real world needs of users, customers, and other constituencies affected by a software system, and the capabilities and opportunities afforded by software-intensive technologies. It is also concerned with how these factors are taken into account during the implementation and maintenance of the system, from software specifications and architectures up to final test cases. Over the last ten years, RE has moved from an immature software engineering phase to a well-recognised practice and research area spanning the whole system lifecycle. RE requires a variety and richness of skills, processes, methods, techniques and tools.

2.5 The Knowledge Paradigm

Knowledge and knowledge management fall in the heart of the initial stage (requirements) of the system development process (BS 6719, 1986). As mentioned earlier by the Requirements Engineering Specialist Group (RESG) of the British Computer Society, see section 2.4.5.

It is worthwhile mentioning that the knowledge management (KM) this study addresses is not the KM people talk about, but the managing of knowledge of both the customer and the system developer at the requirements stage. In today's knowledge economy a skilled technical workforce is an essential resource to the UK. But this skilled technical workforce must be made aware about the business issues as well as the technical issues (Berry and Linoff, 1997; Stevenson, 2002). UK system developer organisations would be unwise to overlook the value of Business/ IT (BIT) professionals to form alliances in search of the right BIT skills. The IT and IS skills shortage are still with us (Taylor, 2004; Gubbins, 2004a), despite the slowdown in the economy and more layoffs across the technology sector. According to Fielding (2002b) and Computing (2002), the percentage of shortfall of skilled IT people in the UK is predicted to increase from 10% in 2001 to 12% by 2002. UK skills shortfall has been matched by Western Europe skills shortage over the same period. The article also highlighted a 27% annual growth in demand for technologists with 'soft skills' in Western Europe. During the millennium (bug 2000), the Halifax Building Society had given skilled IT staff pay rise of 30% in order to hang on to its software developers at the time (Kelly, 1997). There is a growing trend towards more innovative skills resourcing and deployment, the UK should not be confusing in-house IT responsibility with IT outsourcing experts but provide added value to larger organisations looking for a more strategic approach.

2.5.1 Business Professional and Intellectual Knowledge Culture Clash

There has been considerable debate concerning whether professional organisational culture clash between the customer (non-IT departments) and system developer (IT department) can be managed actively and much of the debate revolves around the extent to which a culture can be change to a desirable state (Thompson and Luthans, 1990; Willie, 1989; Schein, 1985). This is due to difficulty in achieving a professional culture change in practice (Al-Karaghouli et al., 2002; Coleman et al., 1996).

The concept of professional organisational culture clash is an important factor in the success and failure of an ITS, also it is a major core of this thesis. Therefore, organisational culture clash can hinder or ruin an ITS project before it begins (Detert, 2000). Many researchers believe in the crucial role of leadership in the success of ITS projects (Flowers, 1996; Fortune and Peters, 1995). Knights and McCabe (1998) added "it seems politically naive if not unrealistic to assume that a leader can make employees want what he wants" as suggested by some organisations. They emphasise that resistance to change can not be overcome simply by strong leadership or communications. Individuals who have vested interest in perpetuation of particular business organisations and accompanying technologies would resist any move to change the current situation regardless whether a strong leadership existed. Moreover, they should be able to communicate and adopt a participative approach in an effective way and to create a professional culture that values sharing information an empowerment (Flowers, 1996; Al-Karaghouli et al., 2002).

2.5.2 Knowledge Diversity and Communications

Acquisition of business and technical knowledge is very important to any organisation. Equally likely, continuous communications (Sturt, 2000, Harrington, 2001) are also vital to the progress of any organisation (Computing, 2001) in most organisations there is a clear division between the customer and users (both business users and end-users) of the proposed system and the developers of the system, i.e. different knowledge and perception of knowledge (see Figure 3). Usually the developer is the internal IT department although increasingly it is a third party organisation, such as an outsourcing vendor or consultancy company. This can exacerbate communication problems due to the physical separation of the organisations. Some organisations claim a more integrated environment where the customer and the developers are not seen as separate elements of the business but they work seamlessly together with shared objectives. Even in this environment there is usually a separation in the roles of customer and developer, it is just that they work in a coherent team or project (Tenkasi and Boland, 1996; Sieloff, 1999).

Business users and customers of the system, which we will for shorthand purposes call the 'customer' and secondly the developers of the system which will include business analysts, systems analysts, programmers, software engineers, network specialists, security specialists, etc., which we shall call 'developers'. For convenience we will talk about the two sides but this terminology should not indicate that there is only one of each or that they are not a diverse set of people and levels of seniority involved. Further the term customer is usually taken to mean the person or people (internal customers) within an organisation who require the system to support their part of the business (or the business as a whole). The current concept of a system requirement is ill suited to develop clear "smart" requirements for large systems. The received concept follows a technical rationality, which regards requirements as goals to be discovered and solutions as separate technical elements (Cavell, 1999; Regnell et al., 1995). In contrast, we advocate a view where a requirement specifies a set of mappings between problem and solution spaces, which both are socially constructed and negotiated (Figures 6.9, 6.10 & 6.11).

Communications are also crucial to get the objectives (first the right requirements and second the right system that fits business needs) clear and spilt the work into manageable chunks, so business people (customers) and system developers know what they are doing and know what they are supposed to be doing, so both the customer and the system developer will be willing to put the effort in to contribute towards the proposed system. Teamwork is known as a crucial value of any business and technology process and its success is affected by the way in which team members are selected. It constitutes of a collaborative and learning environment where teams from different backgrounds are encouraged to share and transfer knowledge, skills and expertise (Sowa, 2000; Liebowitz, 1999; Laudon and Laudon, 1996). One extreme, some researchers (Andrews and Stalick, 1994) view organisation culture as an enabler and an internal variable in the change process. They go as far as saying that organisational politics can be cast aside provided that management changes their role (Liebowitz, and Beckman, 1998). In any system development, the business organisation will be faced with some resistance to change, particularly because people feel that they are taking national control of local information. A lot explaining is needed about the benefits to organisation is needed.

Some authors have attempted to categorise a series of intermediary stages in the acquisition of ITS process. For example, Clark et al (1988) identified initiation of acquiring and implementation of an ITS as the critical steps. Dowson (1996) showed that while these stages are helpful in analytical terms, the process is often anything but linear and smooth in practice. McLoughlin and Clark (1994) pointed out that technology has no influence upon the nature of organisational change, but that it is only one of many interacting and complex factors. They concluded that effective introduction of new technology required challenge to conventional prerogatives and commitment from <u>all levels</u> of the organisation, and even then the results tended to be evolutionary and emergent. This means that it is difficult in practice to apply definitive models of innovation such as the "reverse product life cycle" suggested by Barras (1990). Similarly, rational and linear models (for example strategy development, implementation, evaluation) favoured in traditional organisational change texts such as Chandler (1962) or Ansoff (1984) appear very limited in terms of their ability to explain the dynamics of change, the author believes that an ITS should be treated as a living body which grows and interact with business needs continuously.

2.5.3 The Role of Knowledge in a Retailing Organisation

Access to customer information will be a significant factor in the competitiveness of a retail organisation over the coming years. Empowering employees with the right information for daily tasks, in a user-friendly way will radically improve their effectiveness and productivity.

Knowledge will probably have the most far reaching and profound effect on how retail organisations work in an era where the access to information plays a significant part in the competitiveness of an organisation. Delivering knowledge to employees will enable them to perform their business tasks and provide a huge opportunity for the retail organisation they work in to improve customer service and productivity. In any company, information is held that in various formats, some in databases, but most in electronic files, emails and other unstructured sources. Using a standard desktop screen, ITS is able to deliver information from all these sources to empower employees in retail for decision-making. It is important to understand the types of information within the retail organisations which includes: business data - discrete facts from external data and core business, information - semi structured content such as emails, documents, voicemail and multimedia, knowledge - experiences, ideas, insights and values of individuals. Managing these knowledge assets creates a dynamic, innovative and agile organisation. Without managing them, information is lost, lessons are not learnt, work takes longer and trends go unnoticed. Implementing a knowledge management strategy needs an in depth knowledge of both the business needs of an organisation, and the underlying technologies.

2.6 Misalignment of Technology Strategy and Business Strategy

Coombs 1992; Fitzgerald, 2000a and 2000b, blamed the tendency for business organisations to focus upon rational, linear planning (also see Chandler, 1962) when implementing new ITS projects, thereby ignoring the inevitable political process within organisations, which Coombs (1992) and Fitzgerald (2000b) claimed would sabotage the most careful plans. They noted that these project planning models become increasingly limiting as ITS projects become ever more strategic in scope, and must reconcile a number of different interests. To address the problem, he recommended the revision of organisational structures to allow closer working relationships between techie and business people. McLoughlin and Clark (1994) also noted that the relationship between employee and machine resources was often badly managed, and in addition they observed a poor understanding and fit at the organisational level between technology strategy and the overall business objectives of the organisations studied, which this thesis addresses.

2.6.1 Relevant Theoretical Debates

The area of SSM-rich picture, which was developed in 1970s out of the failure of other system development methodologies, is used in the model this study considers. SSM origins in Peter Checkland (1981) attempt to adapt systems theory into a methodology which can be applied to any particular IS's problem or situation. SSM is about creating relationship between People and System which nicely fits in the model this study proposes.

SSM defined as *"a methodology which put emphasise on the human involvement in information technology system (ITS) and models their behaviour as part of systems analysis in a way which is understandable by non-technical people"*. The Rich picture has been used in different processes of the KRF (see chapter 6) due to its relevance and as a powerful tool of SSM as explained in the next section. The area of applied ITS has been enriched both in theory and in practice by the contributions of those in the fields of hard and soft system methodologies (Avison 1995), and by experiments to improve the quality of designed systems. We quote Lewin's dictum that "the most practical thing in the world is a good theory" which has been practised in its fullest sense by sociotechnical system innovations. Our research is a witness to the fact that applied ITS, e.g. soft system methodology has made significant progress in contributing to organisational change strategies and that experiences in soft systems have provided a particularly viable agenda for the future of organisational change (Checkland, 1998). However, no work in the applied ITS subject area can ever be completely comprehensive.

Therefore, we have chosen to highlight three topics of the field; one, the points that have been basically responsible for the ITS glitches/failures, two knowledge and its role in requirements, and three, the role of business requirements including the Knowledge Requirements Framework (KRF) and its contribution to ITS developments.

2.6.2 SSM Framework

Stage One: The problem situation (unstructured)

The stage is concerned with finding out as much as possible about the problem situation from as many different affected people as possible. The structure of the problem in terms of physical layout, reporting structure, formal and informal communication channels will also be explored. A soft system investigator will often find that there is vagueness about the problem situation being investigated, the situation that surrounds it and what needs to be done.

Stage Two: The Problem situation (expressed)

Stage one was about gathering an informal picture of the problem situation. Stage two documents these findings. While there is no prescribed method for doing this, a technique that is commonly used is known as "rich picture". A rich picture can show the processes involved in the problem under consideration and how they relate to each other.

Stage Three: Root Definitions

According to Checkland (1999), a root definition should be as a "concise, tightly constructed description of a human activity system which states what the system is".

A root Definitions can be formulated by considering the elements CATWOE.

C - Customers or clients (beneficiaries of the 'T' below).

A - Actors (those involved in the 'T' below).

T - Transformations Process (conversion of input to output)- this lies at the heart of the root definition.

W - Weltanschauung (worldview which makes the above 'T' meaningful).

O - Owners- the sponsor, controller, to whom the system is answerable (have power to stop the above 'T' and cause the system to cease).

E - Environment constraints & limitations (factors outside the system).

Stage Four: Building Conceptual Models

A conceptual model is a logical model which contains the key activities and processes that must be carried out in order to satisfy the root definition produced in Stage Three- A simple diagram shows the activities and links between them.

Stage Five: Comparing Conceptual Models with Reality

The purpose of Stage five is not to alter the conceptual models so that they fit more closely with what happens in reality. Instead, it is to enable the participants in the problem situation to gain an insight into the current situation and possible ways in which the change to reality can be made.

Stage Six: Assessing Feasible and Desirable Changes

Depending on the outcome of the previous Stage, an analysis of the proposed changes can be made and proposal for change drawn up for those which considered feasible and desirable.

Stage Seven: Action to Improve the Problem Situation

This stage is concerned with the application of the model. SSM does not describe methods for implementing solutions, this lies outside the scope of the methodology. There is no reason that SSM should not be used as a tool for assisting the implementation of the required solution, the steps can be repeated. SSM has often been used as a "front end" to more traditional structured development methodologies such SSADM.

2.7 Frameworks for Technology Transfer

The Thesis aims to explore methods, techniques and models for facilitating the successful development of technologies, from both practitioner as well as academic perspectives. Support for collaborative writing and supporting the specification of user-oriented system requirements through a mixture of formal and informal approaches and documentation support tools.

There is ample evidence that finding requirements early saves time money and anguish later on in a project. To be able to find the requirements you need to make them functional to all the different stakeholders by quantifying them in a consistent and understandable way. The requirements KRF template leads to a common language for expressing requirements. The template provides a guide for identifying functional requirements, non-functional requirements, goals and constraints and linking all these components in a requirements network. A requirements shell identifies a number of quantifiable components about individual requirements: unique identification, requirement type, description, purpose, customer value, conflicts and fit criteria. You can use each of these components as input to testing the requirement to determine whether it is or is not a well stated requirement. For example, the fit criterion is an unambiguous specification of how you will know whether any given solution fits, or does not fit, the requirement. The KRF's quality gateway is a process for testing requirements. To pass through the gateway and be included in the requirements specification, a requirement is tested for relevance, coherency, traceability, completeness, consistency, viability, and a number of other qualities that successful requirements must have. These tests are concerned with ensuring that the requirements are as complete and accurate as possible, and that they do not cause unnecessary problems later in the project.

2.8 ITS in Retail : A Driver of Strategy

The biggest impacts of ITS on business retail organisations have occurred over the past two decades. The impact of ITS on the retailing sector in the UK has been immense. The retailing sector has experienced many IT/IS advances with the most prominent being the checkout, warehousing, barcode and recently the radio frequency identification (RFID) which will replace the barcode (Ranger, 2002c; Thomas, 2004a) in a few years. ITS provides a fundamental competitive advantage for many retail in the UK and this can be seen in a circumstance in the form of competing to acquire the latest technology in e-commerce.

The new retail generation has been able to compete and to close the gap between them and the older retailers as a result of rapid adoption and automation practises. These adopted retail practises, such as just-in-time and supply chain, bring about efficiency and the provision of innovative services. The integration and co-operate systems of both IT and IS have made it possible to deliver diverse services via telephone and e-shopping. However, inadequate infrastructure of IT/IS creates barriers to the full utilisation of both ITS and business opportunities. The dependence on ITS by the retailers is supported by the view expressed in the questionnaire with business in mind. It is difficult to dispute that decision-making process in retail can be only as good as the information upon which decision is made. The rapid progress that is being made in the ITS and applications of IT for retailers is therefore highly pertinent to the development of retailing. According to Ody (1987) that:

"At the highest levels, retail executives have realised the need for help in these areas for some time-but they are only beginning to appreciate that computer-literate marketing staff manipulating sophisticated database can provide them with the answers."

The widespread use of ITS in accounting, personnel, warehousing and transport was firmly started in the early 1970s. From the retail viewpoint, the most relevant area of development has been the growth in electronic point-of-sale (EPoS) technology. For example, a retailer with full EPoS data capture system can process all information overnight to provide its branches in the morning with a completely up-to-date picture of sales trends by item and by store. Not only does this enable immediate adjustments to be made to reorder levels, it also provides a formidable weapon in negotiating with suppliers. It would be quite wrong, however, to assume that this type of information, however comperhensive and rapidly available, is a complete substitute for liaison between customers and retail stores. Furthermore, customers usually have extensive information about existing items, much of which is internally generated through advertising and therefore more likely to be trusted than information supplied in relation to new products (Dennis et al., 2002). Retailers can use the information to keep their inventory up-to-date and track goods throughout the supply chain. The recent invention of 'smart tags' which will replace the barcodes within five years (Ranger, 2002c), will be used to free up staff time and make it quicker to find products that are past their sell-by date.

2.8.1 ITS Sophistication in Loyalty Cards Implementation

In September 2002 the public saw the launch of Nectar by Loyalty Management UK (LMUK), a new multi-store loyalty card run by the founder members of Nectar which includes supermarket chain Sainsbury's, Barclaycard, BP and Debenhams (Smith and Voyle, 2003b). It took little more than 12 months to develop. Nectar is now the largest loyalty scheme in the UK, more than 50 per cent of all households have a card through retailers such as Sainsbury's, Debenhams and BP. The new reappraisal of the loyalty scheme is part of the broader marketing review, offering a range of special deals including free flights. The Air Miles market is very competitive. Air Miles can be collected by using

NatWest or Shell credit cards and by shopping at Tesco. Barclaycard gives a point for every £2 spent with the card, while Amex is simplest of all, giving one point per £1 spent. A shopper paying for Sainsbury's shopping, will get two points for every £1 together with Barclaycard, would get three points for every £1. The same applies if Sainsbury's own Visa card used in the store. The Air Miles scheme has been widened to include Flybe, bmi, Aer Lingus as well as British Airways. Nectar has linked up only with bmi and Virgin Atlantic so far. But comparing the value of these different schemes is complicated.

Nectar is Sainsbury's latest attempt to gain ground on archrival Tesco's Clubcard. Nectar brings the big loyalty schemes together so shoppers can earn points a lot quicker. It is a new loyalty card scheme, replacing Sainsbury's existing reward initiative and backed by heavy television advertising. Nectar will be backed by major high street names such as Debenhams, BP and Barclaycard. Barclaycard has 3.5 million people signed up to its existing reward scheme. This will end in February 2002, when the customers will be transferred to Nectar. But points can also be spent on other products as many suppliers signed up including Blockbuster, TGI Friday, Odeon cinemas, the airline BMI, Madame Tussaud's, Thorpe Park, Chessington and Alton Towers to give rewards. There is more choice and rewards come faster because it has never been easier to collect points. This means, shoppers can get cut-price deals on everything from burgers, videos, petrol, holidays, flights and shopping. This is an aggressive attack on the lucrative Air Miles programme, Nectar plans to poach millions of customers. Employees will be able to start using Nectar before shoppers to ensure the smoothness of the process. Like anything in retail, and in fact the world, the acquisition of a loyalty card starts with a business process (not IT process). Customers apply in the retail store concerned for membership of the reward scheme and are sent a card. Customers earn bonus points on purchases which are stored cumulatively (usually one point for every £1 spent). Methods or redemption include exchanging points for discount voucher. All food-supermarkets are being innovative in ways to redeem these points in order to add value to the scheme (Worthington, 1999; Worthington and Hallsworth, 1999). For example, Sainsbury's boss Sir Peter Davis is anxious to fill the gap left when it parted company with Air Miles in early 2002, sales were hit. Tesco immediately took over from Sainsbury, Sainsbury was hurt and the main beneficiary was Tesco.

Tesco introduced self-scanning devices and had the advantages of learning from Safeway's mistakes. Tesco's self-scanning device is considerably more superior than its forerunner at Safeway. Also, in a joint development with Siemens Nixdorf Information System and Telxon (Ody, 1997). Currently, Tesco is introducing small terminals equipped with liquid crystal displays, radio communications, touch screens and possibly integrated swipe card readers. This device will be used as a scanner but will also be able to display messages of special offers and could become a multipurpose information device that works in conjunction with the loyalty card database- tailored offers to the individual customer can be displayed on the trolley screen. A Tesco loyalty cardholder can now swipe the card to obtain a specially equipped trolley. These special trolleys have been provided for this purpose and very basic controls allow the customer to scan the goods as they shop. The scanned codes are returned into item details and the till receipt is printed out. Customers then take their receipt to the checkout where they can pay without the shopping load having to be unpacked and rescanned. Hallsworth (2000), mentioned that in the UK some customers become locked into a loyalty scheme, whilst others such as 'card junkies' and 'premium hunters' are able to manipulate the scheme to their advantage due to competitive replication by all superstores. Loyalty schemes are a vehicle by which 'retailers evolve from distributor' to become the 'source of all knowledge', whereas manufactures become 'the weaker side' in this jigsaw. Detailed knowledge of the ITS could also be seen as a potential product, especially in relation to e-retailing. Suppliers advertising space on the site and on self-scanning screens is another possibility as well as specifically relevant voucher and offers to be printed off at point of sale. The development and application of ITS in the UK retailing have clearly been advantageous to them including Tesco if only for a limited period in some circumstances. More and more retailers realise that IT will play a vital part in retailing in general and in food retailing in particular in the future and is prepared to expand its current ITS (Stewart, 2002; Watson, 2003a).

According to Voyle (2002), Sainsbury claimed that there are 11million users of the new loyalty card despite the glitches that had hit the web site which have been fixed. The online launched was suspended just after September due to the amount of online traffic, the design has been simplified and capacity increased. The Web site was the most disappointing piece of the launch programme. A chaotic launch of its Nectar loyalty card when computer systems collapsed, leaving thousands of customers unable to register. Technical problems allowed customers to view another person's account details.

The crucial Nectar-IT project was months behind schedule. Sainsbury insists any delays in the project are down to rephasing or adding new elements into the project, such as the Nectar loyalty card in September. Some older EPOS systems cannot process the new Nectar card, leaving frustrated shoppers unable to redeem points on the widely promoted loyalty card in about 50 stores, the majority of its stores are reliant on systems that need replacing. Inefficiencies in the old system continue to cause real problems at the checkout, while teething problems with the new system are also being blamed for lengthening the queue at tills in unconverted stores. Sainsbury had 8 million users under its old reward card, which was closed at midnight on Saturday 16th November 2002.

2.9 Understanding IS Failures: Good Things Shine Through Errors

Despite the implementation of such methodologies over many years, information technology system projects continue to fail as the recent "UK Passport Office failure and the London Stock Exchange glitch (April 5th 2000)" illustrated, such events are reminders of the limitation of such hard approaches. This chapter explores a new informal soft approach (methodology) which combines management science and information system approaches. It is argued that the Knowledge Requirements Framework (KRF) described in the chapter 6, is well fitted to clearly identify the pre-requirement stage in the life cycle systems approach. KRF is a tool to facilitate bridging the knowledge gap and the understanding gap in software development between the software engineer and the customer. The development, and establishment of clear, rigorous requirements is one of the most important keys in the success of software development. KRF is an approach that uses many tools to improve software development methodologies and to lead a better handling of the software development process (Nash, 2003).

Statistics indicate that there appears to be a problem with project management in the retail sector than that of other private sectors due to the size of large ITS in use (CBR, 2005; Watson, 2003b; Watson, 2003d; Watson, 2003f). However, the problem is not as great as in the public sector (see Appendices A & B -cases of failures; and Parker, 2002) where the success rate of ITS projects is some of the worst in both sectors. With regard to the public sector, the government task forces have suggested that better project management might help address some of the problems and have recommended better training in this area (Parker, 2000). On the other hand information technology system failure and in particular software failure is not susceptible to wear and tear but due to many undiscovered bugs (errors) of software which went undetected by the system developer, which causes the failure of such a system. In addition ITS is a high risk industry and a glance through the 14 pages of risk factors in Nasdaq's fillings of Qualcomm (a Californian producer of wireless chip technology) will confirm that the ITS industry has higher risk profile than other sectors because of the nature of the business it is in which changes rapidly.

2.10 Conclusions

There are far more successful ITS projects that meet their objectives (not business requirements) than there are failures. Regular surveys show a majority of projects fail in some way. ITS manager are too shy to admit the cock-ups behind most of their projects, projects that, in public are claimed as great success (Kelly, 1999; Jovit, 2003). This chapter has considered the wider issues that impact upon the research study of determining smart requirements of ITS in the retail sector, and justified the analysis of detail case studies as the most appropriate method to address the chosen research question. The major points raised can be summarised as follows:

• The prominence of human and social issues (as opposed to technical constraints) throughout the acquisition process of new ITS highlights the critical need for effective management of change in dealing with the initial requirements process to avoid ITS failures.

• In such circumstances, a focus upon quantitative measures of improvement and ITS development change has limited explanatory power in comparison with a detailed study of contemporary case studies that illuminate the requirement (human-to-human) process involved in information technology change.

• Major retail and system development organisations should be playing increasingly important roles in the process of acquiring an ITS, but there is as yet little evidence of co-operation remains to be seen despite the high levels of investment made.

• This could mean that opportunities exist for organisations in general and the retail organisations in particular to utilise the potential of ITS more fully and hence secure competitive advantages.

• In practice this potential appears to be inhibited by lack of accountability of both the customer and the system developer, a focus upon technology and automation of existing practices, ineffective identification of initial requirements and project management of new ITS projects and patching of legacy ITS.

In summary, the hypothesis to be investigated is that the failures of ITSs is related not so much to technical failings, as to the way in which initial requirements is defined, agreed, captured, conceptualised, mapped, and managed within technology adoption process in organisations. It is hoped that the research study will lead to an advancement in knowledge of how acquisition of an ITS may be better understood and aligned with business needs and requirements. The review indicates that there is a degree of consensus that the professional culture clash within which the business organisation is an integral part of it and would greatly influence ITS changes or how should be conducted. Therefore, the professional culture clash identifies as important factor of this thesis and will address in the next chapter in more details. The review also highlights that the human (social) and technical systems, of a business organisation, simultaneously influence one another (sociotechnical). This implies that successful IT/business change in identifying requirements of a newly developed ITS require careful consideration to the context and the process of change in system developments methodologies and approaches.

Some of the information in this chapter has been obtained from the following useful internet URL links (Accessed 26/11/01).

Cabinet Office http://www.cabinet-office.gov.uk/index/civilservice.htm)

Cabinet Office http://www.cabinet-office.gov.uk/

Central IT Unit, Cabinet Office (CITU) http://www.citu.gov.uk/

e-Envoy, Office of the http://www.e-envoy.gov.uk/

Government Commerce (OGC) http://www.ogc.gov.uk/

Government Information Service (Open) http://www.open.gov.uk/

National Audit Office (NAO) http://www.nao.gov.uk/

Chapter 3 - Setting Out: Conceptualising ITS Models Using the UK Retail Sector as an Example

Summary

This chapter begins by a brief and relevant review of the current retailers in the UK and the ITS implementations in the retail sector. The purpose of review is to show the complexity and sophistication of current ITS applications in retailing and it features in the conceptual model presented. Also in this chapter, the aim is to provide *a conceptual and the theoretical framework* that will inform subsequent analysis of the actual influence of business requirements in system development process within the retail sector. These days retailing is a fast changing service industry due to constant change brought about by economic, demographic, vast technological improvements and fierce competitors. In the future competition will base purely on information, leading data warehousing to play a key role. Although these generalisations obviously cannot be applied in every case, they do help to underline the need for positive and long-term planning. This somewhat utopian scenario is then compared with what is actually happening in practice in the real world. It is beyond the scope of this research study to investigate possible links between the decline in the state of the retail sector and the effective implementation of IT/IS within organisations. But this discussion introduces the issue at the heart of the thesis as the apparent state of diminishing returns in the retail sector despite massive IT/IS investment at the organisational level. It is contended here (and developed further in Chapters 5 & 6) that detailed examination of individual IT/IS projects can provide insights into a problem which appears to be endemic at the initial level.

3.1Terms of Reference

This research work was prepared to fulfil the Ph.D. degree requirement for Department of Information Systems and Computing. The system functionality proposed in this thesis is real. Due to my obligations to some organisations, I am not allowed to share all the specifics relating to a specific product information or timeframes. For this reason, this research is vague in some areas and does not reflect what software, hardware or networking was actually used.

3.2 Introduction: The Retail Sector

The roadmap of this chapter will include a critical review, discussion and analysis of relevant research topics and the proposed conceptual model as follows:

• The UK retail sector including current retailers.

• The conceptual model with a brief look at the workshops.

• ITS e-applications in the retail sector.

For many years there was a tendency to regard retailers as subordinate. The rapid shift of power from manufacturing to retailing has forced a change in this view. From being a highly fragmented service industry, retailing is now highly concentrated in many areas, with some major retailers having grown larger than their largest suppliers, the factory outlets villages are good examples of such recent expansions (Varley, and Rafiq, 2000; Walters and Hanrahan, 2000; Foster, 2004). According to Sullivan (2004), online sales are forecast to contribute \$31bn (£172bn) to total retail sales in the US alone as more retail organisations and retail providers link multiple buying channels and services. Also, retailers see the technology as a powerful competitive tool (Bretherton, 2004; Mortleman, 2004; Nairn, 2004).

Despite spending a significant amount of money, ITS in retailers still suffered from glitches (Rigby, E. 2004a & 2004b; Watson, 2004c). This is mainly due to the legacy of the large and significantly old system many retailers have acquired over the last 50 years and mismanagement of their large ITS projects. Also, retailing these days is a fast changing service industry due to constant change brought about by economic, demographic, vast technological improvements and fierce competitors (Sudhir, 2001; Smith and Voyle, 2003a; Voyle, 2003d; Sherwood et al., 2004). The more powerful retailers have taken an increasing degree of control over the elements of the traditional retail and the e-retail mix (Kahn and Lehmann, 1991; Lee and Png, 2002; Scott Morton at el., 2001; Voyle, 2003e). Well informed and appropriate retail decisions require the availability of comprehensive, timely and accurate information. The development of many IS including the EPoS systems represents a major step towards better customer and product information for operational and marketing decisions. Internationally agreed barcode systems have developed alongside the technology for capturing customer data at the EPoS and scanning, these two systems can provide a wealth of data and information to assist distribution, buying, replenishment and marketing decisions, provided that these data are assimilated into an effective IS. Therefore, aspects of customer needs can also be enhanced, but care must be taken to avoid higher and unreal expectations.

More than 60 per cent retailers still depend on paper-based manual processes for their supply-chain management, which could effect their financial and business position, despite the advance mentioned above in the implementation of technologies (www.kmmagazine.com, 2004).

3.2.1 The Retailing Organisations

Our view in the different chapters of this thesis is one. That is, the focus on both the internal customers (different departments within organisations) and the external customers in developing product and also in developing a computer system of a retail organisation. This view is also highlighted in our KRF model which is based on the TQM approach as it focuses on satisfying customer needs, in our case business requirements.

Before looking at the different ITS used in retailing, it is worthwhile to define what retailing means. Kotler, et al. (1996) defines 'retailing' as the event that includes all the activities involved in selling goods or services directly to final consumers for their personal, nonbusiness use. Retailing is a channel activity that provides customers with goods and services. Retailing covers a wide range of sectors, including food, beverages and grocery, banking and financial, services, clothes, footwear, household items, electronic goods, books, stationary, hire and repair services, restaurants, hotels and catering. Although most retailing activities occur in retail stores, in recent years, transactions outside retail stores or non-retailing stores, e.g. mail-order, telephone, door-to-door (direct selling), vending machines, and the internet, has grown tremendously. Retailing is the UK's top service industry, employing just over 3 million people in the UK (1 in 10 of the UK workforce). In 2003, the sector had £250 billion in sales (a third of total consumer spending).

- **Current UK Retailers and ITS**

Retailing is one of the major economic sectors of the country, with retail sales of £221 billion, employing around 3 million people and operating over 300,000 shops. The leading retailers are huge, multinational businesses which dominate the sector. They operate a range of stores from major hypermarkets and supercentres through to small convenience stores. Retailing is also significant in its social dimension as well. Whilst economically retailing bridges production and consumption, in social terms it effects most of the population every day. The quality of UK retailing and its locations thus has both an economic and a social bearing on the perceptions of the country. The retail organisations, especially the supermarkets are targeting financial services and in particular online banking to find new sources of profit to offset the maturing UK grocery market. They are also well placed to exploit the big bank's poor reputation for lack of customer care. The UK retailer Sainsbury announced a partnership with bank of Scotland in November 1996 to offer financial services including deposit accounts and credit cards with low interest rate to its massive customer base. Sainsbury is intended to offer a full range of banking services through telephone and online banking. As the provider of a new service, Sainsbury is free to select certain banking products that will add value without needing to offer the loss-making services such as cheque accounts that usual banks and building societies must provide. Sainsbury can target the banks' most profitable customers from its large pool of regular shoppers. Tesco has a similar arrangement with the Royal Bank of Scotland, and by May 1998 the retailer had opened 1 million deposit accounts with total balances exceeding £2 billion (Financial Times, 16 May 1998). The main attraction to shoppers is the generous rate of credit interest (currently 8.5%) which is way in excess of the rates offered by the traditional banks (e.g. Barclays 4.5%) and the low credit card interest (Tesco 12.5% compared to Barclaycard 24%). The same article reports a prediction by analysts from Merrill Lynch that the two supermarkets will produce combine annual operating profit of £300 million just from financial services by 2003. According to Pesola (2005), the corporate IT budgets expected to increase by an average of 2.5 percent for about £59bn ($111bn) in 2005, this is the biggest increase since 2001. Watson (2003c and 2003d) states that Barclays annual ITS investment budget is £300m which includes regulatory program and the most important project of a technology refresh programme (variety on new desktop systems, applications and devices) across the bank's 2,077 branches to help bring its branch network into the 21st century. All the major banks invest heavily in ITS to support their business and developments of phone banking and e-banking as it is cheaper and convenient (Ballard, 2003)

Sainsbury is now considering a move to the mortgage market and Tesco into pensions. Sainsbury and Tesco, also looking into the Motor Industry, at the opportunity of selling cars. They would like to offer shoppers cars at discounted prices but this remain to be seen as an invasion by the big motor car manufactures especially after the recent mergers between different car manufacturers such as the French Renault and Swedish Volvo cars. Sainsbury depends heavily on its 25 in-house IT staff in developing their ITS. Sainsbury's IT strategy is determined through the partnership with Accenture and Sainsbury's business managers. Sainsbury's IT strategy has needed to keep pace with a changing business environment and has had a top-to-toe overhaul over the past fifteen years to keep it inline with other competitors. Retailers know that by putting new systems into place, they will gain the business flexibility and agility they need to thrive in the ferociously competitive market. In addition to a reliable ITS, retailers need people who understand complex relationship with experience of commercial challenges. Retailers depend on a combination of service delivery and technology focus with some continuos learning of consumer habits. The same tendency towards applied psychology prevails when it comes to ITS. To make the point about the importance of speedy and efficient electronic point-of-sale (EPoS), customers become schizophrenic when they are shopping and wandering around the supermarket looking for bargains, they are calm, docile, with all the time in the world. But when they reach queue at the checkout, their nature changes, they become well not happy, sometimes agitated and violent. The implementation of ITS in retail has been designed to help ease the above mentioned situation and has improved profitability for retailers (supermarkets, stores and banks) that have got their ITS strategy right (Knights, 2005b & 2005c). Every retailer whose opinion was canvassed stressed that the ultimate end of ITSs was to improve customer service and choice. For example and according to Howard Bryant (Trading Director), in early days when Tesco was still experimenting with EPoS, it stocked just 5,000 food items, now Tesco offers more than 25,000 food lines plus a wide of household, wines and spirits health, and beauty products. This is in part due to efficient transportation delivery system, stock control and ordering through e-trading. Tesco continues to outperform its competitors during 2004 with annual pre-tax profits at £1.6bn, up 17.6 per cent on last year figure (Voyle, 2004b).

More recent successful ITS developments in the retail sector including, Tesco's infrastructure for "Tesco information exchange" known as Tie, Sainsbury's transaction processing systems, Direct Line's CRM-acquisition system, Lloyds Bank, the Woolwich Financial services and Barclays bank "big bang" approach in implementing customer system (Bocij et al., 2003). Many retailers are running pilots of the wireless technologies especially the radio frequency identification (RFID) which they hope that it will provide better understanding of the consumer habits, cutting cost and will replace the current used technology of the barcode (Huber, 2004). The retailers are exciting by the developments and the implementations of radio frequency identification (RFID) technology (Gubbins, M. 2004b; Hall, 2004) despite the limitations of current hardware, as RFID tags application become widespread and can be integrated into existing business processes. These include Asda Wal-Mart, Kaufhof, Marks & Spencer, Metro Group, Migros, Safeway, Sainsbury, Scottish Courage, Selfridges, Tesco, and Woolworths (Ody, 2004). In retail, like everywhere else, the information technology revolution (ITR) continues to accelerate (Moran, 2002), see appendix I for more on ITS in retail. The applications of this universal tool seem limitless, such as hand-held devices to manage inventories and shelf stock control have been used, and different ITSs including supply chain system. Retailers have been employing ever more sophisticated methods in the race to attract customers and studying customer's psychology are now being applied to ITS (Buckley, 2004a; Buckley, 2004b).

In the retail organisations, IT directors should concentrate on using ITS to reduce costs rather than pretending that IT can increase profitability. Business and IT management urgently need a way of making sound judgements about the flexibility of business technology solutions, and the alignment of this flexibility with the adapting needs of the business and to assist them in delivering on their customers needs. KRF is flexible in mapping, managing requirements and linking it to business or social value.

3.2.2 Scale and Scope: Analysing the UK Retail Sector

Retailing is a crucial sector and major contributor to the UK economy, as table 3.1 shows. At a simple level, for the majority of consumer goods and services it provides the link between production and consumption. All of us shop and many have weekly if not daily contact with some form of retailing. The sector is also a significant employer, particularly in the youth and female segments of the labour force. Furthermore beyond the large omnipresent chains, exists a large body of independent businesses, which provide self-employment opportunities.

Category	**Retail Sector**	Whole Economy	**Retail as % of the Whole Economy**
Number of Enterprise	215373	1735386	12.4
Turnover £m (exc. VAT)	218936	1960686	11.2
Total Employment (000)	3050	24693	12.4
Approximate Gross Added Value at Basic Prices £m	49275	606228	8.1

Table 3.1: Retailing in the UK Economy During 2000

Source: ONS Annual Business Inquiry 2000.

Note: Whole economy defined as SIC sections C-O – Production, Construction, Distribution and Services (excludes Agriculture, Forestry and Fisheries etc).

Despite its significance, identifying the dimensions of the overall retail sector is quite difficult. Official government statistics in the sector are poor and inadequate and the commercial providers often struggle to produce meaningful comprehensive data. Often data sets purporting to measure the same thing do not tally. The most recent Retail Inquiry for example does not even contain an estimate of the number of shops in the country. In general terms, broad identifiable scale parameters include:

• Retailing has sales of £221 billion (current prices).

• It is comprised of over 215,000 businesses operating somewhat over 310,000 shops.

• Between 2.8 and 3 million people work in the sector which additionally contains a further 300,000 self-employed people.

Within this sector there are many dichotomies. The size of business varies enormously from some of the largest in the country (Tesco with sales of over £22.7 billion) and components of the world's largest business (Wal-Mart) to the local corner shop or even car boot sale stall-holder. A single shop could employ many thousands of staff (Harrods) or could be a one-person enterprise. Many staff are paid at the minimum wage for a few hours work, whereas owner-directors such as Philip Green can take in over £100 million for turning around BHS, or even 'normal' directors such as seven of the current Tesco board can earn over £1 million per year. For such a crucial sector of the economy detailed mapping of the sector is also far from easy. Analyses are traditionally conducted on product or store format based typologies e.g. the food retailing sector, or superstore sector or convenience store sector. Official data, produced by ONS, essentially follow a "line of trade" typology, and this approach pervades most of the reviews of the sector produced by consultancy and market research agencies. Although driven by the confines of data collection and presentation, any analysis of the sector should recognise that there is now a fundamental blurring of the "retail sector" in both horizontal (e.g. product line) and vertical (e.g. channel activity) dimensions.

The horizontal characteristics of the retail sector, as businesses have sought to grow and the physical size of outlet has expanded, traditional product boundaries have dissolved. Food retailers now no longer merely sell fresh and dry groceries but also retail electrical products, financial services, clothing and entertainment products (CDs, Videos, newspapers, toys). The boundaries of traditional "hardware" retailing now encompass garden products, furniture, and home furnishings. The widening of consumer demand and changing consumer expectations, increased sophistication of stock control and management information systems, plus the appearance of new product markets (e.g. mobile telecommunications) all involve pressures which have encouraged retailers to think and operate "outside" the traditional retail product boxes. Change in the vertical dimension of the retail sector is best illustrated by changes in who performs and manages channel tasks and activities. The traditional view of retailing has seen it as one function or activity within a distribution channel which links supply or production to demand or consumption. Tasks, activities and roles within this channel process were clearly delineated. Retailers were essentially passive, responding to the lead of brand manufacturers, and relationships between the various actors were dyad focused and transactional in nature. As retailers have used their increased organisational scale, and growing control over customer access and information to take the lead within the distribution channel, the management and organisation of tasks and activities has changed. Retailers have assumed a pro-active role in a demand (as opposed to supply) chain to manage the whole channel process. The need to meet a range of customer needs, desires and priorities has required retailers to manage costs and activities within the channel through a more co-ordinated, integrated approach to activities. This is well seen in issues such as the persistence or not of wholesaling, transportation or packaging businesses. The outcome is again a "blurring" of the traditional boundaries used to delineate retailing and assess its role and importance within the economy. This fundamental change process for the leading retailers, and generally for the retail sector as a whole poses problems in understanding the contribution that retailing makes to a country and in any international comparisons. For the UK at least, any statistical process is further complicated by the poor quality and quantity of official statistics.

Within the UK for example it is almost unfair to consider the 'average retailer' or to talk about the retail sector as a whole. Analysis of the sub-sectors shows that there are considerable variations within and amongst parts of the retail industry. Although certain measures are derived from publicly quoted data, even these figures are open to question. It is unlikely that floorspace and labour input are measured accurately enough to allow meaningful productivity analysis at store, company, sector or country level. Answering a question over the productivity level of retailing over time is thus very complex given the lack of adequate data and the changed nature of the business. Much will also depend on the exact dimension of productivity that is examined (space, labour, capital) and the way in which externalities and other impacts are accounted for. In short, we believe that simplistic concentration on headline macro figures, be their productivity or price, is wholly misleading and does not further understanding of the competitiveness of the sector or its constituents. This can be considered further by reference to international comparisons and showed how headline figures could be misleading.

3.3 The Conceptual Model

The view of two cultures, that of IT and the business, is in evidence in many organisations. The culture of system developers is typically technically oriented and is based on an understanding of technical issues (Price Waterhouse, 1991, 1992). In systems development this is reflected in a focus on issues such as the functionality of the system, its performance, the response rate, the type of programming language that should be used, etc. (Flood, 2000). On the other hand, the organisational culture and focus is rather different and is more concerned with business issues, individual issues and the system as support for business and management processes. To achieve business needs and objectives, the process of requirements engineering is recommended in the conceptual model as shown Figure 3.1 and is based on business needs.

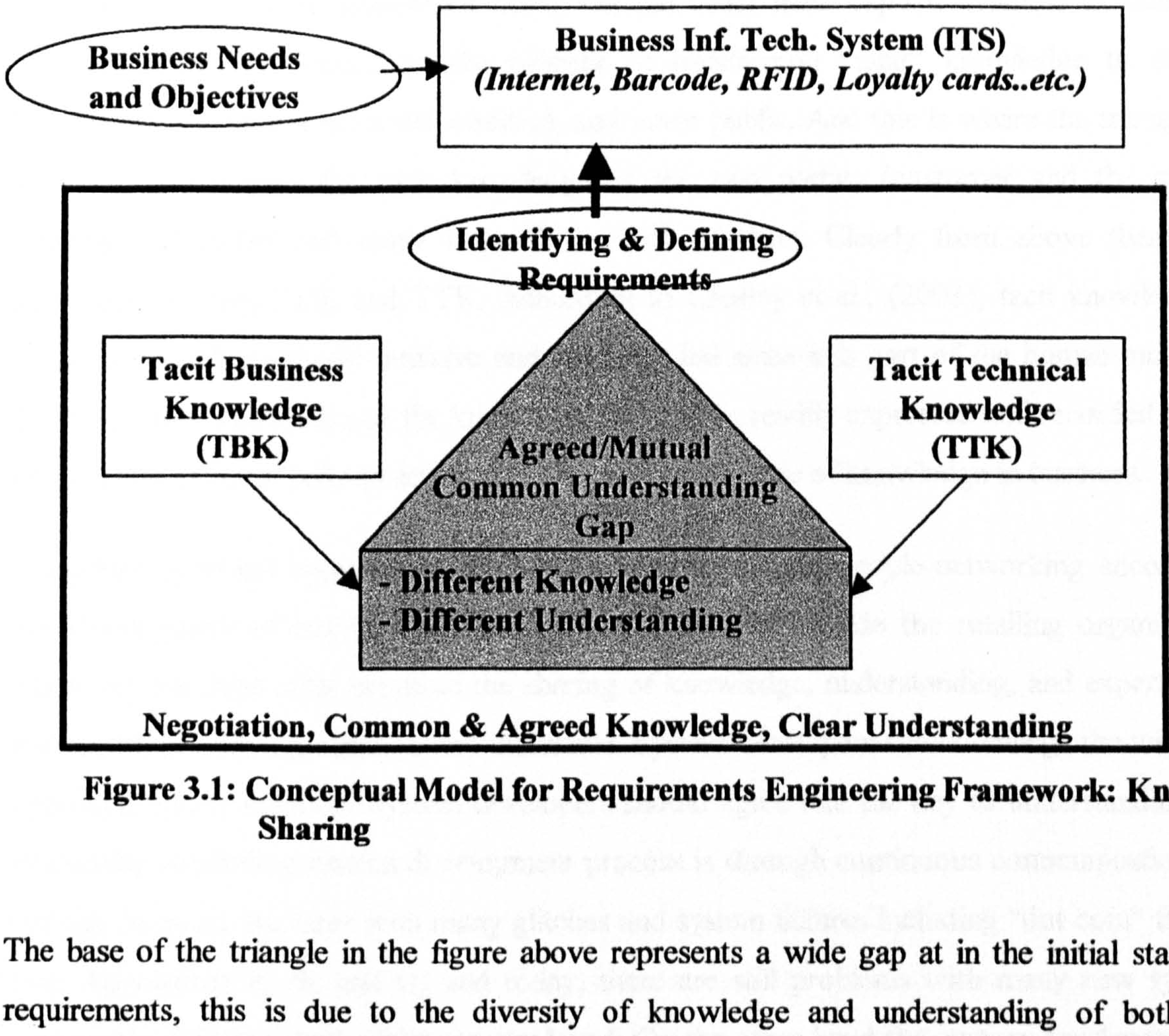


Figure 3.1: Conceptual Model for Requirements Engineering Framework: Knowledge Sharing

The base of the triangle in the figure above represents a wide gap at in the initial stage of requirements, this is due to the diversity of knowledge and understanding of both the customers and the system developer. This is due to the role of tacit business knowledge and tacit technical knowledge in determining requirements. The existence of different knowledge and understanding gaps lead to grey or non-functional requirements architecture within a system development methodology. Our aim is to narrow or close the gap which represented by the tip of the triangle in figure 3.1. This could be done by applying the tools and techniques used in the KRF model which are illustrated in chapter 6.

3.3.1 Match Knowledge Through Communications

Knowledge, whether tacit or explicit is an important factor in the development of the lifecycle of any product including the ITS.

Referring to figure 3.1, both the tacit business knowledge (TBK) and the tacit technical knowledge (TTK) are different, as the TBK can be defined as the business knowledge acquired over many years in someone's head (mind) that cannot easily be explained, is private unique to each person. TTK can be defined in a similar fashion as the technical acquired over a long period of time in someone's mind. On the other hand explicit business or technical knowledge can be defined as the process of transferring "tacit" knowledge to others. Knowledge has been articulated, codified, and made public. And this is where the strength of KRF lies in bringing the tacit knowledge of the two parties (customer and the system developer) together and made it public to both of them. Clearly from above there is a difference between TBK and TTK. According to Chaffey et al., (2003), tacit knowledge is mainly intangible, typically intuitive and not recorded since it is part of the human mind. He defines explicit knowledge as the knowledge that can be readily expressed and recorded within information systems, refer to appendix I for more on the role of knowledge in business.

Therefore, personal communication is important. Successful people-networking encourages the development of strong relationships both inside and outside the retailing organisation. These relationships often promote the sharing of knowledge, understanding, and expertise, to the benefit of both organisation and individual. System developers should change the way they approach system building. System developers should agree that the key to understanding and eventually controlling system development process is through continuous communications. In the last 50 years, we have seen many glitches and system failures including "dot com" failures (see Appendices A, B, and C) and today, there are still problems with many new systems despite the different methodologies employed. On the other hand the system developers have been exposed to greater knowledge tan ever due to the expansion in communications and communication technologies.

People-networking exercises and group discussion workshops will help participants in:

• Understanding organisational culture and its affect on IT and non-IT departments.

• Recognise those people-networking exercises that will contribute to personal success.

• Build, develop and sustain strong relationship within the retailing organisation.

In order to gain organisational business objectives, customers and system developers must insure that knowledge, information and understanding are recognised as business critical and acknowledged as so by all stakeholders. However, information about vital new system developments can take a long time to spread through the system development community. This means that in the past progress in system development has not been as quick as it could have been, "sharing knowledge is a good idea because important discoveries are happening all the time but very often system developers in other sectors won't have access to new information for months, or sometimes even years." Poor communication clearly slows down the pace of system development. With the new forms (tools and programmes) of communication system developers in part of the world to share their findings far more easily and quickly than they might have done in the past and as a result, we believe we could unlock the problems of system glitches and failures that much sooner. Knowledge is the currency driving business in today's competitive global market. To build a computer system that satisfies business requirements, you need to match the customer business knowledge with the system developer knowledge. To compete successfully, you should remember that knowledge grows with the business infrastructure.

Matching knowledge of business and techie need integrated approach that bridges the gap between business needs and technological needs available to meet them. Understanding business requirements in estimating at the detailed system development level are growing in importance, as ITS spend is looked at more and more critically by the business. In rapid applications development projects, for example, estimating is a critical process and the re-prioritisation of requirements are fundamental to approaches (methodologies), without which other issues cannot be effectively resolved. Business knowledge and requirements should be regarded as mission critical systems. Understanding and managing requirements will provide a quality approach to the management of projects. Also, clearly understanding requirements will provide a new experience of infrastructure and business applications projects.

3.3.2 The Importance of Managing Knowledge in Business Organisations

Tacit IT (technical) knowledge (TTK) strategy and tacit business knowledge (TBK) strategy are two side of the same coin, moving in the same direction to deliver the same goal and to ensure it remains profitable in the face of rapidly increasing competition and pressure to improve efficiency. Yelle (1979) suggested that barefoot KM is about involving the right people (management and users of different departments) to develop an authentic approach to future system development process that delivers strategy without confusing KM with acquisition of specific information systems (IS). It is important to be clear about agreed business strategy (why, what, where, when, and how) between the different users and participants. Creative brainstorming technique needs to be introduced for producing and building good ideas into the process. Also, an overview map of the process needs to be explained (see Chapter 6 -KRF section). The process of managing these knowledge assets creates a dynamic, innovative and agile company (Adler, 1990, 1991; Binney, 2001). Failure to manage information leads to information loss, lessons not learnt, work taking longer and trends going unnoticed. Implementing a knowledge management strategy needs an in depth knowledge of both the business needs of an organisation, and the underlying technologies. The emphasis will be on making connections between theory and practice in the following areas:

• Knowledge as a strategic issue in determining requirements.

• Groupware and collaborative learning towards better understanding of requirements.

• Barriers to learning and knowledge management.

Tacit Business Knowledge (TBK) and Tacit Technical Knowledge (TTK) are critical parts of any retail organisation's role (Computing, 2001). The shared knowledge of the organisation is its most important asset. Disseminating this knowledge is difficult to do in a timely, effective fashion (Argote, 1999). For this reason, communicating the knowledge management process through the development of a systematic knowledge system is indicated. An organised (KRF) knowledge and requirement system will entail the following benefits:

• Detailed, searchable information at the organisations' fingertips.

• Access to all information across the organisation.

Figure 3.2 represents the conceptual paradigm of the above conceptual model. Also, the diagram illustrates the relationship between system costs and the breadth and depth of the features of the proposed system. It is possible to have a low cost system meeting basic requirements with little possibility of adaptation and expansion, see 'lower features' Venn diagram. Alternatively, a 'higher features' bespoke system can be produced at much greater cost, however with possibly lower system lifetime costs and certainly much greater flexibility for expansion and development, in both cases the "lower features" and the "higher features", we can identify a strong correlation between system costs and the features of the proposed systems as a measure of customer requirement being satisfied by the ITS. Finally, there is the common generic software problem, as shown by the 'medium features' Venn diagram. In such a case a fairly fully featured packaged system is available that seems to offer excellent value for money. However, such packages often leave many important customer requirements unsatisfied.

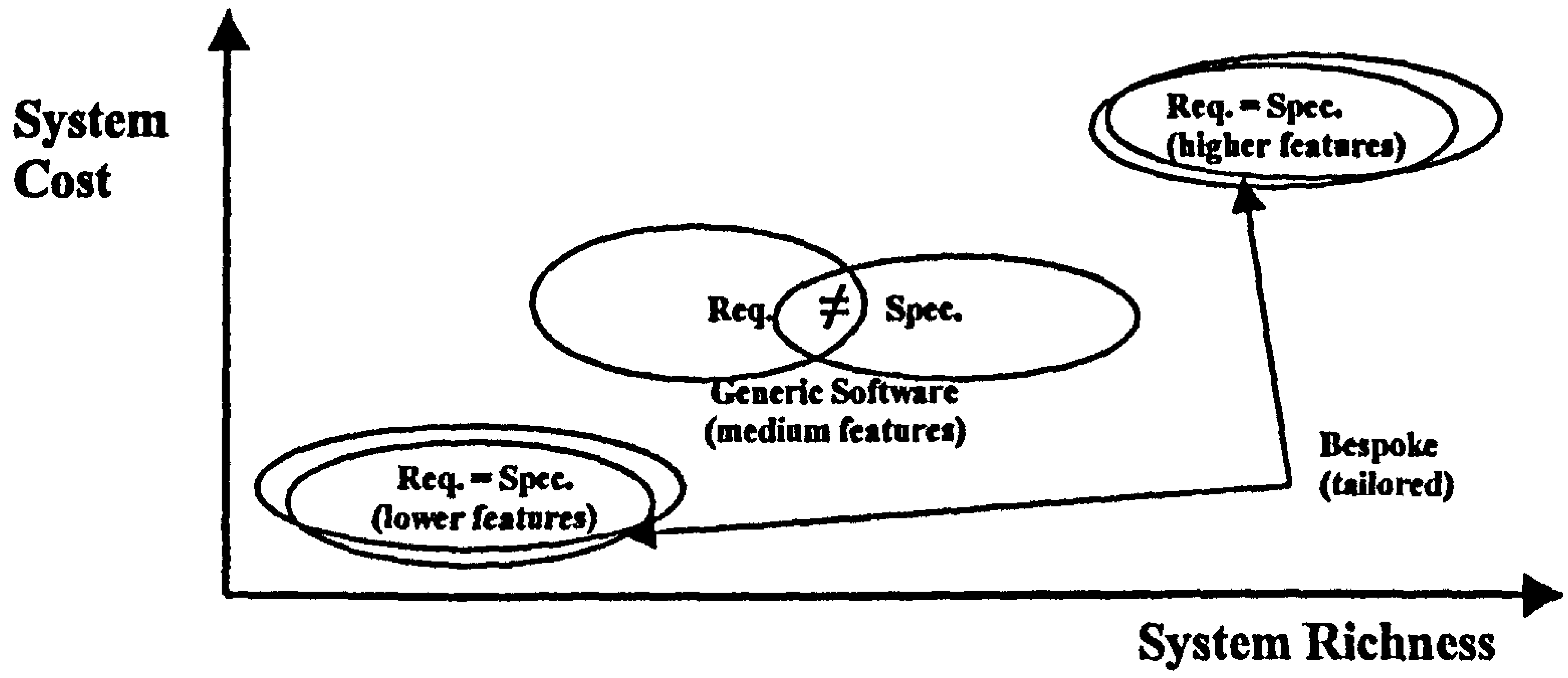
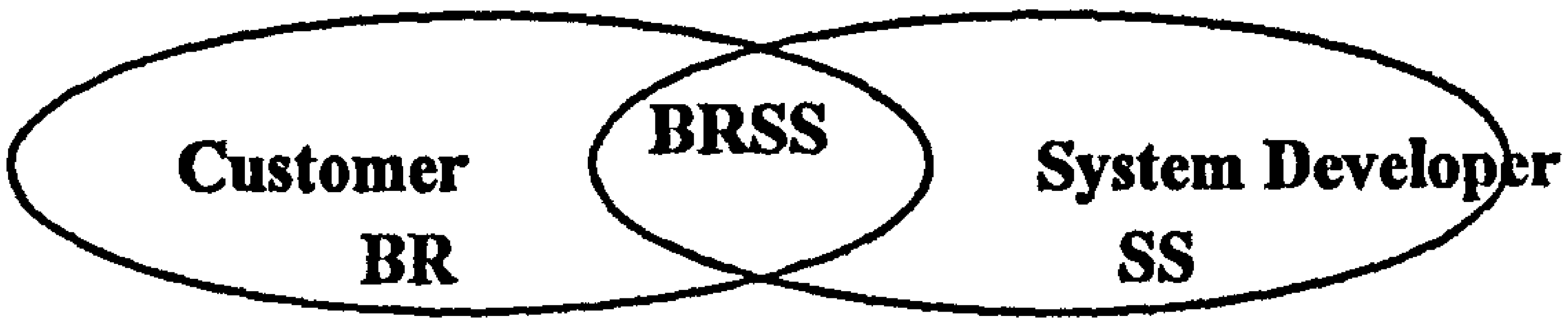


Figure 3.2: The Conceptual Paradigm of System and Customer Requirements Correlation

3.4 Analysis

The main domain of this research is to look at the problem of failure of big ITS projects, which they do not finish on time and on budget.

We can not claim that our approach will provide or deliver a sliver bullet solution to the problem of many ITS project failures, due the many factors involve in any ITS project. Our idea is simple but powerful which constraint on Customer Requirements (BR) vs. Developer Specifications (SS), the point of failed communications between the customers and the developers. We got our idea from observation to the way that some ITS products have been delivered to the customer. These days if you want to buy a PC, you can have it with MS products already installed on it because the producer assumed you need MS products without listening or discussing your requirements, therefore many people who bought PCs wanted the MS software to be taken off their PCs to give them the freedom to install what they want. From this simple real observation we start looking at the large ITS, look at the requirement and the specification, i.e.:



Customer Requirements ≠ Developer Specifications

Process of Engineering requirements (ER) lies at the heart of system development. ER is concerned with identifying the purpose of a system development, and the real world needs of users, customers, and other constituencies affected by a system development, and the capabilities and opportunities afforded by software-intensive technologies.

3.4.1 Looking Back at The Workshops

This research study provides an opportunity for researchers and practitioners to share ideas and experiences, describing novel research, and experience. The purpose of running the workshops was to tackle the problem of understanding the requirement which determined the initial process of creating (developing) a new computer system. The research results are, no doubt, a form of ideas and thought of both the customers and the system developers, these information have been inputted in a computer package namely called "Sphinx" which analysed the data and produced useful information.

These workshops consider the research results as a form of text, encouraging discussion about the nature of this dynamically created textual point-of-requirements. In the case of text representation of research results these tasks are combined to create a new information that describes and links other system requirements or needs. The workshops focused on the aspects of business knowledge and understanding business requirements of the proposed system. Many points have been considered in designing the questionnaire, which includes:

- How previously unseen questionnaire might be presented to people who involved in retail and ITS in retail?

- How people navigate through use of ITS?

- What are the informative role and value of the newly created information?

- Does the users/developer influence by the reading of the questionnaire?

- Does it change the focus and the meaning of the questions, as readers perceive them?
- Are there any emerging questions or understanding conventions within system requirements and among system contributors that can be used in order to facilitate discussion through research results (e.g. naming use of paragraph arrangements and use of lists and preferred methods of methodologies list ordering).
- Grouping of results.
- Labelling of questionnaires of different groups.
- Creating hierarchies of results.
- Comparisons between customers & system developers perception of results.
- Issues of results refinement.
- Similarities detected between results.

Given that requirements engineering is a critical determinant of the quality of the final system, and given the size and complexity of the current generation of software development projects, the area has attracted increasing research attention. In recent years there has been a movement in HCI and requirements engineering that recognises the need for methods and models for studying work practice in order to inform the process of requirements gathering and the design of workplace technology. This move has been reflected in the development and application of a number of theories such as distributed cognition, activity theory and situated action theory, and also in the development of methodological approaches such as contextual design, scenario-based design and participatory design. The degree of interest in forging connections between studies of work practices and the design of technology to support work was highlighted by the level of interest shown in the many workshops held.

The workshops aimed to bring together participants from many business disciplines such as retail, consultancy (e.g. KMP, Pricewater house, Cooper & Lamberd), accounting and banking, to discuss the nature of one of the most frequently cause of system failures seen by business in recent years (Fielding, 2003; Chapter 2 and Appendices A and B- list of system failures). The goal of the workshops is to create an interdisciplinary community that is able to address issues concerning business system development. The workshop aimed at bringing together those interested in the theme to facilitate their future collaboration. The aim of these workshops is to generate a discussion about effective ways of using Scenarios to express requirements, including:

- Describing the structure of requirements as problems faced by stakeholders.
- Organising user and system requirements.
- Validating requirements, specifications, and designs from the start of the project.

3.4.2 Issues of Evaluation and Outcomes of Workshops

Our research results will address the wider domain problem of system failures and the narrow domain of clearly understanding, identifying and evaluating business system requirements. Also, limitations, how to assess and improve non-functional requirements. We aimed for gathering business and system developer knowledge to enhance and integrate our experience about developing successful and usable ITS in order to improve the options users need in business which includes the following:

- How results are read.
- Does experience change users perception?
- Different users - different perception?
- Large scale case studies.
- Task-specific case studies.
- Commercial applications.

Based on our past work and a critical assessment of other approaches and systems, we are tackling the challenges now faced by what we see as the limiting factors for future collaborative human-computer systems. We are developing new approaches to support distributed cognition in which human processes such thinking, working, learning and collaborating are redistributed in new ways among stakeholders, and their physical and computational artefacts when these are used as media for collaboration. Collaborative human-computer systems need to be rethought in the context of the wicked nature of most problems confronting society where the human processes above need to be supported. We have been developing the Environment and Discovery Collaboratory (EDC) as an integrated physical and computational environment representing the convergence of simulation games, action spaces, and reflection spaces. The EDC is based on new conceptual frameworks such as creating shared understanding among various stakeholders, contextualizing information to the task at hand, evolution of system through use, and creating objects-to-think-with in collaborative design activities which take place around the table and beyond.

3.5 The Stakeholders

This thesis looks mainly at the business requirements and the business operation attitudes (internal customers) towards system development since they are stakeholders. They may also straddle other stakeholder groups. Within a retail organisation there are many complex groups of stakeholders often with competing if not conflicting demands. These can be simplified in to the list that follows:

- Headquarter of a retail organisation (it could be national or multinational).
- Executive of a retail organisation.
- Regional Offices.
- Head of an IT department and Heads of non-IT departments (e.g. Personal, Marketing, Finance, ..etc.).
- IT members of staff.
- Non-IT members of staff (internal customers).
- External Customers.
- Suppliers.
- Professional (including government regulating or non-government) bodies.

- Academic Institutions (relation through R&D).

3.6 The Internet Adoption in Retail

The internet technology is widely considered to be one of the primary factors behind the rapid economic growth of the late 1990s and contributing for transforming the way many retailers and financial organisations now conduct business. In part because of the internet's growth, the retailing sector spending on ITS rose from $142 billion (£95 bn) in 1993 to $233billion (£155 bn) in 1998 (Margherio et al., 1998). Despite the importance of the internet, however, a surprising number of retailers and financial sectors still had not adopted this technology, even several years after its commercialisation. Recent research in the IS and economics literatures has emphasised how prior IT investments and new forms of emerging organisation structure may be complementary with investment in new technology (Bresnahan et al., 2002). In this chapter we examine the importance of such investment and the returns to adoption simple and complex internet technologies. This research study makes important *contributions* to two fields of research. First, it represents a contribution to the *literature on the implementations of ITS in retail* by developing and testing unique hypotheses. We explore the possibility that recent ITS investment can reduce the returns to adopting new technology (Raymond and Pare, 1992; Swanson, 1994), thereby leading to complementarily between recent ITS investments and adoption of new technologies. Moreover, by observing the adoption trends of geographically concentrated and dispersed organisation, we examine whether the internet helped organisations to reduce communication and co-ordination costs created geographic distance, a result that would suggest the presence of positive relation between geographic dispersion and internet adoption. Second, this research work contributes to the literature on *commercial (retail and finance)* internet adoption. Prior research has studied the development of the internet's technology with out the emphasis on practicality.

3.6.1 Opportunities for e-Commerce

At the end of 1995, there were over 300 retail sites on the web based within the UK, according to the 'UK-Yellow Pages' services UKDirectory (1996). These varied from independent operators, such as Austin Reed, Toys R Us and The Body Shop. Sixteen virtual shopping centres opened, including Barclays' BarclaySquare, and London Mall. Compuserve opened its customised non-US merchant service in the form of the UK shopping centre.

Tenants included Dixons, WH Smith, Tesco, and Virgin stores. Estimates suggest that the BarclaySquare site received more than 200,000 visitors between its opening in May 1995 and March 1996. Sainsbury was on record, believing that home deliver would gain between 5-10% of the UK food market in the long-term (The Times, 1996). According to Cope (1997), other food-store retailers followed suit but have no concrete plans for such a service- few are ruling it out. At the time of writing, namely late 2003, most food retailers had an internet site. In 2002 the UK arm of Chemists and the leader in sales of health and beauty products in implementing a new customer relationship management (CRM) system. Boots is using CRM system which will save its Wellbeing online service £160,000 a year (Nash, 2002). In the past, Wellbeing depended on outsourced campaign management and customer services. But the infrastructure was not sufficient to service increasing customer needs in addition, analysing data about what the customer were buying did not work. The aim of the CRM venture is to improve customer service and provide targeted special offers.

According to Kotler, et al. (1996), goods sold worldwide across shop counters in 1996 was worth over $5 trillion (£3.33 trillion). Looking ahead, there are a wide variety of experiences and opportunities offered to retailers through internet sites. Tesco was the first supermarket to develop home shopping via the internet and has introduced it into six trial areas. For example, Tesco spent between £10 and £20 million to set up its ClubCard scheme, a sum new entrants find daunting. Such costs have even discouraged Asda from going down the 'loyalty root', preferring to invest in high margin items such as 'George' clothing brand (Richard et al., 1998). Tesco's site took six weeks from concept to full implementation, involving around five persons. This work includes the efforts of their IT division, the business information technology (BIT) group who designed the 'look' of the internet superstore and Microsoft consultant services (MCS) who provided the expertise in the merchant server application. Customers can use the Tesco direct website, which sells more than 22,000 products, the same as a normal food-supermarket. ClubCard holders shop on-line in the virtual superstore and have the goods delivered to their home for a £5 charge. Sainsbury estimates that about 20% of its 12 million customers a week are interested in some form of "e-shopping".

3.6.2 Global Retailing in the e-Market

Retail organisations and corporations are experimenting with new ways of structuring their business and IT activities to better address the needs of their customers. The new models are more flexible, but pose real problems for the unwary (Garrahan, 2004). The modern technology on one hand is about empowering the external customers to find and access information on products and services while reducing the need for staff assistance or queue. On the other hand, technology helps a retailer target products at the external customers to connect them to the latest information on products and services, while increasing brand awareness and influencing current, impulse and future decisions via data mining.

Broad changes in today's retail business are pushing retailing away from traditional models of organisation (Gabriel, 1996; Barnes and Hunt, 2000; Brynjolfsson and Urban, 2004). Customers have been global in scope for decades, but are now demanding more offerings and different tastes. Second, new kinds of retail enterprise have emerged that compete globally in one product area rather than attempt to provide a broad product line (Figure 3.3). Future retailing might be done by self-shopping via browser in the shop, kiosk, self-checkout, and hand held device; or via the internet. Modern retailing technology contributes to extended range (stock every product in every variation in every store), loyalty schemes (a retailer to communicate membership benefit in a more effective way) to increase customer satisfaction, loyalty, delivering better value for money, and reduction in personnel and training costs. It has been proved for the last decade, that modern technology in retailing has led to increase in sales, improved customer service, loyalty and loyalty cards have grown; and customers enjoying shopping in stores physically and in the cyber-space! Examples of the above can be seen in John Lewis, Marks & Spencer, Co-op, Orange, and Easy shop.

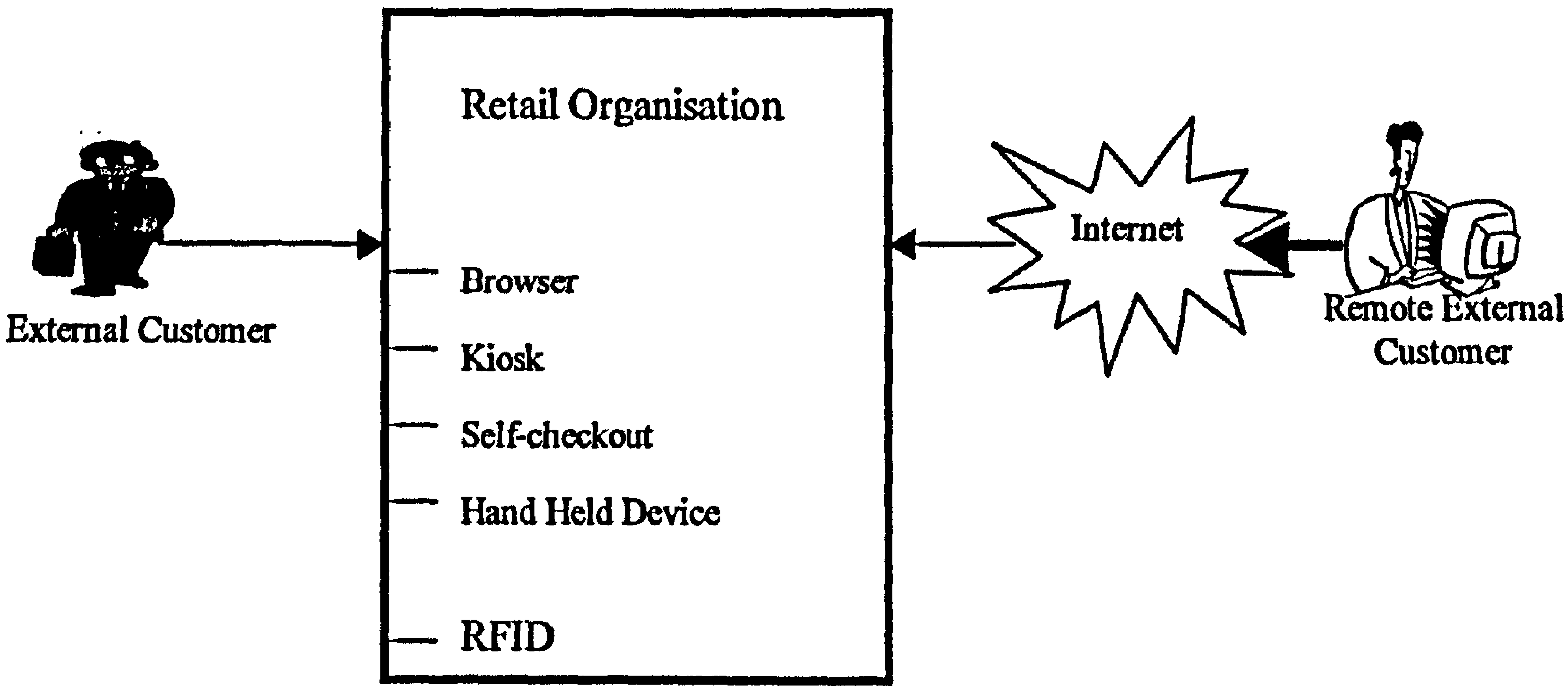


Figure 3.3: Future Retailing

Third, competition has intensified in traditional and "e" retail business cores, leading to shrinking margins and low growth rates. Many retail corporations have started to look towards value-added services and financial products they can sell alongside their traditional products. The sales on the internet count to 7 per cent of all retail sales in the UK and this figure will surge to 10 per cent by the end of 2004 (Nuttall, 2004). According to Swann (2004), in the United State the retail sales via the internet jump to $17.2bn (£9bn). The figure shows 25 percent increase on the same period in 2002.

What is the best way of meeting these new demands within a traditional retail corporate structure? The usual approach is to put in place informal or temporary coalitions rather than create entirely new arrangements. To manage a global customer in retail, for example, a first stage would be to appoint a global internal co-ordinator of all different businesses that sold to the customer. And if that was not sufficient, a cross-business team would be created with representatives from each department. Such structures are usually kept informal, but they overlay all existing structures. Espoused by such organisations as International Business Machines (IBM), Hewlett-Packard (HP), Citibank and Electronic Data System (EDS), a new model has emerged that attempts to satisfy two needs simultaneously: the need for integration between country or sector divisions and the need to create higher value in relationships with customers. Its central feature is a clear spilt between the front end (customer demand) and back end (provider/supply) of the corporation. The structure of the customer-oriented front end varies from case to case, but typically it is divided first into customer sectors, with specific global customers within that, and then with countries as a secondary line of reporting.

The front-end/back-end structure may be leading the effort to add value for customers, yet it also has a number of problems. This can be explained using the two practical examples in the following paragraphs:

Following the success of its global services business in the early 1990s, IBM developed a front-end/back-end structure. It would sell whatever combination of products and services the customer requested, whether that meant sourcing the products from inside IBM or selling competitors' machines. Product development units could sell directly to customers, but they could also function as internal suppliers to the company's service (financial consultancy) units that serve industry segments. IBM centralised the management of this front-end/back-end relationship, establishing a finance centre to manage the "financial consultancy" business, internal transfer pricing, and regional leadership groups that focus on resource allocation.

In the second example, HP has existed for most of its 60-odd years as a highly decentralised company, with as many as 83 units responsible for developing and marketing its products. Customer relationships (CR) were managed through a global sales organisation, split by country first, and overlaid with global account management structure. This structure helped to create strong managers and impressive record in new product development. On the other hand, customers faced numerous sales and marketing staff, and the company was so focused on projects that it missed the boat on large initiatives, such as the development of company-wide internet strategy. When Carly Fiorina became Chief Executive in 2000 she quickly moved towards a customer-focused structure. The result was a structure with two back-end divisions developing computers and printers, and two front-end divisions focused on corporate sales and customer sales. The new structure has had mixed views. Many HP executives enthuse about the success, and say that modifications are helping to simplify the structure and become more effective. Others are less positive, saying the new organisation created disorder and failed to win support. Some employees were also discouraged by their decreased lack of control and financial responsibility. Philips, Shell and Nestle also exemplify this division structure in the 1970s which gave enormous power to countries and regions, but made co-ordination of product development and manufacturing across countries very difficult. The global product division structure, adopted by Matsushita, General Electric (GE) and many others had the opposite characteristics, clear accountability for production assets worldwide but little sensitivity to the differences in customer demands from country to country. Also, Country management is still of great importance in the developing world, where such things as government relations are central to success.

The front-end/back-end structure represents a solution to one set of problems, particularly the new demands companies are facing as well as the enormous complexity of their current technology-based structures/systems, and reconciling the inevitable legacy between them. It is too soon to say if the companies mentioned here have been successful with the front-end/back-end model, but it represents an attractive, if somewhat risky, approach to many multinational retail organisations. In the retail organisations, IT directors should concentrate on using ITS to reduce costs rather than pretending that IT can increase profitability.

3.6.3 The Importance of Information Technology Systems to the Retailers

The recent developments in ITS (traditional and "e" retailing) have provided both opportunities and threats to the traditional retailers. Hardware and software costs have reduced, and networking (wire and wireless) capability have increased sharply. A historical view by Barras (1990) noted the scale information systems investment by retail and financial sectors. He found that by 1975 the industry accounted for 50% of all UK computer mainframe installations, and between 1975 and 1981 the growth rate of total banking systems investment approached 20% per annum and a recent survey by Morton (1996) found that spending on ITS by banks equated between 20% and 25% of total business costs. A more recent article by Nairn (2003) found that spending on ITS in retail equated to 25% of total business costs. Since this review the centrality of ITS to the business operations of the financial services in particular and the retail sector in general has continued to accelerate.

Many retailers emphasised how ITS has developed into a strategic issues because it is used to increase efficiency, cut cost, deliver business objectives and goals, link diverse locations, streamline business processes and enhance customer services. Despite the growing importance of ITS and the large sums of financial investments, Currie (1995) found that IT departments are still regard merely as support functions and not as part of the integrated business strategy of a retail organisation. This finding confirms the assertion made in Chapters 1 & 2 that the retail sector constitutes an important example of fast technological change to study (Voyle, 2003e; Nuttall and Pesola, 2004; Watson and Thomas, 2004) because of its position as the leading investor in new technology. The size of its domination also means that findings from an industry study have a wider relevance in the context of modern IT/IS change in the new economy as a whole. The diverse range of systems which have evolved to handle different business processes in a retail organisation were often technically incompatible (e.g. Sales department vs. IT department). It was therefore impossible to assess whether a particular internal customer relationship could be extended to other process. For example, the development of "middleware" technology in the late 1980s allowed disparate systems to be linked for the first time, facilitating the extraction and analysis of customer data, which could be used to evaluate relationships and improve business decision making. It is only recently that the retailers have had the capacity to utilise their technology to its full potential, and it remains to be seen if the process can be effectively managed. The retailers will need to make the most of the opportunities presented by this situation if they are to overcome the competitive threat from industry newcomers that was described in above two sections.

3.7 Conclusions

This chapter illustrates the diverse range of IT/IS and ITS failures that is taking place in the retail sector. It begins with a review of the development of the UK retail sector, with the aim of placing the theoretical issues raised in the previous chapters in the context of specific sector to be studied. This material is largely taken from the secondary sources and the author's own knowledge which was accumulated during a seventeen years period of full-time employment in the UK. The retail organisations seem to be utilising IT/IS opportunities to devise innovative products and radical delivery channels of products and services. The more powerful retailers have taken an increasing degree of control over the elements of the traditional retail and the e-retail mix. Well informed and appropriate retail decisions require the availability of comprehensive, timely and accurate information. The development of many IS including the EPoS systems represents a major step towards better customer and product information for operational and marketing decisions. Internationally agreed barcode systems have developed alongside the technology for capturing customer data at the EPoS and scanning, these two systems can provide a wealth of data and information to assist distribution, buying, replenishment and marketing decisions, provided that these data are assimilated into an effective IS. Therefore, aspects of customer needs can also be enhanced, but care must be taken to avoid higher and unreal expectations.

In summary, the problem of ITS failure in retail to be investigated that the difficulty of translating IT/IS opportunity into increased market share is related not so much to technical failings, as the way in which requirements is conceptualised and managed within adopting organisations, this was illustrated by the conceptual model and the identification of TKB and TTK. It is hoped that the research study will lead to an advance in knowledge of how requirements may be better conceptualised, understood and managed.

Chapter 4 – Research Methodology: Finding Out

Summary

This chapter outlines the research methodology and the research methods that were used to address the questions raised in this thesis. It begins by describing the problems encountered in obtaining access to the retail organisations for interview purposes. The chapter then considers the merits of using multiple questionnaires and sources, and testing in multiple case studies in this way, and explains why the approach is particularly suited to retail sector research.

The chapter goes on to explain how primary data was collected by means of a series of semi-structured questionnaires, telephone calls, and interviews with senior managers from both business and IT departments who participate in various ITS projects. Finally, this methodology is transformed into a protocol, which acts as a data collection instrument where data are elicited from multiple questionnaires and tested in multiple retail organisations. The business organisations studied include both traditional UK retailers, newcomers, financial organisations, and software development industry, which enabled the major issues raised (system failures, requirements, knowledge and understanding gaps) in the literature review to be tested and comparisons made across different IT/IS projects and organisational boundaries.

4.1 Introduction

This chapter is concerned with the methods used to collect or generate data and discussion on the limitation anticipated as well as problems encountered plus steps taken to overcome them. This research study was designed to examine the efficiency of capturing business requirements in the retail sector and was designed to examine the implementation of a business-IT led approach to overcome ITS failures. The roadmap of this chapter will describe the research design and the way the chapter has been organised into the main following sections:

- Research methodology; definition of the problem and research design.
- Sample selection.
- Instrumentation, i.e. questionnaire design and interviews.
- Data collection and brief analysis of data collected.
- Limitations.

The chapter goes on to describe how the case study material collected and analysed by the development of "grounded theory". This approach is a rigorous method of qualitative data analysis devised by Glaser and Strauss (1967) which uses comparative analysis of specific cases to synthesise new theories from case study data. By comparing and contrasting the research findings from a number of cases with the results of earlier studies in the system failures, it was possible to evaluate the range of possible explanations for clear requirements which contributes to ITS productivity (Myers and Avison, 2002). Each alternative theory was assessed in terms of the degree of individual project success or failures that ensued in the various cases. In contrast, and as stated in chapters 1 and 2, earlier studies have tended to focus upon individual examples rather than attempt to evaluate a range of possible explanation for the smart and clear requirements on ITS outcome. It is hoped that this method will lead to a broader understanding of the complex issues involved than has been the case in the past. Appendix F provides a specimen letter requested initial interviews, the names and titles of all the interviewees listed in Appendix E and a sample interview transcript which included in the analysis (Appendix G). We can say that system developers are technically-orientated investigators of how a computer system works. In most cases, the developers of computer systems miss important aspects of work activity, especially those which are facilitated by social interaction, or those which are not obviously directed towards the goals of the work. The reasons for this research work and approaches used in this study are thought to arise from the outsider's perspective of the investigator who observes the work processes and then attempts to describe them in terms of his/her own models and vocabulary, for example in the language and concepts of systems analysis, or business process re-engineering. Furthermore, they are often incomplete, focusing on those aspects of the system which are most relevant to the observer's preferred model and solutions, e.g. the introduction of a computer-based information system.

4.2 Definition of the Problem and Methods

The literature review and analysis referenced and presented in the previous chapters indicate that this research is based on the rationale that many IT/IS projects have failed mainly because of lack of communications between customers and system developers, sometimes lack of communications between the different outsource parties, complex data quality and data integration issues. Essentially, there are two parties for investigation; the first party is customer and the second party is the system developer.

The topic of IS failure is sensitive in that implementation of certain new ITS and technologies could render obsolete the entire structure and knowledge based upon which careers have been built and on which peoples' jobs remain dependent. According to recent report by Computing (2003a) the ITS's deals that Whitehall has struck since 1997 totalled more than £4.5bn, this will increase to £12bn within the next two years. A part of the research study took place during the hype of the Y2K problem of which the Cabinet Office justified the £380 million spent on government IT systems, the very people in charged with ITS development often have a vasted interest in preservation of the status quo, so great care needed to be taken. Phillips and Pugh (2001); and Bell (2001) emphasised the importance of obtaining the backing of a reputable academic institution in these circumstances to facilitate access. The hypotheses developed by listening to what the research participants say (see chapter 1). The method involved in developing hypotheses after the data were collected, is known as hypothesis-generating and uses two basic principles: (1) questioning rather than measuring, and (2) generating hypotheses using theoretical coding which available on the Sphinx package software. Research participants were the source of knowledge as the business people are experts in business and the system developers are experts in ITS development, i.e. both parties are experts in their areas which are being studied. This methodology questioned the research participants about their subjective experience and generated hypotheses from their answers. Using data analysis procedure called theoretical coding it was possible to develop hypotheses based on what the research participants said. Qualitative hypothesis-generating research involves collecting interview data from research participants and then using what they say in order to develop hypotheses.

4.2.1 How the Research Started

The Financial Times (Financial Times, 1997) is a newspaper highly regard by the City analysts, in fact they consider it as the bible of the City of London, was a good starting point to pick up the retail organisations and details of retail organisations were extracted from "Retail and General section"(The London Share Service -last two pages), see Appendix E. Details of who managing what and which department were gathered first from contacts who are colleagues, professional and postgraduate students taking Master or MBA degrees at the Westminster Business School which is my work-place. The other important source was the *"Shopping Centre and Retail Directory, 1996 &1997"* which was *"The Source"* of names of people, their job positions, turnover of the retail organisation, number of employees,..etc. At the time, to me, it was like finding a Goldmine! These retail organisations can be found in both the Financial Times and the Shopping Centre and Retail Directory under the following headings:

• Financial Times: Retail Food; Retail General.

• Shopping Centre and Retail Directory: Retail Companies.

The area of Retail was identified as the area of study due to many factors of interest. One of the main factors is that retail makes an extensive use from different information technology systems (ITS) they employ in many of the areas in their daily use such as:

• Questionnaire design and refinement: data collection of their product, services, and external customers' habits.

• Budgeting and financial forecast.

• Personal and Human resource.

• Sales and Marketing.

• Inventory stock.

• Planning.

• Advertising their brand.

More than one extensive face-to-face meetings have been held with members of HCI at UCL (see Appendices E and F) who are also members of the BSC-RESG to discuss my ideas and benefit from their knowledge and experience in the area of Requirements Engineering, the latter was a significant turning point in our research.

4.3 Research Design and Roadmap Procedures

This involves a review of the published literature, which enhances the development of understanding of investigative domain, intensive discussion with interested colleagues, interested parties. A model development process then begins, resulting in the development of hypotheses which can be seen in Figure 4.1.

4.3.1 Research Strategy

This research study has been conducted using surveys, observation, interviews and workshops. Since the research is on the ITS failures in the retail sector, substantial amount of data is needed from retail and financial organisations. These will be collected by the following methods:

• Published materials in books, journals, professional publications, websites and thesis will be referenced for additional data to understand the topic thoroughly and to design a model framework.

• Relevant retail and a financial organisations to the ITS failure problem will be selected and data required to meet the objectives will be collected using questionnaires, contacting their members be letters and phones and followed by interviews. These methods are selected because the actual data to improve the accuracy of the research and its outcomes.

• Workshops will be run over four month period to enhance the data collected by the methods mentioned above.

The framework for overall research process involved in this study is presented in Figure 4.1, as according to Rudestam and Newton (1992), one way of thinking about the phases of the research process is with reference to the so-called research wheel (Rudestam and Newton 1992). The wheel metaphor suggests that research is not linear but a recursive cycle of steps that are repeated over the period of time, for the purpose of validating the empirical stages with the theory from where the theoretical concepts stems out. Research methodology may follow three stages (Janesick, 2000). Similarly, the author has developed an empirical research methodology, which is based on the three stages namely: 1) research design; 2) data collection, and, 3) data analysis which are illustrated in Figure 4.1 and are analysed in following sub-sections. As demonstrated in Figure 4.1, and based on the literature review and analysis, a conceptual model was developed as identified in chapter 3. Aspects of the model will be investigated using empirical studies. Based on the needs of the empirical study, it was decided that the research design would use a multi-method research approach. This consists of a survey method combined with interviews/case studies. The justification for selecting this research strategy is given in section 4.2. The research design was then transformed into a plan of action or protocol.

Research protocols are a necessary investigation tool for a number of reasons, including:

• To put the task of data gathering in a manageable format;

• To ensure that targeted data is collected;

• To ensure that the research follows a specific schedule;

• To track the path at which knowledge was developed; and,

• It acts as a map that others may follow to achieve similar conclusions. This is especially needed where the issues under investigation are subjective, and where the research depends on qualitative and/or qualitative methods.

Within the *protocol*, qualitative and quantitative research methods were developed to gather data as required by the units of analysis. The method was in the form of an interview agenda (see Appendix D) for customers (end-users) and system developers (software engineer) questionnaires, which is a series of questions relating to the units of analysis, and designed to guide the researcher, during the structured interviews. In addition to the interviews (with customers (telephone interviews) and system developers (face-to-face interviews), data was collected through several sources like archival documents, minuets for meetings, consultancy reports, and the website of the organisations. The use of multiple data collection methods makes the triangulation possible which provides stronger substation of theory (Eisenhardt, 1989).

4.3.2 Research Process

To conduct the research process, the following are the stages taken;

- Stage 1, conducting a comprehensive literature review in the areas of system failures, requirements engineering and knowledge management, with a particular focus on data quality and data integration issues involved.

- Stage 2, developing the Conceptual Framework (a priori Model).

- Stage 3, conducting face-to-face interviews with IT/IS developers. The researcher's objective was to find out their proposed solutions for the above problems. The researcher also used and analysed data from their documentation and reports.

- Stage 4, conducting questionnaire/survey and telephone interviews with organisations that have implemented KRF Users. We have sent large-number of questionnaires (820 questionnaires) to customers and system developers from large and medium sizes retail organisations, ranging from retail sector to finance and public sectors, all within the United Kingdom and mainland Europe. Furthermore, the researcher conducted more than 180 telephone interviews with IT/IS managers of organisations that have answered the questionnaire. The reasons for the interviews were; either there were blank answers in the questionnaire, or the answer(s) were not clear. As well as the above reasons, conducting these telephone interviews is to complement the survey method, and help to investigate the above problems further.

- Stage 5: Refine the KRF. This resulted in a Frame of References for KRF Implementation within the context of data quality and data integration.

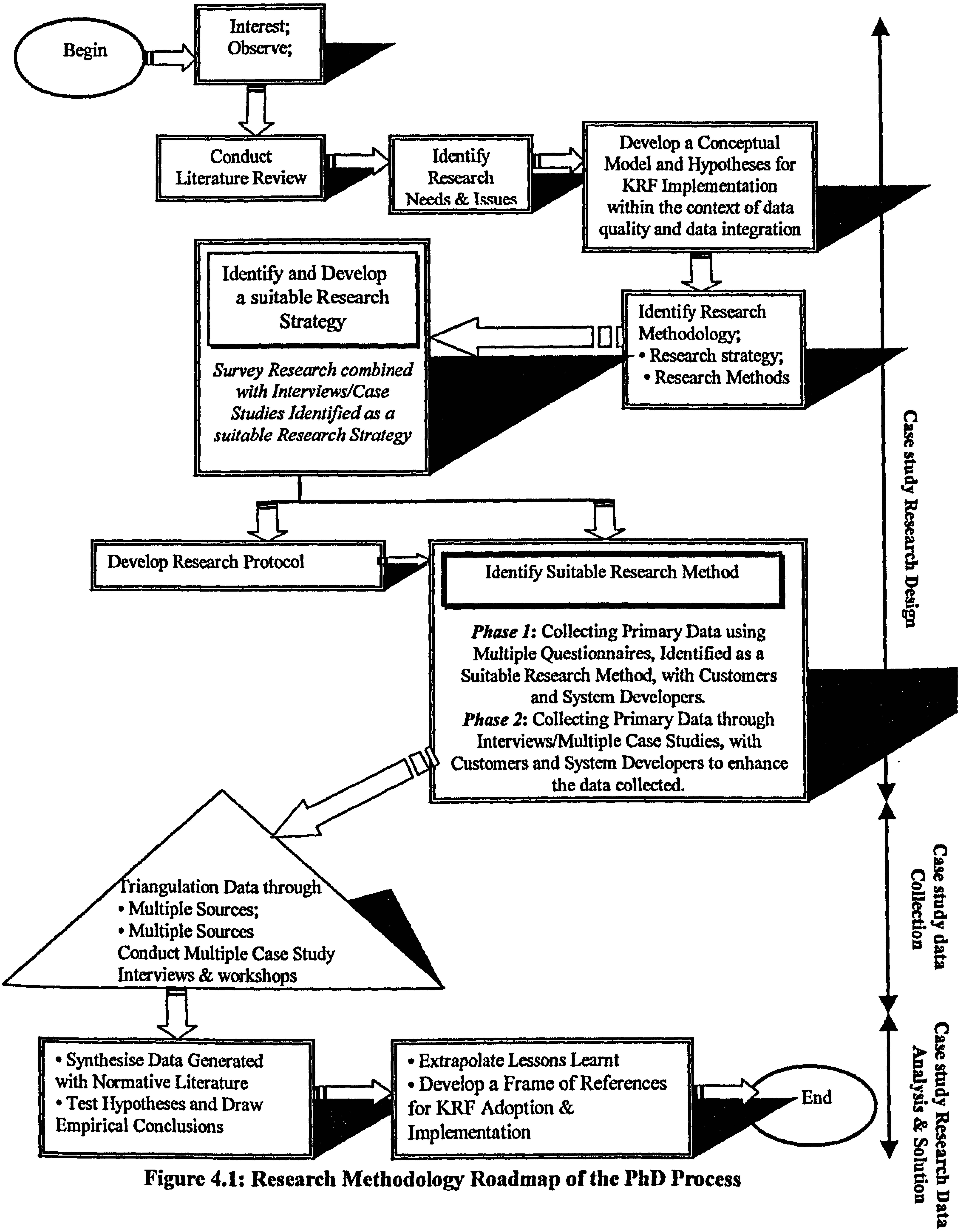


Figure 4.1: Research Methodology Roadmap of the PhD Process

A formal project management process has been utilised in this research study. This was considered desirable for a number of reasons, which might include:

• The research study is over a relatively long period of time.

• Other complicated time commitments might impinge on the research study.

• Tasks need to be carried out in a specific order.

• Time scale of responses is not under the control of the research study management.

• This is a new challenge for me.

It is desirable that this research study can be used as a Performa for future research.

4.4 Factors Affecting the Selection of an Appropriate Research Strategy

According to Galliers (1994) and Walsham (1995) among others that the selection of an appropriate research approach is a major task during the research design process due to the multiple methodologies to choose from. The purpose of this research study is critically examine the requirements stage and how it affects the development of business-lead ITS to achieve organisation's operations and goals. The objectives of the research study include the following:

• How business requirements influence the development of future ITS.

• How ITSs influence a retail organisation's operations and goals.

• Identifying bad practice in the developing of ITS which led to many ITS failures.

• Determining the countermeasures available to help the retail organisations mitigate such bad practice.

• Determining if adequate framework facilitate improvement of the development of ITS in retail.

The above objectives will be explained in more detail in this chapter. Although, many IS methodologies are successful but many IS system are still failing, several issues need to be considered before building a framework as mentioned in chapters 2 and 3. Furthermore, to investigate steps of other system methodologies or already taken to treat the problems and limitations of these methodologies. Then, critically investigate a new approach (KRF) and its role to improve the rate of ITS failures. Overall, the research study looks at the issues of requirements, knowledge and understanding gap, and system failures using IT and management approaches and tools with emphasis placed on investigating the efficiency and potential of a business-IT led approach in ensuring system success. Due to the scale of IS failures, multiple research methods, tools and techniques from IT and management science have been applied to multiple business organisations in both the retail and the finance sectors (Galliers, 1994). The decision to select a particular research strategy is a complex one, and should only be decided after careful consideration of a number of factors as indicated below by Galliers (1992, p.147).

"A research approach (or strategy) is a way of going about one's research, embodying a particular style and employing different research methods with which to collect data".

Two wide questionnaires, followed by interviews to enhance the quality of data collected. This followed by multiple case studies for testing purposes. The two questionnaires sent to customers and system developers. The extensive interviews with heads of IT and business departments exposed many problems in the strategy of acquiring an ITS. In many cases proper study or methodology have not been conducted, basic activities (such as involving everyone in the process) were not being applied satisfactorily and there were limitation to the business due to those mentioned basic activities. This research study of determining the important role the requirements plays in system development and to highlight the non-functional architecture of requirements in order to make it functional at the initial stage of the system development process. Taking into account the high level of daily dependence on ITS in the retail sector which cannot be ignored, the study is intended to find out the impact of requirements of the development of ITS, level of dependence on ITS, success or failure of such systems.

119 retails were surveyed, one store department and one financial organisation were chosen from relatively large organisations that have a big IT system to secure an adequate information. Each retailer performs the same functions, production, distribution, and stock control. The model (framework) developed, see Chapter 6 -KRF, was tested at the level of the senior business and IT work group rather and some part of the organisation, given that the relevant personnel (stakeholders) are not likely to be of the same business or technical

knowledge throughout a retail organisation (Abernathy et al., 1999; Alderfer, 1977; Ancona and Caldwell, 1992; Comstock and Scott, 1977; Daft and Lengel, 1986).

4.4.1 Multiple Sources and Multiple Testing: Hypothesis-Generating Research

As described in Chapter 1 and 2, the research study uses an analysis framework based on mixture of IT (Taguchi, 1986a & 1986b Seemann, 1995; Glass and Oskarsson, 1996; Lewis, 2000) and Management tools and techniques (Feller, 1971; Crosby, 1979a, 1984a & 1985; Juran and Gryna, 1988; Ishikawa, 1983, 1985a & 1985b; Wadsworth at el., 1986; Bierman at el., 1991; Easton and Jarrell, 1998; Yu, 1998; Winter, 1994; Anderson at el., 1995; Kettinger and Lee, 1995; Oakland, 1999; Wisniewski, M. 2002; Andreou, 2003; Kan, 2003).

At each stage of the data collection process, the data was analysed for meaning using the software package *'SphinxSurvey Plus2'* (Scolari, 2000). This analysis was conducted in order to determine subsequent data collection and to suggest further aspect of data to be collected from subsequent subjects (Pinch, 1977; Phillips and Pugh, 2001). This iterative process was undertaken by sending a second wave of questionnaires which were followed by necessary telephone calls to ensure that the final data collected provided as much meaningful information as possible. The quantitative and qualitative approach to research design leads to hypothesis-generating research that are quite different from those designed using the more traditional approach referred to as quantitative research that leads to hypothesis-testing research (http://www.nyupress.org/webchapters/0814706940chapter1.pdf.....)

4.4.2 Justifying the Use of Quantitative and Qualitative Research as Combination

Whilst considering which research strategy to adopt, Yin (1994) argues that the way the research question is stated will drive the selection of an appropriate research strategy. Yin claims that who, what, where, how many and how much type questions may require different research strategies depending on the extent of control a researcher needs to have on a contemporary event (as opposed to an historic event).

On the other hand research methods can be classified in various ways; however one of the most common distinctions is between qualitative and quantitative research methods (Myers and Avison, 2002). Maykut and Morehouse (1994) stated that quantitative research is founded on observations that are transformed into distinct units that can be compared to other units through statistical analysis. While, qualitative research mainly examines people's actions and words in narrative or explanatory ways, more closely indicating the situation as experienced by the participants. Myers (1997) reported that quantitative methods are well accepted methods, laboratory experiments, and numerical methods. Qualitative methods involve the utilisation of qualitative data such as documents, interviews and participant observation data, to understand and explain social phenomena. The case for combining research methods generally, and more specifically for combining quantitative and qualitative methods, is strong (Gable, 1994). Much has been said on the relative merits of qualitative (e.g. case study) versus quantitative (e.g. survey) research methods (Cook and Campbell, 1979). This has also received significant attention in the IS research methods literature (McFarlan, 1984). Attewell and Rule (1991) highlight the 'complementarity between survey and field work approaches to study the information technology', stating that 'each is incomplete with out the other'. Danziger and Kraemer (1985), same as Kraemer and Dutton (1991), reported the same statement, i.e. the complementarity between survey and field work approaches to study the information technology.

Attempts were made by contacting selected group of people, within the IT/IS departments of organisations that have implemented IS project. This has been done either by phone or e-mail, to arrange personal interviews. Unfortunately, some of the organisations refused to co-operate outright with excuses; either they are too busy, or they are not allowed to participate in this sort of study due to confidentiality policy of the organisation ...etc. Only 2 organisations agreed to have the interviews over the phone. However, these organisations agreed with the condition that the telephone interviews need to be a short one (no more than 15 minutes). Therefore, the idea of conducting personal interviews with system developers and customer (business department), using in-depth case studies was dropped, and it has been decided to use an alternative research strategy. The postal survey method was seen as alternative to accomplish the above task for the purpose of this study. For the reasons mentioned above, it was decided to use a multi-method research approach. This consists of a survey method combined with interviews/case studies, carried out in three stages. This approach is believed to help produce richer and more reliable results (Gable, 1994; Yin, 1994; Mingers, 2001a, 2001b & 2003).

4.4.3 Quantitative and Qualitative: Justifying the Use of Qualitative Research

Both quantitative and qualitative approaches were employed in order to yield new and exciting understanding about business requirements, system failures, and professional gap. However, a research study of quantitative and qualitative nature requires considerably more time and a tremendous burden to create new paths for analysis where previously no path had existed. A quantitative and qualitative preliminary study helped to, more clearly define population, and develop instrumentation more specifically. Multiple-choice questions were used to administer response from managers of organisations in the UK and offered a way to reduce the time respondents will need to complete it, thus increasing the number of completed questionnaires. Considerable care was taken to avoid limiting the sample size or getting a poor response.

This research is concerned with people's perception of the system failures in the UK. These issues inherently qualitative in nature that the study further, investigates aspects and issues in which context is of primary importance. This is, therefore important for the research methods, including data collection and analysis, to be designed in order to capture the contextual information that gives meaning and value to the issues involved, qualitative research has the capacity to do so. Neumann (2000) argues that quantitative research approaches may reduce the richness and value of contextual issues. Therefore, because of the suitability of both qualitative and quantitative methods, both were chosen for this research study to supplement the benefits of the other.

4.4.4 Determination of Population: The Access Problem to Retail

The study sampled retailers in the UK from a well-known newspaper "The Financial Times" and from "Shopping Centre and Retail Directory 1996 & 1997" (some names withheld for confidentiality). The rationale for this sampling plan was to evaluate the model with people (business and IT) operating in retail ITSs, and to then generalise results within the retail/IT sectors who are active in system developments. A research population can be defined as any group whose member's posses or share the same basic and clearly defined characteristics. It was anticipated that there would be problems of access to certain retail and financial organisations for interviewing purposes. Previous research by authors within a retail organisation was hampered by both an ambivalent attitude towards academic research and an insistence on confidentiality as stated by Graves and Ringuest (2002); Liu et al. (2002); Fielding (2002d).

The access problem at retail organisations was addressed by utilising personal contacts of the author to gain admittance in the first instance. As recommended by Jankowicz (1993); Johnson and Duberley (2000); and Carson et al (2001) an assurance of confidentiality was provided in that names of individuals and their organisation would not be quoted, and that the data collected would be stored in a secure place and not used for any other purpose than that specified in advance. It may also be necessary to limit the circulation of the completed research if it is deemed to be contain commercially sensitive data, although it is hoped that this strategy would only be deployed as a last resort. Buchanan et al (1988) recommended cultivation of informal contacts at middle levels of the organisation to form a network of potential source. In their experience access was facilitated by persistence and avoidance of "unreasonable" demands upon organisation time and resources.

4.5 Selecting Research Methodology and Questionnaire Design

Methodology is the way in which to go about researching. A particular subject could be researched using several different methodologies, for example comparative (comparison between two events/issues), experimental (decide from an outcome of any events), historical (using past data), and also using surveys and observations in all fields tend to overlap, or appear in combination. The following sections address aspects of the design of the investigation, including the selection of the quantitative method, the time horizon of the study, the choice of the particular case study, the unit of analysis, and the method by which respondents were selected.

4.5.1 The Questionnaires: Questionnaire Design and Refinement

Given the KRF model embeds complex human relationships between customer and system developer, we collected self-reported primary customer and system developer perceptions using two questionnaires. An initial structured one questionnaire was generated (contains 50 questions) which later modified and refined to become two questionnaires based on existing literature, feedback from earlier participants, the model's theoretical antecedents, face-to-face interviews with more than 40 customers and 40 system developers, telephone and e-mail discussions with gurus in the field of IT/IS. Putting the two questionnaires (customer and system developer) together took a great deal longer than I had anticipated and involved numerous drafts that were discussed with a number of different people. The final form is included in Appendix D along with the covering note sent to all the participating retail organisations, a selected list appears in Appendix E.

Two form of questionnaires have been designed to solicit relevant information about the topic researched from well-known retailing organisations in the UK. One type of questionnaire sent to the managing director of IT departments, the second sent to the managing director of business departments, e.g. accounting, marketing. It was intentional to make the two questionnaires relatively easy to fill-in while retaining the focus on the main issues of requirements, project management, and ITS failures so as to enable higher response level (a freebie was in-mind, a summary will be sent when the study is concluded to the persons who provide their details). Each of the two questionnaires included 19 questions related to various constructs discussed in this study (Appendix D). The questionnaires were pre-tested for content, scope, and purpose. The respondents were asked to comment on questions and to suggest other issues that could be considered. As additional tests for content validity, the questionnaires were pre-tested with ten postgraduate groups (MSc and MBA) and professional Courses at the Westminster Business School (WBS) of whom many of them in senior managerial positions working in both business and IT disciplines. The questionnaires were refined based on the feedback and initial analysis. The final questionnaires included 19 questions as mentioned above, which related to the various constructs were retained a long with other information that captured customer and system developer patterns, as it can be seen from the following sections.

This was an important element of the research study and the method used to obtain information about a defined problem so that data, after analysis and interpretation, result in a better appreciation and understanding of the problem- the effect of requirements in system development and professional gap. Questionnaires were planned, designed using Sphinx package software and sent to selected retail and banks by post covering a large geographical area in the UK. The questions were carefully worded and designed with only one interpretation where feasible for easy understanding. Systematic follow-up including visits in some cases were made to increase response to an acceptable level.

4.5.2 Basis for Questions

The questions fall roughly into two categories: involvement of customers in the requirement stage, information about the respondent and information about the use of and perceptions about information technology in the retail sector. The aim was to establish a general profile of the respondent and to understand their relationship with the information changes taking place in this sphere of their lives.

To maintain a focus on the task of data collection, a set of questions was developed. These questions are set for the researcher and not for the interviewees and act as a reminder for the researcher, concerning the data. This data is essential to be collected to investigate the effect of requirements in developing IT/IS. Interviewees are not exposed to these questions, but were used for consultation before and during the interviews to maintain some form of structure to the interview. Essentially, the main purpose of the protocol questions is to keep the interviewers (author) focus during the data collection process. The author had an opportunity to review key questions that the interview should address. For that reason four questions were developed to be asked of the interviewee and represent part of the questions, such as the one summarised in Table 4.1.

Question Number	Question
Q1	What are the factors used by the case organisations that Influence the decision making process for KRF adoption and evaluation?
Q2	What are the human, organisational and technical factors that are associated with KRF adoption?
Q3	What are the benefits, barriers and costs associated with above factors?
Q4	What are the evaluation criteria used by the case organisations during the evaluation of future IT/IS developments and KRF solutions?

Table 4.1: Questions addressed by the Empirical Inquiry for Customers and System Developers

4.5.3 The Questionnaire Seeks to Establish

Which areas are producing satisfactory benefits and to whom, those groups or individuals who feel that they are excluded from this process of change, IT usage amongst IT and non-IT members of staff. The questionnaire is deliberately designed in what appears to be a somewhat random way to avoid automatic ticking of boxes or pursuing a particular thought train that might influence the next question. Following the design of the questionnaire and its distribution I then set about the follow up process of some of uncompleted questionnaires. I decided that I would need to use software packages optimum analysis of the data.

4.5.4 Insights from the Questionnaires

The first bit of feedback really started when I raised the subject as a possibility with various members of the retail sector by phone (see Appendix E -list of surveyed retail organisations). These included Directors, Heads of IT departments, and Heads of non-IT departments, members of staff of IT, members of staff of non-IT departments (especially finance). They were all very helpful and enthusiastic, but clearly felt that they had had no input into the systems that they had had imposed upon them (in some cases).

The other pre-questionnaire insight was how varied and diverse the experience of information technology was and the lack of understanding about what it might be able to do. Initial indications from the questionnaire show a greater enthusiasm for increased relationship of customer's (non-IT) involvement in the system development process amongst those who have attained a higher level of education. Of those who completed the questionnaire there was also unexpected enthusiasm for IT failures. However, those that completed the questionnaire are probably the exception rather that the rule. The idea of providing details of project budget online was less popular than expected. Contrarily the number of people who indicated that they would contribute to the development of a system during the earlier stage (requirements) of the system development was higher that anticipated.

4.6 Data Collection

Data collection for this research study is a vital part of this research, on the other had it is very difficult to collect all the necessary data due to the nature of the topic of OTS failure and the reluctant of the organisation understudy due to the marketing intelligence and security reasons at the financial organisations.

The data collected through the questionnaires (IT and business personnel were targeted). In addition, the data collected for the study were largely from interviews conducted in person, some through workshops and on phone with selected respondents, as well as from material published by the retail organisations concerned. An investigation and analysis have been carried out on both the data and the problems identified in previous chapter. A model frame (KRF) was modelled to overcome the process of capturing functional requirements.

4.6.1 Data Collection Methods

Data were collected from both primary and secondary data sources (see also Chapter 5). To achieve this research study objectives, the researcher has conducted by use of both primary and secondary data. Information is collected mainly from the big retail organisation of the UK retail sector. Other sources include: emails from gurus in IS and IS failures areas, Internet, journals (including Harvard Business Review), books, professional publications (e.g. Computing, Computer Weekly and the Financial Times), conference papers. Furthermore, some part of the information in this study is collected from government and official statistics. Finally, the materials of case studies used are collected from annual reports of UK retail organisations on IT/IS projects.

4.6.2 Primary Data Sources and Collection Instrumentation

In view of the fact that secondary data provide incomplete picture to the research problem, primary data sources were utilised. In this case, the research study was designed, data collected, analysed and information summarised.

Two main instruments were utilised to structure the sample collection viz; properly designed questionnaires and interviews. The research was conducted by mainly posting the questionnaires, and followed by telephone interviews, asking respondents to take few minutes to complete the questionnaire and sometimes via e-mail. Also, interviews were conducted by face-to-face workshops at the author's work place over a period of three months. The interviews were both free form and semi-structured. Primary research to gather primary data and information for this research study were collected by way of:

- Questionnaires sent to relevant retailers, a self-stamped envelope was provided too to speed up responses.

- Sometimes the above was followed by a personal phone call or interview of either business or IT managing director who poses adequate knowledge of their departments.

- Workshops to gain more knowledge and understanding of both IT infrastructure and nature of business were ran for both professional and postgraduate students who are employed by most retailers in the one mile-square of central London. Also, these workshops played a vital role in testing the initial and the final Knowledge Requirements Framework (KRF).

- E-mails sent to gurus in the field of ITS failures were conducted.

Top Ten ITS Suppliers	1999 Revenues in £
1. EDS	1,450m
2. IBM	1,450m
3. ICL	825m
4. CSC	637m
5. Cap Gemini	635m
6. Andersen Consulting	609m
7. Microsoft UK	540m
8. Sema Group	521m
9. Oracle	519m
10. PriceWaterhouseCoopers	460m

Table 4.2 The Top Ten ITS Developers in the United Kingdom

Source: Mathieson, S.A., Computing 2001.

This study included interviews, surveys and analysis to determine what gaps exist in the development of ITS, and explores methods of improving the situation. Also, to determine what strategic-support capability ITS industry currently incorporates, and envisages for the future. To determine how IT/IS consultants view the strategic value of these systems. The survey includes some of the top ten UK ITS suppliers and consultancy firms, which are mentioned in the Table 4.2.

4.7 Data Analysis

The main research methods used in this thesis can be categorised into two types, primary investigation and analysis; and secondary data collection.

The objective of the overall data analysis was to address the researched *requirements* issue. The analysis techniques involved three steps: preparing the data for analysis- a form has to be manually generated, classifying the data- data has to be coded before transferring into the form and processing the data using 'SphinxSurvey Plus2' to find links and patterns. Publications and annual reports published by the organisations concerned were also reviewed. Classification of data involved the separation of data-items from each questionnaires and related interviews, and organising these items into common categories. Primary-level and secondary-level categories were produced as appropriate by the software package 'SphinxSurvey Plus2'.

4.7.1 Practical Primary Investigation and Analysis

Research conducted within two different retail organisations was used in building the KRF model and drawing conclusions about system development in the current business environment. The data collected by conducting a survey of which two questionnaires (see Appendix D, D1-D2) have been designed instead of the original questionnaire. The reason for the second two questionnaires was due to low return of filled-in questionnaires and the feedback. Also, the primary data collection was achieved through frank and open discussion with senior member of IT and non-IT department of the retail organisations in the form of "informal interviews" and through structured, standardised face-to-face interview "formal interview" (see Appendix D). The former were used to establish comfortable interviewing meetings and to assist with formulation of more focused questions by becoming acquainted with the organisations' existing processes and vision of the future, with particular reference to the system development process. The latter were necessary to allow the interviewees to provide complete answers without any limitations. Quite often the interviews would develop into in-depth discussions between the respondents and author. This was necessary to avoid any ambiguities in the answers.

The questions used in the interviews were based on the set of rules developed as a guideline for organisations in system development process (section 4.5). This facilitated the structure and scope of the thesis and served in keeping the work consistent. The analysis of the responses and the findings are summarised in chapter 5. Following the ethical practice and to maintain organisation's confidentiality, the names of the organisations, including the names of the participants have been excluded from the main body of this thesis. A reference of the information on the organisations concerned is included in Appendix E (all the participants were made aware of the research).

4.7.2 Primary Data Analysis and Interpretation

The focus of this section is on the analysis process of the data collected from the respondents. The information given was quantified with numerical scores and tabulated. The data come from a research study of large departmental stores and big financial institutions located in London and the greater London areas. The retail organisations have from 120 to 270,000 employees see Appendix E). Table 4.3 illustrates the different organisations that the questionnaires distributed to and their rate of responses.

• The total number of questionnaires administered to the retail-business and retail general departments was 820. Of the 820 questionnaires that were administered around 543 received of which 230 deemed were properly completed and returned of which the research based on. This represents 28% of total number of questionnaires administered. The rest were uncompleted.

The data collection process consisted of telephone interviews with the total population of 230 retail organisations in which some initial data collected, and permissions were asked to send two types of questionnaire to the business and IT senior management. Questionnaires were then sent to all retail organisations listed in Appendix E. One hundred and fifty six questionnaires were returned (some of them within two weeks of posting), others after one follow-up call was made to those organisations that had not observe the return deadline.

Eighteen cases either had only filled out front page of the questionnaire or missing information, and they were removed.

Organisation	No. of Questionnaires Distributed	Distribution Percentage	No. of Questionnaires Returned	Return Percentage	Respondent position in an Organisation
Finance	110	13	76	14	Chief Executive, Financial Director, Managing Director
Retail	445	54	288	53	Retail Director, Marketing Director, Commercial Manager, Operations Manager, Merchandise Director, Sales Director
Retail-IT & IT	190	23	134	25	IT Director, IT Manager, IT & Buying Systems Director
Public sector	40	5	24	4	Chief Executive, Director, Managing Director, Manager
Manufacturing	20	3	11	2	Chief Executive, Director, Managing Director, Manager
Other	15	2	9	2	Director, Managing Director, Manager
Total	**820**	**100**	**543**	**100**	

Table 4.3: Questionnaires Distribution and Response Rate

Using the business and IT management as the informants, the data that are not publicly available represent the management's view of the organisation and it's ITS situation. This view is particularly relevant in retail because the senior managers strongly influences the decision making process. Here, we follow the sampling strategy advocated by Seidler (1974), and Anderson et al (1995) by using the same type of key informant in all the sampled organisations, thus holding the sample bias constant across the retail organisations.

4.7.3 Secondary Data Sources, Collection and Analysis

Existing literature on system failures, requirements, knowledge and sociotechnical was reviewed for the purpose of establishing a ground of this thesis (see chapter 2). The most relevant information therein was interpreted and applied in a way facilitating the structural content of this research study. In addition, update news-release, professional publications and information found on the internet proved to be very useful in providing a clear picture of the current retail organisations and information technology environment. These consist of the sources of the information already collected by other and archived in some form. The secondary data sources used were mainly books, journals, professional publication (e.g. Computing, Computer weekly, Conspectus, Shopping Centre and Retail Directory 1996 & 1997), the Financial Times FT-IT review, online journals and internet web related sources to requirements, and cases of system failures (Fielding, 2003). These provided the opportunity to learn about what were already well established and what remains to be learnt or investigated (in additional to references list, see Appendices A, B and C).

As this work was designed for investigating perception of requirements, system failures, and gap of knowledge and understanding between business and system developer, responses were collected from a wide variety of sources. Then, the information and findings were combined within a single framework (KRF). Secondary research helped in defining the agenda for the primary research. The author would like to admit that to do the above was not easy.

4.8 Sample Selection and Sample Size

An important decision was to identify the location of retail and ITS development organisations where the research will be focused. To achieve the objective of this research study, investigations were carried out at several organisations, grouped into retail including banks (e.g. Marks & Spencer, Sainsbury, Tesco, and Abbey) and ITS developers (e.g. EDS, ORACLE, and Cisco). Researching on a wide range of business organisations and ITS developers was imperative in order to properly investigate business's (customer) perception of relevance ITS developed (system developer) to serve different retailing needs.

The sample size used in this research study was 820 retailers and including a number of IT professionals. Sampling involves systematically choosing a number of units to represent the population under study in order to minimise time and cost. Due to the size of the population, sample has been chosen from the Financial Times list of the retail sector (1996) and the Shopping Centre and Retail Directory (1996 & 1997) as it is seen to express the population adequately.

4.8.1 Sample Statistics

Contact established with some of the retail organisation prior to sending the first wave of questionnaire to have a feeling to what they think about our research. The response we got is that the area we research is of interest to them. The first questionnaire contained thirty questions for both the customer (non-IT departments) and the system developer. The response was not encouraging. Contact mainly by telephone followed in order to have a feedback with regard to the non-respondents. Two reasons we were give, the first is that the questionnaire was too long, they prefer maximum of twenty questions due to the tight time the different managers have at the time. The second (which we totally agreed with them- hence it is good to have a feedback to make modifications) is that it is better to design two questionnaires to avoid confusion of business issues and technical issues. As there were a few responses, these were disregarded and not included in this current study. A few questions have been taken out and new ones add one to the two new questionnaires. The two forms of questionnaires (see Appendix D, D1-D2) have been sent out in two different periods over two-years time, one to the business experts in the retail organisation and the other to the system developers within or those outsourced by a retail organisation. In total 820 questionnaires have been sent out. The responses were overwhelming, we received some of them with weeks. We had a few who refused to fill-in a questionnaire including the famous Microsoft.

Most of the customers and the system developers responded to the questionnaires within short period of time. There were 543 completed questionnaires. Some respondent returned the questionnaires blank (including Microsoft UK due to confidentiality). After eliminating incomplete questionnaires, 230 were received. Of these responses, 53 were rejected because of scattered and substantially incomplete data.

4.9 Preparation for Interviews

This section describes the interview technique, the preparation for the interviews and the interview questions. Preparation of respondents initially began, in some cases, through personal contacts followed by sending the first wave of questionnaires. In other cases an initial telephone and e-mail in which the purpose and style of the research was explained. This initial contact included preliminary discussion of the nature of the work performed by the organisation. Once an appointment was made, a common questionnaire headed by a short letter explaining the study and outline the areas of particular interest was sent to the interviewee as shown in Appendix D.

4.9.1 Interview Questions, Interviews and Techniques

As mentioned above, the interview questions were based on the theoretical material and facts finding process in Chapter 2 and 3. The interview style aimed at achieving full and frank responses. Full responses were achieved by ensuring that questions were simple and clear, and by allowing sufficient time to respond. The first questions in each line of investigation were general and led to questions that were more specific.

All interviews were conducted by the researcher, in person, at the organisations concerned, some by phone and e-mail of the respondents' organisations. Some of the interviews were recorded using dictation machine on mini-audiocassette with the consent of the interviewees for the research purposes only.

The data for this investigation was collected through in-depth interviews with the chosen respondents. In-depth interviews were followed the earlier stage of sending two waves of questionnaires. In-depth interviews were chosen in order to explore the contextual richness of the interviews' experiences. A semi-structured interview format was chosen in order to incorporate a set of topics' questions that had been developed from the theoretical material presented in Chapters 2 and 3. The interview format was therefore standardised, flexible and to some extent, allowing for meaningful comparison between respondents, the same approach applied during the many workshops held. However, the structure of the interview and the workshops remained flexible in order to incorporate unanticipated and organisation specific issues. With an objective of the interviewer to retain control and direct the interview by introducing topics to which the interviewee responded (Trauth and O'Connor, 1991; Phillips and Pugh, 2001; Burns, 2000; Gill and Johnson, 2002). However, the interviewee had opportunities to highlight issues not directly raised by the interviewer. The semi-structured interview approach enabled part of the questionnaire of our research to address both exploratory and descriptive ideas.

4.9.2 Interviews as a Way of Enriching the Quality of Data

This was the alternative and sometimes the complementary primary research method used in this research study and was mainly open-ended, informal interview. Topics were specified in sequence and wordings of questions determined in advance. This increased the comprehensiveness of data collected whilst interviews remained fairly conversational. All applicable questions were asked and care taken to minimise difficulty that would have risen in attempting to quantify the results.

To better understand the challenges and the research study of business requirements, system failures, professional gap, in-depth telephone interviews and many workshops were conducted with related parties in the UK, and selected visits to large and small organisations in the city of London took place. The interviews and workshops were ran over three months period and focused on organisations grouped by industry including retail organisations, financial services-banks and building societies, government and public sector, and system development organisations. The questionnaire and interview format was structured in a manner that ensured consistency. Both were designed to capture a range of issues, including major trends affecting each industry, issues posing the greatest threats, how the enterprise identify ITS problems in satisfying business needs and what they do to reduce or bridge these problems and gaps. Both methods of primary research highlighted above were set up to collect data from business developing and implementing ITS. Some managers did not like filling out the questionnaire, and an alternative way to solve this problem was to talk to them in person or over the telephone. Managers were asked a list of questions on how to determine requirements, overrun time, overrun budget, glitches and system failures have affected their business.

4.10 Research Methods and Triangulation of Data

The main research methods used in this thesis can be categorised into two types, primary investigation and analysis, and secondary data collection.

We have adopt a case study approach, we used historical case study because for the availability of information and also historical case studies provides holistic picture of the development process from inceptions to implementation. We believe that the lessons could be learned from past failures, those who are planning to embark on systems development will be in a position to fallow and emulate the best practices and avoiding the mistakes of the others. The time factors make it impossible for us to fallow a recent process from inception to completion. This research study is expected to be of tremendous benefit to academics, retail organisations and IT practitioners at large by highlighting the importance of effective ITS development strategies in the retail organisations.

4.10.1 Instrumentation

It appears from the objective of this research study, that the issues under investigation are confidential and subjective, with many contexts to the data needed. This suggests that the selected research methods must be able to take into account these issues and acknowledge that many retail management decisions are idolised and guided by circumstances pertaining the organisation. The research presented in this thesis, focuses on the factors that influence the decision of business managers and IT managers when acquiring and developing information systems.

4.10.2 Selection of Respondents

The aim of selection of respondents was achieved from different sources including the listing of the retails and software developer organisations in the Financial Times, Directory of Retail, and Prospectus. The numbers of interviews undertaken were determined by redundancy, that is, the data collection continued until the data collected became repetitive. An evaluation was made after each interview as to whether additional interviews would provide additional value to the study. In the initial phase of the interviews, single respondents at different retail organisations (Marks & Spencer; Lloyds, and Abbey National) were interviewed. The aim of this phase of interviews was to achieve an understanding of factors influencing the development process of IS in retail and the best ways into which the retail organisations can achieve a better development and implementation of their systems. In order to achieve a well-balanced investigation, a combination of personal contacts was used in selecting respondents and organisations for investigation. Senior IT personnel and senior business managers of the organisations holding high-level managerial roles were chosen to be interviewed as it was considered that they could provide an overall perspective of their organisations and environment on the issue of system failure. They gave more information as per their altitude about the benefit and cost of IS.

4.10.3 Establish Contacts

The data for the companies obtained from the companies' records and files, financial resources, electronic resources, telephones call have been made to verify the accuracy of the information, also email questions to people working in those companies. Views of consultants and analysts that published in professional publications (e.g. computing, computer weekly and the Financial Times) were taken in board for cross-reference. The research also undertakes an interpretative viewpoint as defined by Neumann (2000) who believes that the goal of interpretative research is to develop an understanding of social life by getting to know a particular social setting and seeing it from the point of view of those in it.

4.11 Guidelines for the Change in System Development Process

In the previous sections, it has been shown that there are benefits to be gained from exchanging and integrating information across the organisation to provide an infrastructure that allows exchange of knowledge and the knowledge to flow freely from the IT to the non-IT departments. Therefore, the need for organisational change towards the way information systems managed and developed is once again emphasised because of the recent frequent rate of system failures. In the next chapter, the focus will be on the actual change process itself.

4.11.1 Research Accuracy

The research method was designed to be as accurate as possible and followed guidelines for research as describe by Yin (1984), Trauth and O'Connor (1991), Creswell (2002), Gill and Johnson (2002), and Sekaran (2002). In the following section, the issues regarding the accuracy of qualitative and quantitative research and how these issues have been addressed by the research methods are discussed in terms of credibility and dependability.

4.11.2 Credibility

By credibility we mean that the research is trustworthy in the sense that the reader may be confident that the findings are true to the context in which the study was undertaken (Phillips and Pugh, 2001; Gill and Johnson 2002). The respondents were honest in their responses in that it was felt unnecessary to conduct multiple interviews at each organisation to produce collaborating evidence. The researcher and a specialist friend in the software package 'SphinxSurvey Plus2' reviewed, validated the classification and interpretations made in the analysis of the data for accuracy.

4.11.3 Dependability

Dependability implies that if the study was repeated in the same context it would yield the same findings (Yin, 1984; Gill and Johnson 2002). This is equivalent to reliability in quantitative research (Creswell, 2002). The interview tapes were checked to ensure that the interview style produced quality outcomes in the sense of full and unbiased responses.

4.11.4 The Use of Case Studies

A useful starting point is to define what is meant by the expression *"case study"*. Yin (1984) defined a case study as:

"A case study is an empirical inquiry that:

- Investigates a contemporary phenomenon within its real-life context; when
- The boundaries between phenomenon and context are not clearly evident; and in which
- Multiple sources of evidence are used".

This approach enables conclusions to be drawn and recommendations made as to future strategies, based upon analysis of both historical and current issues within an organisation. This research study draws upon empirical material obtained from established retail and financial organisations in the UK. The materials was derived from e-mails, a review of written, semi-structured interviews with relevant managers, workshops and observation of organisational seeting and contexts (Phillips and Pugh, 2001; Fielding, 2002d; Oliver, 2003). This approach allowed a longitudinal feature material in this chapter by providing a specimen letter along with a questionnaire requesting initial information followed by interviews (Appendix D), the names and titles of some the interviewees (Appendix E) and a sample interview transcript (Appendix F).

4.11.5 Time Horizon

The study is conducted over two years (1997 & 1998). This strategy was selected for pragmatic reasons, as there was limited time available for data collection. Additionally, the research is interested in assessing the latest status of system failures especially in the retail sector of the UK.

4.11.6 Using Sphinx as a Method of Scoring the Questionnaires and Analysis

The software package 'SphinxSurvey Plus2' handles both quantitative and qualitative analysis. The package "Sphinx Survey" has been used to analyse the data. Some of the results confirm our gut feeling others were minor surprises. It should be said that without the SphinxSurvey Plus2 package software (Scolari, 1998) the statistical analysis of the data can by very work intensive and laborious. If the respondent fails to answer a question in any set of questionnaires was ignored and not included the analysis, some 35 questionnaires were excluded from the research study.

4.12 Scope and Limitation of Study

The scope of this study will be limited to the initial requirements stage in the development of IT/IS and to the importance of an effective ITS development strategy and how its appropriate implementation can improve the overall performance and profitability of a retail organisation. Expansion of the area of research will be curtailed to afford a reasonable focus. Despite the fact that this research study was conducted in accordance with best practice guidelines, there are some limitations on the success of the research methods:

- A limited number of respondents were interviewed. While it is felt that these respondents gave a comprehensive insight into the development of IT/IS in retail, the respondents nevertheless represent a small proportion of the organisation (despite their seniority) and in some cases, may not have been managing IT technical personnel (in case of outsourcing) of the organisation interviewed. So their ability to provide a comprehensive and accurate account of the study may be limited.

- The research focused on only a few organisations hence may make the study not to be appropriately covered by this research.

- Some of the techniques and tools, e.g. Venn Diagram and Fishbone used for the data analysis and presentation of the findings have been previously used for this kind of research before and so may not be entirely appropriate or relevant to organisation in the UK. This may have an influence on the results obtained as well since all the interview questions basically followed that.

This research study is limited to actual implementation of KRF in retail to enhance business understanding of IT and vs. versa. It did not go further into the detailed and complex nature of how the different ITSs work in retail. For instance, mentioned has not been made about the co-ordinations of different IT/IS in a retailer. Also, technical issues such as detailed hard methodologies were avoided to keep it as simple as possible to understand from the business prospective. Furthermore, only a selected number of retail organisations were investigated and mainly those heavily involved in a big way in the investment in IT/IS.

The following constraints critically limited the research study as follows:

- The constraints of time and travel.

- The speed at which ITS develops.

Nevertheless the above constraints were taken into consideration when analysing the results due to the working knowledge the researcher (certain inside knowledge was provided by postgraduate working at some of the retail organisations) posses thus enable to work around some of these constraints thereby ensuring that the study retains it validity and reliability.

4.12.1 Limitation of Methodology

Due to the sensitivity of the topics of system failures and budget of ITS project, many respondents were reluctant to release information relating to these issues. Another serious setback was the general attitude of company staff towards academic research. They were simply not willing to spare their time to fill up questionnaire or answer interview questions. The other issue was the cost of pursuing this research study in terms of making telephone calls to large number of people in organisations as well as visiting establishments within the UK.

The major limitation faced in the process of collecting data for this research is some of the data required, e.g. ITS failure, deals with the image of the retail organisation. The information required was sometimes of sensitive nature, e.g. budget of a project, period of the project, and number of successful or failed projects, see Appendix D (D1-D2 questionnaires). The managing director and some member of staff in certain organisations were therefore reluctant to reveal information which was seen as either confidential or embarrassing. Other problems encountered were:

- The nature of the topic made it difficult for staff to honestly answer questions.

- Some senior staff attitude towards research findings was not encouraging. This may be due to pride, time constraints or educational background.

- Time and travel cost. It was not easy to find long time slots to make the research more elaborate due to work commitments.

4.13 Conclusions

The findings support a main theme in the ITS literature (see Chapter 2) and persist in a retail industry (see Chapter 3). This theme directly contradicts an untested assumption that retail intraindustry heterogeneity within a retail industry should be transitory. Although numerous empirical and none-empirical studies have endeavoured to show that success rate of ITS can be sustained within the ITS industry, there is still disagreement regarding these studies' findings (Petroski, 1985; Friend, 1986; Keil, 1994; Kanellis et al., 1998; Lin, and Shao, 2000; Cassidy, 2001; Irani et al., 2001; Lee, 2001; Voyle, 2002). This offered room for critics to question the value of research on ITS successes and failures (Lyytinen, and Hirschheim, 1987; Lyytinen, 1988; Abdel-Hamid, and Madnick, 1990; Allingham, and O'Connor, 1992; Bashein et al., 1994; Hilhorst, and Manders, 1995; Beynon-Davies, 1996; Flowers, 1996; Al-Karaghouli, 1998; Liebowitz, 1998; Remenyi, 1999). Recently, mixed results and confusion in the literature have been attributed to the lack of understanding about the relationships between the customer and the system developer and how this relationship evolves over time.

The goal of the present work is to fill this particular gap (knowledge and understanding). By delving into the retail sector ITS industry's history with panel data, we were able to trace the origin of ITS strategic divergence. Dranove et al. (1998) emphasised the importance of demonstrating group-level effects. Our data suggest that increasing actions and reactions to groupwork and R&D was a group-specific phenomenon. The findings also speak to some conceptual inconsistency in the literature. Indeed, the data indicate the need to increase the number of R&D people from both business and IT, and thus successfully developed novel approach in the retail's ITS area. Evidence suggests the gap between the customer and the system developer increase over time if communications do not maintained. We plan to address the relationship between the customer and the developer models in future work.

We have examined the effect of KRF on ITS development strategies in the UK retails. Our results show that although the development approaches were not much different from each other, subsequently they outsource more of their ITS instead of developing them in-house. These retailers also successfully introduced many of the new technologies (Ranger, 2002c; Rangers, 2003; Watson, 2003) to help them maintain competitive advantage. In contrast, most retailers did not commit their resources to R&D and remained peripheral in developing and generating none methodologically (hard or soft methodologies) approaches.

There are several limitations of the present study. First, given the limits of our data, we could not adduce the sources of the "big brother" in IT such as Microsoft sustainable advantage. Our results are, however, consistent, they were able to show that large retailers benefit from economies of scope by sustaining diverse portfolios of research. Such diversity also allows retailers to better capture internal, external business knowledge and technology spillovers. Similarly, we found that our business/technology group outperformed in introducing new ITS development entities even in areas not related to retailing. This evidence is anecdotal at best, however, and future studies should investigate this issue more systematically.

Chapter 5 – Data Analysis: Making Out

Summary

This chapter presents and analyses empirical data collected from 820 questionnaires sent to the prospect of the two groups; Customers (non-IT departments in a retail organisation) and System Developers, and placed the specific IT/IS projects studied in the broader retail sector context by describing how the retailers have come to rely upon IT/IS over the past 50 years as their operating environment has become very competitive. Questionnaires sent first followed by telephone contacts and in some case face-to-face interviews took place to enhance the data collected, finally many workshops conducted over a six month period with professional students to enrich the data.

The objective of this chapter is to test the proposed conceptual model, presented in chapter 3, which the researcher proposes to examine each case by describing respective approaches to adoption of KRF by using the analysed data collected from both Customers and System Developers. In the second part, the analysis of the empirical data collected in relation to the requirements issue is presented. In doing so, the researcher attempts to identify the problems and assigns the main root causes to identifying unclear requirements that leads to system failures. The next Chapter deals with the tools and techniques, the model (KRF) established, and the tools used and tested for the issues raised in the case studies especially the identification of Smart Requirements, bridging the Intellectual and Professional Culture Clash gap between the Customer and the System Developer which addresses the central question of this thesis -why IT/ISs fail and the role of Smart Requirements in the process of system development.

5.1 Introduction

Earlier chapters, i.e. chapters 2, 3 and 4 of this research study have identified that there is a need to further investigate and analyse the adoption of a framework to identification of smart requirements of IS/IT developments in retail organisation. This research study has established that there is often unclear understanding/elicitation of requirements of both parties who involves in the process of developing an IS/IT system. This is due to the intellectual and professional culture clash gap (knowledge and understanding mismatch between the customer and the system develop) which illustrated in chapter 3 (figure 3.1) and figure 5.2 in this chapter.

The roadmap of this chapter will include the relevant subject areas as follows:

• The operations of a major retail organisation A and ITS systems in use.

• ITS Problems encountered in relation to requirements.

• The operations of a large financial institution B and ITS in use.

• ITS Problems encountered in relation to requirements.

• Questionnaires, sample, data collection and data analysis (including a sample of the results).

• Research study findings and application to the above two organisations A and B.

Gathering practical case studies examples of ITS project failures is not hard, What is hard is to get a fair assessment of the issues and reliable figures on the extent of the failure. What is even harder is to get the entire project protagonists agree on what caused the failure and where the responsibilities lie (they can of course lie outside the project team). ITS project failure has to be looked at with extreme humility. ITS project managers are generally bright, experienced, motivated and knowledgeable. When a project is deemed strategic the best resources are generally pulled in. And sometimes - even quite frequently if we look at the statistics - it fails, thereby demonstrating that good ingredients are not sufficient to make up a good procedure.

Moving from the conceptual to the empirical phase of this research study presented in chapter 3, the validity of the proposed conceptual model is empirically tested using case settings to explore information through comperhensive questionnaires and many interviews with both the customer and the system developer, as well as multiple-lines of inquiry, for the purpose of testing the conceptual model presented in chapter 3.

The absence of theoretical model(s) that focus on the complex knowledge and understanding gaps, professional and intellectual culture clash gap issues involved in system development, have led the author to propose a novel model that consists of: (a) the essential components that form strategy for bridging the knowledge and understanding gap, (b) the customer and the system developer Organisational change, (c) a framework for evaluating the quality and integration of customer business requirements, and (d) a framework for evaluating Quality tools that is needed to support both (a) and (b).

To examine the validity of the above model, and in an effort to identify the complex information issues involved in system development, the author conducted three-part study. The first part consisted of questionnaires survey designed to glean trends from a large number of retail organisation and system developers. The second part involved conducting in-depth interviews with numerous leading retailers and system developers. The third part involved workshops over three months period with managers studying an MBA and postgraduate degrees at the University of Westminster. In the absence of theoretical models that focus on business requirements adoption have led to propose a novel model that consists of factors that influence the adoption of KRF. The author examines the validity of the proposed conceptual model using the case study strategy. In doing so, the cases of two retail organisations are presented and analysed in the following sections. The author selected only two case organisations (a major retail and a large financial institute) since they provided enough information for this research study. The data was obtained from questionnaires, interviews mainly with senior managers of both business (operation departments) and IT department, and enriched by conducting brainstorming session as workshops; and outsource system developers within the retail organisations under study as specified in chapters 3, 4 and Appendix F. and also from secondary sources such as literature provided by some of the retailers concerned. In recent years there has been a movement in system development, and requirements engineering that recognises the need for methods and models for studying work practice in order to inform the process of requirements gathering and the design of workplace technology. This move has been reflected in the development and application of a number of theories such as distributed cognition, activity theory and situated action theory, and also in the development of methodological approaches such as contextual design, scenario-based design and participatory design.

5.2 Case Studies in Retail: Business-led Rather than Technology-led System

The pressures for change in business organisations are inexorable. The emergence of enlarged markets, global markets, and new competitors bring both significant opportunities and threats. At the same time, customers are becoming more demanding and starting to trade globally, being better informed and more precise in their requirements. To respond to and exploit these changes, business organisations are increasingly focusing on time and flexibility as weapons in the market to gain sustainable competitive advantage (CBR, 2005). Time to market, product lifecycles and customer response times are all vital ingredients in competitive and sustained success. Greater flexibility is needed to meet these more demanding time business requirements, and to satisfy more exacting and diverse customer needs. Enhancing ITS is critical to retail organisations' capability to operate faster and more flexibly to meet changing and demanding business and customers' needs. It can enable faster, more extensive and more comprehensive communication. It is a critical enabler as organisations move towards rationalisation and integration.

Improving business-lead computer strategy is not merely about getting the technology right, it's about sorting out the mish-mash between delivery working ITS and bringing out what business users need. Acquiring an ITS system needs to be linked to business needs, and another essential ingredient you need a large element of luck!

5.3 Case Study One- A Major Retail Organisation A

Due to the sensitivity of the ITS failure issue, Out of the 450 retailers surveyed, two retail organisations participated in testing our KRF model and in further our research, the first is a major departmental store, and the second is a big bank participated. The name of the organisation that is being investigated can not be reported due to confidentiality reasons. As a result, the researcher has adopted the name Organisation A to refer to this retail organisation and reflect its business. Organisation A is one of the major retail organisations in the UK with headquarter in London.

• **Vital Statistics:**

Number of employees: 65,498

Turnover: £8bn+

Branches in the UK: 285 (267 in town centres and 18 out-of-town)

Products/Services: Department stores with food halls, also offers financial services.

Established: 1884

Organisation A is in the top five retailers. This Public Limited Company's is one of the UK's leading retailers of clothing, foods, homeware and financial services, serving 10 million customers a week in over 300 UK locations. The organisation also trades in 30 countries worldwide, and has a Group turnover in excess of £8 billion. The organisation values of quality, value, service, innovation and trust aren't new - they're the principles on which the business was founded in1884. Here we look at a range of areas of business its approach to operation issues.

• **Organisation A Performance Last Year**

The organisation profit before tax and exceptional items, although supported by strong cost control, ended the year 19.0% lower at £618.5m. UK Retail sales at £7.8bn (incl.VAT) were 1.9% lower during the year. The organisational International operations – including franchises in 30 territories, the wholly–owned stores in the Republic of Ireland and Hong Kong and Kings Super Markets in the US – performed strongly with operating profits up 47.1% at £65m (up 51.2% at constant exchange rates).

In Clothing, sales fell 3.1% to £3.8bn, led by continuing weakness in Womenswear. Lingerie suffered from having too wide a range. Menswear held up well in a difficult market, while Childrenswear market share had stabilised for the first time in three years by the end of 2004/05. All product groups suffered from an inconsistent price architecture. Opening price points are now benchmarked against key competitors and appropriate good, better and best pricing is being introduced across all ranges, giving more real choice and better value for all their customers. Food sales were £3.5bn, 2.4% higher in total and market share was broadly maintained across the year, although sales dipped by 2.6% in like–for–like terms. Demand for their food remains strong with "Food Halls" in out–of–town stores performing well. Food sales in their city centre stores suffered particularly where customers were deterred by a lack of accessibility, particularly parking. The UK food market continued to increase in value terms. Whilst prices in the food sector remained roughly stable, competition continued to intensify, with competitors working to improve their offer, particularly in their premium ranges. Organisation A has concentrated on driving their business by continuing to deliver new and innovative products of the highest quality. The Home division had a year of transition as they closed Lifestore and refocused on their traditional areas of bedroom, bathroom, kitchen and dining. Sales were 21.4% lower at £0.4bn. Again, value realignment was key to re–engaging their customers.

• **Product**

Organisation A has a strong customer base. Over 15 million people visit their stores weekly with footfall rising 1.5% over the year. However, only around nine million of them chose to buy, with transaction levels falling by 0.5%. This clearly demonstrates the appeal of their brand and the opportunity to improve conversion of visits into sales. The organisation has clear objectives: better product in easy–to–shop ranges; sharper opening prices and real value across all ranges; and increased levels of new and innovative product. To deliver better product they need to buy better, buy smarter and buy more quickly. They have strengthened their buying teams across all clothing groups and set up a Buying Training Academy for their buyers, designers and merchandisers, all of whom will be retrained by July 2005.

Price and value are key priorities with prices monitored on an ongoing basis. Additionally, the organisation reduced the number of different products on offer by around 17%, or 1,500 less lines, providing more real choice in store and less proliferation. In food, there has also been a focus on product and increased innovation.

Organisation A introduced the "eat well sunflower" on 700 products, added 40 new lines in the Cook! range and introduced Gastropub meals. In 2005/06, the organisation will trial new food concepts in–store, such as hot food to go. They have removed slow lines and simplified ranges to provide a clearer, simpler offer. They have also begun to emphasise the quality and uniqueness of their food both in–store and through advertising. They have continued to expand the "simply food network", thus making their quality food available to a wider audience. At the year end, they had 129 Simply Food stores, including 27 run by their partner Compass.

• **Service**

Retail management was reorganised in 2004/05, putting the organisation's most experienced and senior people in charge of improving standards and service. Particular focus has been on the largest 34 stores, with the creation of two flagship divisions. They have also concentrated on having more customer assistants on the sales floor at the busiest times by reworking shifts. They have one of the most generous return and refund policies on the High Street, but it needed simplifying. In May 2005, the organisation sets a 90–day limit for refunds – three times longer than most other retailers – and now allow customers to take product back to any of their stores.

• **Store Environment**

The organisation's own research confirmed that their store environment was generating a negative response from customers. Last year, they de–cluttered their stores, rationalised in–store décor and improved signage as a first step to improving the shopping experience. They also started to reinforce their own brand, which had become diluted by too many sub–brands and a lack of focus. Last summer, they launched the "your organisation A campaign", which aimed to draw the brand together and highlight the unique relationship they have with their customers. It has been used across all their advertising and in–store décor. They also reviewed their sub–brands and to date Menswear sub–brands have been reduced from eight to three and Lingerie, from nine to four. Further changes in the other clothing areas will follow in due course, all aimed at making it easier to find great product in–store. A new store concept was also tested in four existing stores. This trial will be extended to a further 21 stores this year, totalling one million sq ft of selling space.

• Driving Down Costs

Overall, organisation A is on course to achieve cost and margin savings of over £250m by the end of 2005/06 and £320m by the end of 2006/07. These savings are being achieved by renegotiating terms with suppliers and reducing non–product related costs. The former will deliver a £140m annual saving by the end of 2006/07 against 2003/04. In 2004/05, UK Retail operating costs before exceptional charges were down 0.1% to £2,148.6m, including logistics. The organisation is also focused on reducing markdowns in clothing through tighter stock control. In Food, they are focused on delivering a £5m annual saving through reducing wastage levels. The organisation is spending more where customers can see the benefit. Having reduced their overall capital expenditure budget to £220m for last year, their capital expenditure is forecast to be £350m during 2005/06.

• Market Context and Outlook

The UK retail market slowed considerably during 2004/05 amid concerns about falling house prices, rising taxes and increasing interest rates. The UK clothing market saw limited growth in value terms. Price deflation continued to prevail, driven by increased competition, a stronger dollar and better sourcing. This is expected to continue. The outlook remains challenging, with tough economic and competitive conditions expected to continue in 2005/06. Footage growth in the clothing market is expected to continue at around the same level as in 2004/05. Meanwhile, the trend for supermarkets to drive non–food growth will continue. In Food, pricing is expected to be broadly flat in 2005/06, following some deflation last year. Volume increases look set to slow slightly, generating modest market growth at similar levels to 2004/05.

5.3.1 System Background to Integration of the Euro (€) and New Card within One ITS

This project was a major ITS project, initiated in early 1997 in response to the European Unity and increasing competition in the retail sector. The aim was to improve business performance and enable profitability levels to increase within five years or by the being of the 21st Century. Although the project was centred around IT, it involved and impacted upon every part of the retailing sector as all retailers were to have the Euro (€) integrated within their systems. It was intended that external customers would be able buy or gain electronic access of their credit cards too. The entire structure and image of the retail organisation was to be altered, removing a traditional emphasis upon geographical spilts and making the layout of the 267 branches in the town centres more efficient and welcoming. More than £110million was invested in the technology required to effect this transformation including new self-service electronic point of sale (EPOS).

5.4 Case Study Two- A Large Financial Institute B

Due to confidentiality reasons, the researcher uses the term *Organisation B* to refer to the financial institute being reported. Organisation B is one of the large financial institutes in the UK with headquarter in London.

• **Vital Statistics:**

Number of employees: 25,000+

Turnover: £1,000bn +

Branches in the UK: 687

Products/Services: Personal financial services.

Established: 1849

The financial institute B established date back in 1849, with the establishment of the National Freehold Land and Building Society. In 1944, it merged with the other building society, then in July 1989. It was the first of the British mutual building societies to seek a wider market by converting to bank status in 1989 and floated on the London Stock Exchange. In 1996, financial institute B launched a takeover of another society, for £1.35bn, catapulting it into the ranks of the country's leading financial service businesses. In 2000 it opened merger talks with Bank of Scotland, but was quickly targeted itself by an acquisitive big bank. In the end neither deal materialised and financial institute B remained independent. The group reported two years of horrendous losses for 2002 and 2003 as a result of a disastrous move into wholesale banking.

• **Background**

Financial institute B is one of the UK's leading financial organisation. It offers a full range of personal financial services both direct and through intermediaries, to 18 million UK customers and expatriates. The range of services includes mortgages and savings, bank accounts, loans and credit cards, long term investments including pensions and unit trusts, life, critical illness and unemployment cover and household insurance. It also provides offshore banking for expatriates, its goal is to be the leading provider offering only personal financial services in the UK via both direct and intermediary channels. In September 2003, the organisation re-launched its business and brand, with plans to 'turn banking on its head'. The name was shortened and it announced a radical shift in how it would treat customers.

All its businesses and assets outside the UK personal financial services remit have been placed in a portfolio business unit (PBU) and will be managed for value and exit by the end of 2005 in order to maximise returns for its shareholders.

• **Size and Offices**

Financial institute B is the sixth largest bank by assets and the second largest provider of mortgages and savings in the UK main offices are in London, Milton Keynes, Bradford, Glasgow and Belfast. For main office addresses, please follow the link on the right.

• **Business Divisions**

- **Sales and Marketing** - a new division formed in 2005 by merging the former Customer Sales and Customer Propositions divisions. The sales teams are responsible for service and sales at all points of customer contact (branches, telephone, internet banking) for both direct and intermediary customers. The Marketing teams are responsible for developing understanding of its customers and designing better accounts and services - encompassing all advertising, marketing and brand activities across the company.

- **Finance & Markets** - a new division combining Finance, Financial Markets and the PBU.

- **Insurance & Asset Management** - a new division combining Insurance and Asset Management has been created to signal the importance of these markets to the organisation.

- **Manufacturing** – a new division formed in November 2004 by merging the former Customer Operations and IT divisions. The division is responsible for cost control and operational efficiency across the organisation.

- Accounts and Services - personal financial accounts and services offered by the organisation include, mortgages, savings, banking, investments, general insurance (buildings and contents), credit cards, loans, critical illness, accident and unemployment insurance, life assurance, pensions, business banking, sharedealing services.

5.4.1 System Background to Developing Smart Card and Integration of Branches Within One Network System

The business issues of this financial institute at the centre of case study are the provision of smart card which combines debit and credit card facilities and one network system. Once the market leader in this field, the financial institute has nation-wide presence and quality image, but this has recently come under increasing pressure from new entrants and competitors especially the leading super markets in the UK. The IT/IS project began in 1994 and involved some 500 staff. It was supposed to combine all of the organisation's separate computer systems used in different locations for the various business functions into one global network system. The rational behind the project was that the state of the art functionality it offered would enable the organisation to regain its leading market position. Or in the word of one interviewee:

Did anyone ask the customers what they wanted? No, it was merely an attempt to be different, to stand out from the crowd. They were trying to resurrect a historical image, recapture the glory days, but it was over ambitious" (Division Manager).

5.5 Before Adopting KRF: Scope of Problems

5.5.1 Scope of the Technical and Skills Problems in Retail Organisation A

In the course of the change system, problems began to surface (including hardware and software) due to unclear requirements and as the retailer tried to reconcile planned job losses with a severe skills shortage in the area of new technology development and management, and the often conflicting *aims (requirements and needs)* of business and technology *(specifications)* clash (see Chapter 6, section 6.7). It appeared that member of staff felt their skills (especially IT skills) were being devalued, or their jobs put under threat. There was little commitment of both business and IT personnel to the change process and moral suffered. Clear and visible intellectual and professional cultural clash was present. Technically, it was difficult to integrate the new client server technologies (written in *SQL Windows*) with the mainframe programmes written many years in *COBOL*. The mainframe system was also financial based and could not be easily changed into a customer-based system. This meant that data concerning external customers with more than one account (e.g. credit card and loan) could not be linked together, and this caused administrative problems, duplication of work and low services quality.

The role of some interviewees in this ITS project was to manage a team within the IT department that was developing and implementing "middleware", new technology that enables disparate system to be integrated. For example, the retail organisation A wanted to have overall view of customer data, and under the old system, customer data would be held in different areas of the retailer depending on the particular products or services involved, and it was technically different and time-consuming task to integrate the data and provide a single figure representing the total outstanding amount owed by an individual customer on credit card and loan. Once the IT systems were upgraded and middleware installed, other branches across the UK could access data held in central systems. This project formed part of the retail-wide systems integration objective of the project. The IT and the various operation departments expanded rapidly as the project progressed (especially IT department), with staff members increased by over 150% between 1997 and 2000. Many of these new comers were temporary, some of them often from overseas deployed by consultancies or by the retailer as short term contractors, to meet what was perceived as a growing knowledge and understanding gap between the skills of original staff, the new technological requirements of the project, and the business staff (operation departments). It is worthwhile to mention here that the application and the test of the KRF model has helped in bridging the gaps (see chapter 6) in major situations during the development of the project. It took longer to identify smart requirements but the teams agreed it was well worth it, as it made the stages that followed requirements easier to establish.

5.5.2 Scope of the Managerial and Sociotechnical (Human) Problems in Retail Organisation A

Significant difficulties were encountered from a managerial perspective in terms of group morale, as many individual found their skills to be obsolete and their secure jobs under threat from new entrants. These members of staff had been used to a stable and understanding environment, looking after an established and well known IT system on behalf of the other business departments. They now had to acquire new skills as new technologies demanded since they were introduced and deal with unforeseen problems in interfacing the new systems with the old mainframe, whilst coping with increasing demands and tighter deadline from business departments, especially sales, marketing and accounts (see Chapter 6, Figures 6.11 & 6.12). In effect, the old working environment and culture was overturned in a short space of time. Uncertainty about the future encouraged rumour, speculation and confusion. In addition, there was no clear project management infrastructure in place to co-ordinate each part of the project, which was under control of different project teams, in line with overall organisation strategy.

As a result, different sub-projects imposed their own procedures and standards (see section 6.11 -KRF in Practice). For example, within the same office some groups were working with Microsoft Access version1 software, others with version 2, and other department with Oracle, which was fundamentally different in terms of its usage and capacity. As a result of these difficulties, the project began to exceed its budget and overrun timescales. A decision was taken to compromise the original objectives of the project in order to keep within the allocated schedules.

It is evident that there was no clear implementation of a standard IT/IS methodology. When the author put the question on the type of the methodology used, a project manager asked "*What are the type of system methodologies you know of?*". The author mentioned some of the hard and soft methodology known to him, the project manager briefly replied **"the gut feeling methodology!"**. Consequently the radical change project was abandoned, in favour of a more incremental adjustment (It worthwhile mentioning that the adoption of KRF was used in other projects, as I have been told by a project manager). Despite the level of investment put into the project, no attempt was made to analyse and address the reasons for the project failure.

5.5.3 Scope of the Technical and Skills Problems in the Large Financial Institute B

The financial institute started to draw up the business requirements in 1992, and by 1998 had concluded that the IT/IS project would be too big and complex to handle. No one had anticipated the scale of all the frequent changes that would be necessary to meet the requirements of each individual market, legal different being one pertinent example. Consequently the prospective of combine debit and credit card facilities system were thrown out, and efforts were concentrated upon replacing just the system which controlled the links between the financial institute and the retailers that accepted the credit card. This compromise was quite different from the initial grandiose plan to replace all existing IT/IS systems with one global network system. The only improvement would be replacement of current disparate systems in use across the UK (that controlled this particular function) with one new system, but this would have little impact upon the business as a whole.

In 1996 a team of business users (customers) were drawn from across the UK to see if the scale down version of the new system would meet different international business requirements, thereby allowing the work to be integrated properly. At this point the IT/IS project was already 4 years behind schedule, due to the effect of the following factors:

• The specific objectives of the IT/IS project were never elucidated.

• The blame culture was in evident (customers vs. system developers). Also there was friction between customers and system developers.

• Games of internal (organisational) politics (including operation departments vs. IT department) were played at all levels of the organisation.

• No coherent overall project plan and timetable existed- lack of rigorous project management.

• The project was sabotaged by participants who were afraid to admit failure and prepared to lie about progress.

• No time scale set for each task (mini-project) to be met.

• No positive co-operation, collaboration and communication between subproject management teams.

• The financial institute organisational structure allowed no individual sufficient power to integrate the systems development and business issues of the IT/IS project.

• The distribution of the business allowed no individual any jurisdiction over the other branches in other regions with interest in the IT/IS project.

• Employees were encouraged to look after their own narrow departmental interests at the expense of the organisation as a whole.

• Departments were reluctant to accept responsibility or take decisions in case they were blamed for possible future IT/IS project failure.

5.5.4 Scope of the Managerial and Sociotechnical (Human) Problems in the Large Financial Institute B

Despite the scale of the project, nobody at a senior level seemed prepared to put a stop the arguments and the internal politics to finally push the project through. Even a mere four months from implementations, different branches in other regions of the UK were still arguing over whether they wanted it or not. It is interesting to note the emphasis of this IT/IS project upon "implementation" as referring to "installation" of the system. Writer such as Leonard-Barton (1995) has noted the problems inherent in maintaining such a narrow view of IT/IS change. In particular, she found that consideration of knowledge creation, sharing and management were vital aspects of a successful overall implementation process that a focus on merely installing a new IT/IS system obviously lacked. The major costs of the IT/IS project had been incurred at the development stage, and by now were considered to be historical rather than incentive to complete. At this stage, it was nearly decide to cancel the project and upgrade the system used in London and extended to cover some regions in the UK. In the end the IT/IS project was implemented, but scaled down so much that even within the limited area of the business that remained under consideration, all the features that would have impacted upon customer service were left out. The bare bones of the project were implemented as "essential-stage one" and all the "desirable-nice to have" features were promised in future upgrades. This meant that from a customer viewpoint, the new IT/IS project offered no improvement in terms of service quality than the predecessor system it replaced. It also cost more to run than it predecessor, and provided little added value to the technical operating staff. This was a somewhat different outcome from it initial conception (requirements) as the physical manifestation of grand IT strategy to regain the leading position that the financial institute had historically enjoyed in the financial sector. Although the new IT/IS system merely replaces the existing one in terms of functionality, it was hailed as a success because the actual changeover from the old to the new IT/IS system was implemented without problems. Everyone was relieved that it actually worked after all the delays and teething problems. The attention of the operators was fully occupied with learning new routines and screen displays, so adverse comparisons with the original project specification required both the time to reflect and a very long memory.

The major project management weaknesses (including the knowledge and understanding gaps between the two groups) are analysed in subsequent chapter, but for information purposes can be summarised as follows:

- There was no sense of accountability for the money invested in the project, (the figure never reveals but it could be estimated at several hundred million of pounds) despite the existence of vigorous controls on expenses and other forms of expenditure which were not related to IT. It appeared that excessive payments could be authorised if the management responsible had no concept of "reasonable" costs for the expenditure concerned, and would approve the expense rather than admit their ignorance of technology matters.

- No attempt was made in advance to quantify the scale and the costs of the project and there fore assess its feasibility. As a result, the IT/IS project lost credibility and morale was low and suffered when its features were regularly downgraded.

- There was no coherent long-term strategy. Shortly after the project was implemented in the south-east it was decided to franchise out that part of the business. The new service provider had its own IT/IS system and so the new system was taken out of the North region three months after implementation. Similar action is expected in other regions in the near future.

- There appeared to be no evidence of business-IT sharing and learning (professional intellectual gap exists). Subsequent IT/IS projects were instigated without the implementation of any organisational changes intended to help avoid the problems experienced with the new IT/IS system. Business managers (operation departments) with no project management experience had been brought in to run the project, and their accumulated knowledge was lost when they returned to their original role on completion of the project.

- No attempt was made to measure the effectiveness of the completed IT/IS project in comparison with its original specification. In fact a review was considered but ruled out due to the anticipated cost of nearly a million pounds.

- Creativity was stifled by "guilt mentality" if any aspect of the project went wrong. Although official policy welcomed sharing ideas and changes from employees, in reality ideas were vetoed if any degree of risk was involved.

- The project leader himself did not have the personal authority to impose the system upon all the regions involved. He was the Head of IT department who reported to a Senior Director. This put him only at the same level, but in a different reporting line, from the leaders of the financial markets in which the new IT/IS system was to be implemented.

• The project leader had no experience of managing a large IT/IS project, he relied upon the testimony of his staff who invariably set over-optimistic time scales or covered the extent of any difficulties that were experienced, to protect their own positions (see section 5.5.3, which is similar to the point mentioned earlier in Case one -Organisation A repeated itself in this case too in relation to the knowledge of different system development methodologies).

5.6 After Adopting KRF

It is worthwhile to mention that interviewees found the proposed KRF model very helpful, relevant, easy to use and reported that it improves IT/IS development. The reasoning is that the proposed KRF supports business issues and allows the IT departments within the retail organisation to better understanding and collaboration between both the business departments (customers) and the IT departments to bridge the professional and intellectual culture gap and to better the capabilities of IT/IS to fit business needs, as well as their IT/IS specifications. Moreover, they express their interest to adopt the proposed KRF model.

A very important and crucial issue the thesis addresses is the alignment of IT strategy to business requirements. The separation of technical and business functions ensured that there was no room for either the IT department to impose the system, on the business, or for the business (operation) departments to enforce their particular needs and requirements from the new IT/IS system. Customers (business) were reluctant to admit to their lack of tacit technical knowledge (TTK) when checking that system specifications matched their business requirements which led to misunderstanding and errors. Although it takes long time for both the business and IT departments to agree on requirements when using the KRF, but everyone agreed that the adoption of KRF has improved communication between the different parties, everyone comfortable with working with each other. Also, it enhances communication, knowledge sharing, and understanding of what a party needs from the other. In practice, KRF encourages teamwork, everyone feels the belonging to one team rather to the IT or business teams.

The requirements agreed upon after going through the different process of KRF matched what the business people need and what the IT people can deliver. Despite taking along time to agree on requirements as mentioned above, most the people commented that it cut cost of going over the process of eliciting requirements and correction processes.

In summary, it was noted that the persons in the *"sales department"* in both organisations A and B (it is most probably true in most retail organisations -see figure 6.20) contributed to the failure or the abundant of some IT/IS in retails due to the financial incentive they received if they meet their target (sale quota). They were pushy, tried to rush the development process in favour of their financial gains and accused the system developers of slackness.

5.7 Survey Analysis and Implementation

The researcher also used and analysed data from multiple sources including the organisations' publications and reports. In doing so, data is analysed and results are concluded. This section presents the second phase, where the empirical data is collected from customers using a quantitative and qualitative research method, which consisted of two questionnaires. This comprises three stages; (a) questionnaire design, (b) questionnaire data collection, and (b) questionnaire data analyses. The objective is to extract more precise and in-depth information related to the research study. In doing so, the author attempts to identify the problems and assigns the main root causes for the system failures and identifying smart requirements involved in system development.

820 questionnaires were sent out to the senior managers in major retail organisations which are listed in the Financial Times (wherever it was possible). The main purpose of this questionnaire is to obtain information that cannot be easily observed due to the sensitivity of the topic of system failures or that is not already available in written or electronic form. Evidence from the questionnaire survey will then be used for one or more of the description, explanation and analysis of the problems. Prior to that, a pilot test (first version of questionnaires) was sent for the purpose of judging the strength of the questionnaire and getting professional feedback from retail organisations and IT/IS professionals in-house and outside the organisations.

The author designed the initial questionnaires, and a postal survey was used as the means for collecting data. The unit of analysis is system failures in the retail sector, however the author's central focus are business requirements in system development and its effect on system failures. The questionnaires were designed to be completed by someone who is knowledgeable in the business area (customer) and the other by IT/IS specialist. Consequently, as stated in the previous chapter, the draft of the questionnaire was then given to different groups of people to seek their reviews and comments. These people consist of; business and IT/IS professionals (collaborative people of some of the organisations that are sponsoring some of their professional postgraduate and MBA students within our Westminster Business School), the department's research directors, and a group of researchers (also within our Westminster Business School and the Department of Information systems & Computing (DISC) at Brunel University; also see Appendix D, D1-D3). After several iterations, the author finalised the survey instrument, and sent the questionnaires (see Appendix G).

Accordingly, the questionnaire focuses on IT/IS projects and requirements issues, where each section deals with specific types of data on the above issues involved in IT/IS development. These issues have been identified in chapters 2 and 3. Earlier questions of the questionnaire deals with the Organisation background, position of the interviewee and his/her involvement in the system development process. These questions attempt to collect general information regarding the organisations surveyed, such data may include: size of the organisation surveyed; the key business of the organisation; number of units/departments; the nature of the organisation (e.g. Financial, Manufacturing, Retail, and IT/IS industry). Later questions of the questionnaire deal with the involvement or contribution of the interviewee in an IT/IS projects and applications Used. The objective is to identify organisations using certain methodologies which might involve the customer in the early stage of requirements in the development process from those who do not get involve at the requirements stage and see the effect of such involvement. The two questionnaires deal with the Business, Organisational and Technical Issues, including information related to budget, testing and meeting project deadlines.

5.7.1 Analysis and Refine Data

To identify the business and technical issues involved in requirements and its effect of IT/IS failures, with a particular interest to business requirements issues involved, the author conducted a survey of enterprise wide-data strategy and business intelligence professionals. The questionnaires attempted to fathom the quality of data of both groups (customers and systems developers), and including status, scale, and scope.

Initially a pilot study was conducted among contacts of the researcher at retail organisations and financial institutions, as a fact-finding mission, using two types of open questioning techniques (customer and system developer questionnaires). The early interviews elicited additional information that necessitated a more detailed investigating at the formal interview stage. This took place over a twelve and a half-month period so it was possible to cross check key comments by using material from early interviews to inform the later questioning. Table 5.1 details the total number of interviews conducted, the role of each respondent within the organisation, and the nature of the specific new ITS projects under investigation. The background to each of the case studies is described in the next chapter. An alternative data collection method of participant observation within the organisations was initially considered, but rejected because the researcher already has several years' experience within retail organisation that can be drawn upon in this regard. Phillips and Pugh (2001) analysed the value of ethnographic studies to a researcher in comparison with semi-structured interview techniques, and concluded that the information obtained by interview was essentially the same as from participant observation.

The questionnaires were sent on July 3, 1997 (see Appendix H). Each questionnaire was accompanied by a cover letter and a prepaid envelope. Although the researcher tried to target large and medium sizes retail organisations in particular, there were a considerable number of small and public sector organisations that were also involved in this survey. The selected organisations were local (national) within the United Kingdom. Figure 5.2, illustrates the general results of the types of organisations surveyed. A reminding letter was sent two weeks later (especially to the IT departments as most of business departments sent their filled questionnaires promptly), and then every two to three weeks thereafter. In the first three weeks from sending the questionnaires, the first respondents' questionnaires started to come back. The organisations ranged from retail sector to finance, industry and public sectors. In the same period, starting on August 10, 1997 (from around when the first respondents' questionnaires start to come back, until the last respondent's questionnaire was received back – around end of January 1999), the author conducted around 210 telephone interviews with business and IT/IS managers and other individuals of organisations who completed the research survey (including; directors, managing directors and project managers, see Table 5.1).

The reasons for conducting these telephone interviews were; either there were blank answers in the questionnaire (incomplete questionnaires), or the answer(s) were not clear. As well as the above reasons, conducting these telephone interviews is to enhance and complement the survey method, and be able to investigate and analyse the collected data related to the above problems further. As reported in previous chapter (chapter 4), one of the real methodological differences between the use of questionnaires and gathering data by interview is the presence of the interviewer and the possible interactional effects that can influence both the quality as well as the quantity of the data collected and interviewee response (Adams and Schvaneveldt, 1991). The purpose of the personal interview is to encourage the interviewee to relate experiences and attitudes relevant to the research problem (Walker, 1988; Levine, et al., 1999; Stake, 2000). In the words of Burgess (1982), the personal interview provides the opportunity for the researcher to probe deeply to uncover new clues, to open up new dimensions of the problem(s) and to secure *vivid*, accurate, inclusive accounts that are based on personal experience. Interviewing is central to most qualitative data collection efforts, as broadly defined by Werner and Schoepfle (1987) 'any verbal confirmation or disconfirmation of observation or any formal, informal or casual answers to a question, constitutes an interview.'

By May 2, 2000 (post the Y2K problem), of the 820 questionnaires addressed 66% responses of the overall questionnaires were received back. 230 questionnaires deemed complete, 53 questionnaires were rejected (not complete), 260 questionnaires either returned blank or a letter or apologies received from the organisation and 277 questionnaires were not returned. Unfortunately, as it is always the case with questionnaire survey method (the low level of response rate), about 1/2 of the 66% responses were those from organisations who either did not want to participate (returned empty, or sent a letter including Microsoft to apologise for not willing to participate). Consequently, the following analysis is based on 230 individuals that have completed the survey. This also included the number of individuals with whom we conducted the telephone interviews. Table 5.1 illustrates the general results of the overall respondents (customers -end-user and system developer -software builder) who completed the survey. All the percentages presented in the following sections have been rounded to the nearest whole number.

Questionnaire Type	**No. of Respondents**	**Percentage**
End-User	158	69%
Software Builder	72	31%
Total Observations	**230**	**100%**

Table 5.1: Customers and System Developers Participated in the Research Study

5.7.2 Fieldwork and Case Study Details

The most striking feature of the data collection process was the difference in the quality of data obtained from interviews where the respondent was known to the interviewer, and that which resulted from a direct appeal to the organisation. In the former case, people were often prepared to give more freely of their time, and provided detailed and honest accounts that would have been sanitised or even omitted for a stranger. For example, the case study of Retail A provided considerable detail which has been extensively utilised in different categories throughout the research project. In contrast, the interviews with Financial institute B yielded lass useful data. This is due to the sensitivity of the financial information. The same can be said about a few well-known software development houses that they apologised to participate for commercial and intelligent reasons.

Retail organisation A and Financial institute B pride themselves on their customer service record and they were anxious to please, regarding the interviews as a public relations exercise. However, the information obtained was rather bland, and provided little added value over secondary data from press sources. On occasions however, prospective interviews which initially appeared uninspiring turned out much more valuable than anticipated. In one case, Retail A, a telephone call I made to one business manager was followed by an IT manager, who had been approached by the business manager and offered his assistance as well. It turned out that he had recently completed an MBA degree at the University of Westminster. After experiencing problems in arranging his own interviews while doing his MBA's project, he was keen to help others in a similar position.

The retailers get many requests from researchers and tend to direct such enquiries to Public Relations or Customer Service in the first instance. The author found it was useful to emphasis his background and current employment in Higher Education to establish a certain amount of trust and credibility. Although, retailers often prepared to spend heavily to obtain advice from management consultancies, there are very few-if-any-official links in place between the UK retailers and the universities which can be drawn upon. In fact the author would go further to say that retailers do not seem to see any way in academic research could add value to their business (especially at the early meetings) despite the turbulent environment in which they are operating. When speaking to the retailers the author emphasised the aims of the research, and how the final results may well be of practical interest to the retailers themselves, but only in one case (retailers organisation A) was this offer taken up. If a manager agreed to be interviewed it was usually justified as a public relations exercise, or on one memorable occasion, *"you may be my online manager one day"*. The second telephone conversion was then followed up explaining the summary of the aims and benefit of the research study and a list of the general subject areas to be covered. It can be said that after one interview it was possible to speak to other people in the department (usually the interested senior manager put the author in touch with other people), or obtain a contact name in different part of the organisation which could be followed up later.

■ Tables 4.3 (chapter 4) and 5.2 (chapter 5) show that the interviewees consisted of directors, managing directors, division directors, and project managers. The level of individual project detail discussed at each interview therefore varied considerably. In some cases, it was not possible to interview very senior individuals but questionnaires have been fill-in by senior individuals and consequently the limitations of the sample in terms of overall "representatives" must be acknowledged. In general terms, the interviews can be grouped into two categories, those which focused upon the intricacies of retail organisation-specific projects and those of much broader scope which examined trends in the IT/IS industry and compared the IT/IS strategies of various market players.

In addition, 5 interviews have been conducted with IT/IS outsource consultants from two major IT/IS consultancies which are based outside London. Discussion did not centre upon the detail of particular new IT/IS projects but upon broader issues such as customer requirements, customer expectation, general trends in the IT/IS industry, the prospects for new IT/IS market entrants and shortage of IT/IS skills. The data obtained has been incorporated into the analysis and concluding chapter together with the above.

The objective of interviews falling into first category was to explore the ideas developed from the literature review in the context of the interviewees' responsibilities for current retail and IT/IS projects at various stages of development with the emphasis on the requirements stage.

In addition to the questionnaires which have been sent, the general trend of the questioning at an interview can be summarised as follows:

- What are the recent/current new IT/IS projects under development in the organisation?
- Have problems been experienced in the course of initial requirements, project development and implementation?
- What was the nature of these problems (customer or IT)?
- How were they overcome?
- Are any procedures (and methodologies) in place to measure the effectiveness of IT/IS projects after their implementation (or even before, e.g. testing)?
- Have changes been made in the management of IT/IS projects as a result of any problems experienced in this case?
- What form should such changes take?

■ The second set of interviews focused upon more general trends in the retail industry and the strategies of the major players and newcomers to the market and with respect to new IT/IS implementation. Some of the interviewees were consultant with broad experience of the UK retailing sector, and well placed to provide a balance interview of current issues as well as comments on specific findings from the individual case studies.

Name of Organisation	Number & Role of interviewees	Description of New IT/IS Project Researched
Retail Organisation A	1 Director (Clothes) 2 Director (Food) 1 Managing Director (Store Development) 1 Managing Director (Merchandise) 2 Division Director (Operations) 1 Director (IT & Buying Systems) 3 Project Manager	Integration of Euro & Credit Card
Financial Institute B	2 Managing Director (Retail Banking) 1 Operation Director (Retail) 1 Marketing Director 3 Project Manager	Developing Smart card and Integration of Branches within One Network System

Table 5.2: Case Study Details

5.8 Evaluation of Data

As the interview process progressed the focus of the questions became more specific as the categories of ground theory began to emerge. This did mean that the interviews became increasingly more useful over time. In fact the process was more adhoc with some early interviews of grater value than later ones. Within this framework, however, it was noticeable that later interviews formed a check on the material covered at an earlier stage. It was also soon apparent that certain issues recurred time and time again in IT/IS projects undertaken by different retailers, and even in successive projects within one organisation. In some acses the interviews with one retailer were spread over a period of four months, so it was possible to return to issues that had been discussed earlier and examine the progress made overtime, and also to reinterpret the material covered in the light of later findings from other case studies. The extent of overlap in the emerging categories of ground theory from retailer to retailer itself became a significant finding as well as the actual content of the issues raised.

When analysing the interview transcripts and recorded tapes, it was noticeable at an early stage that different areas of the same retailers had their own distinct operating practice, and it would have been far easy to allocate the activities of one individual retailer to emerging grounded theory categories. For example, different parts of retailer A exhibited distinct organisational structure and cultures, which were manifested in very different attitudes towards IT/IS innovation and change within the one organisation. The process of grounded theoretical analysis led directly to the organisation of material within chapter headings. The first, and eventually the largest, category to evolve from analysis of interview transcripts was the influence of structural and functional separation of IT/IS and business areas within the retailers on the implementation of new IT/IS projects. The number of facets encompassed within this one heading became rather unwieldy and the information was eventually split into two chapters. This chapter (Chapter 5) deals with the impact of requirements and structural divisions within the retail organisation on the success of new IT/IS projects, and Chapter 6 with the consequent implications of using the techniques and tools for common knowledge (CM) creation and transfer between the customer and the system developer (see section 5.13). The other categories to emerge from the analysis were the role of project manager leadership and impact of professional and intellectual culture clash upon the success of new IT/IS projects. Further analysis showed that absence of organisational learning between business and IT departments was a common theme to each of these chapters, and this issue is explained in Chapters 6 and 7.

The data input into an easy but sophisticated software package called "*'SphinxSurvey Plus2'* (see Chapter 4) which allows both quantitative and qualitative analysis, also it has the facilities that SPSS software provides.

The concepts and technique suggested in this chapter are based on a research study of retail organisation in the United Kingdom and their use of IT, undertaken by the author. The research study was undertaken in the retail sector which depends heavily on large IT systems which typically suffer from the legacy of different developments of hardware and software being added to existing systems.

KRF was developed from a number of sources including a research study of retail organisation in the United Kingdom and their use of IT, undertaken by the authors. The retail sector was chosen because of its dependency on IT and because it typically suffers from its legacy of varied developments of hardware and software (Cavell, 1999, and List, 1999). The study consisted of **questionnaires, interviews, and workshops** in the sector. Two types of questionnaires were designed to study the "pre-requirements stage". The questionnaires were targeted to senior personnel in the organisation, namely the head of the I.T department (developer) and the other type of questionnaire was sent to the different business departments (internal customers) such as the accounting and marketing departments. The Financial Times (London Share Service) provided the starting point for obtaining the retail sources, listed under the subheadings, 'Retailers: Food' and 'Retailers: General'. This provided the basis for a survey of 119 retail organisations in total (23 'Retailers: Food' and '96 Retailers: General'). Each participating retail organisations was sent two questionnaires for the relevant department to collect quantitative and qualitative data. This was followed up by telephone interviews and some detailed face-to-face interviews and discussions in companies with individuals working in both the business and the IT departments, concerning their requirements determination process. Finally, a focus on **two case** studies of major retail organisations was conducted in the second phase of the research. It can be stated that in general the replies received from the business side and the IT side were significantly different, with the customers and the developers in many retail organisations having very different views concerning requirements and the requirements determination process. Further there were clear instances of 'accusations' made between the groups indicating the degree of misunderstanding between customers and developer, and vice versa. The indications are that the responses support the hypothesis that there is a knowledge gap (KG) and an understanding gap (UG) between the two groups (see also Al-Karaghouli et al., 1999; Al-Karaghouli et al., 2000).

5.9 Fieldwork

The research methodology was designed to investigate first the system failures in general and their usage in the retail sector in particular. The second, is the specific topic of customer requirements and its role in developing ITS. Part of the extant literature on these two topics was the planning of necessary foundation for conducting a large-scale postal survey (two types of questionnaires, customer and system developer) into the general usage and perception of requirements and its role (see references).

Two waives of survey had been sent (the first 150 each conducted in 1998, the second additional 100 each conducted in 1999) using a structured questionnaires with 19 questions each requiring mainly precise scale responses in rather particular topics such as communication, pre-requirement, testing ..etc. These questionnaires followed in some cases, interviews and telephone calls to have good feel for the problem. The last 50 years, or so, has seen rapid IT developments, which we would like to call it "the technology revolution" (TR) which contributes to our life in many ways from "the Industrial revolution" (IR). The TR through the internet for example, highly integrated national and international societies (Hoffman and Novak, 1995; Oxford Institute of Retail Management, 1996; Mintel, 1987), but fifty years on and the journey of TR still full with ITS fiascos and failures (Bostrom, 1977a; Bostrom, 1977b).

According to Ody (1987), the rapid progress that is being made in the ITS and applications of IS for retailers is therefore highly contributed to the development of retail.

"Retail executives have realised the need for help in these areas for sometimes-but they are only beginning to appreciate that computer-literate marketing staff manipulating sophisticated data-bases can provide them with answers".

5.10 Methods Implemented

The results presented here are promising for the application of requirements in ITS projects. However, future framework for more complex or realistic setting might consider these results in an attempt to develop a better framework for capturing requirements. This chapter sets the scene for discussion of the empirical case studies by describing how the retailers have integrated information technology into their evolving and dynamic business. Our survey includes many senior manager and board directors at more than 119 UK retail organisations, 53 per cent of respondents said the KRF model provides a strong tools for business and technology investment and would be most likely to boost success of ITS in the UK. Business managers also said in the survey, that ITS was essential to their long-term strategy, 80 percent of respondents describe technology as very important to their strategic business goals. Tighter integration of business and IT consultation during the requirements stage, was one of the most important area where ITS promised to deliver the greatest impact on revenue growth, according to 60 per cent of those surveyed, with 40 per cent planning to implement KRF model as soon as this year.

5.10.1 Further Analysis of the Sample's Data

The sample in this research study includes all the retailers (Retailers, Food and Retailers, General) in the United Kingdom prior to October 1997, from the last pages of the Financial Times 1998 entitled (London Share Service-Retailers, Food and Retailers, General columns), UKDirectory (1996) and the Shopping Centre and Retail Directory (1996 & 1997). There were gaps in the documentation supplied and additional names of Senior IT and business Managers were often provided by personal contacts. The collection of data was very targeted surveys. The contact details of Senior IT and business Managers were identified through the Shopping Centre and Retail Directory mentioned above, through several search engines, from organisation web sites, and from professional postgraduate students studied at the Westminster Business School.

The sample consists of 820 organisations. Self-administered questionnaires were sent, for the most part, hand delivered to the personal contacts to ensure a higher response rate. We closely followed Dillman's (1991 & 2000) tailored design method - this system of interconnected procedures for administering high-quality surveys has consistently produced higher-than-expected response rate (Dillman, 1991). Placing questions in descending order of interest can have a positive effect on the response rate (Dillman, 2000). This is based on finding by Heberlein and Baumgartner (1978) that the response rates depend on the importance of the questionnaire topic. For example, we consulted Dillman in perfecting the questionnaire's visual and design aspects. Design aspects included the use of bold and the italic for some questions and for answer choices, the vertical alignment of question subcomponents, the use of more blank space between questions than between subcomponents of questions, the numbering of the questions, and the maintenance of regularity, symmetry, and consistency. Due to an early-piloted survey, a number of considerations guided the ordering of the questions. These included placing questions in descending order of interest, addressing value-based effects, not placing objectionable questions at the beginning of the questionnaire, addressing addition and subtraction effects, and the increased positiveness of synoptic items when preceded by specific items on the same topic (Dillman, 1978 & 2000; Johnson and Duberley, 2000; Phillips and Pugh, 2001; Bell, 2001; Gill and Johnson, 2002).

Pilot testing the questionnaires (system developer-software builder and customer-enduser) involved interviews with 60 individuals (techie and non-techie). Most interviews lasted well over one hour, some nearly an hour-and-half (especially at the workshops). Cognitive and motivational qualities were addressed (Dillman, 2000), as well as the question layout, the instructions, the answer categories, and the question-numbering system (Oppenheim, 1992). The positiveness of the mailing package (cover letter, questionnaire, complement slip, and self-addressed envelope) was also assessed. The pilot test led to two iterations of item editing, layout refinement and reduced number of questions, the latter due to the precious time of managers involved. We adopted a mixture of telephone and e-mail follow up and reminders to ensure a positively nonrespondents. Ninety-five surveys were returned with two weeks!, which is a response rate of 88% questionnaires with few missing data, some of them were eliminated, which resulted in a final usable sample of 230 retail organisations.

In order to probe further into the nature of the interaction effect between the two groups (system developer and customer), we ran a series of group workshops of professional postgraduate students who some of them came from techie background and the others came from business. At the workshops the individuals divided into two groups.

5.10.2 Looking Back at the Questionnaires

Our survey of 230 directors of business and IT departments shows other factors such as, that the majority of them support tighter budget with up-to-date skilled and better-paid teams is one of the main factors contribute to a better quality ITS not the large of amount of budget assigned to an ITS project. It also reveals that two-out-of-five organisations are planning to reorganise their IT department over the coming year. The average business organisation will employ only five per cent more IT staff in three years time, but will pay them 20 per cent more. This is combined with low-level IT administrators as they will expect ITS to require less maintenance and support. These changes are the result of economic pressure, according to the survey.

Two-thirds of respondents believe their business will either reduce IT investment or hold it flat this year. But they are expecting their budget to be 13 per cent higher by 2006. Three-quarters say they have faced pressure in reduce ITS costs, one-in-four had delayed ITS projects, and more than half plan increased use of outsourcing. The research study showed that twenty three percent (23%) of system developers respondents said not enough resources are given to testing an Its, while a further thirty eight (38%) said the IT senior management failed to understand the cost of improper testing including the time testing takes. Especially in retail's big ITS, where there are many upgrades, retailers would not put more effort into testing. Modern ITSs are extremely complex, so there is no such thing as easy upgrade. Some ITS managers would like to see that they should allocate 20 per cent of the project time and budget to testing at the first stage of development (requirements), to avoid costly systems breakdowns. What is frightening is that testing by many ITS developers are still not seen as essential activity, system developers would rather spend more financial resources on more ITS development. Part of the problem is that testing has not seen as glamorous. With ITS budgets unlikely to be increased in the near future, it is up to developers to raise the profile of the testing process and quantify the financial implications of failing to invest. Public sector respondents were more likely to accept that there were problems and admitted to postponing ITS projects. But we think the confidence in the financial sector is misplaced.

5.10.3 Enhancing the Interview Process

Watson (1994) noted the need for "reflexivity" in interviews, by which he meant considering the difficulty of remaining neutral and objective in which the presence of a researcher influences the answer given and attitudes displayed by respondents. As the research methodology was centred upon system failures, the role of knowledge and understanding in the development of smart requirements (described later in section 6.15) a structured interviewing technique in which the precise line of questioning is predetermined was not appropriate, as this method pre-supposes the existence of theories and relationships which can be tested by specific questioning. At the other end of the scale, a totally unstructured interview, in which no guidance at all is given to the respondent, is never possible because the very presence of the researcher and explanation of the project under investigation will influence the thinking and nature of the responses given by the interviewee. Instead, specific primary data was collected by means of formal semi-structured interviews within the industry representatives. Most questions were open ended to allow the interviewees to express their own views fully. Piore (1979) noted the value of anecdotes offered by the respondents in response to such questions, which illustrated the key organisational or environmental influences upon events, and the relationships between these factors.

Some of the interviews were tape-recorded and later transcribed, so that a full record of the conversation was obtained. The practice of writing notes during or immediately after an interview was not followed as this tends to partially interpret the data, as only issues that were previously regarded as important will be selected and recorded. Transcription can always be returned to and reinterpreted as issues are developed over the period of the research. This method of data collection is well established in the literature, (Easterby-Smith et al. 1991 and Jankowicz 1993) and has been tested by the researcher on a previous occasion, where it was found to be extremely effective in clarifying the often contrasting motives of individual actors. This interaction allowed the literature described in Chapter 2 and 4 to be built upon, and various hypotheses about the nature and extent of the contributory organisational factors to the requirements of the technological projects process to be tested. This process contributes to the development of requirements –RKF, which is described in the next sections.

5.10.4 Experimental Requirement Workshops and Participants

Many workshops held over several months to facilitate communication between the two parties and to enhance the data and information collected. They were two types of workshops. The first type of workshops was held at the premises of the retail organisation and the financial organisation over a two month period. The number of participants was between 4-10 subjects at one time per workshop.

The second type of workshops was among postgraduate/professional students. These workshops held weekly over a period of six months. The participants were from the business and IT working in retail organisations, their occupations are either managers or senior managers, divided to play the role according to their actual jobs as customers or IT specialists. Groups formed (customers vs. system developers). They were 28 participants at one time per workshop and all familiar with the basic concepts of business and IT.

5.10.5 Adopting KRF by Piloting the Experimental Tasks

The participants (customers and system developers) were given the details of a retail organisation with the aim of developing an ITS. Both groups (customer group and system group) were instructed to list the business requirements and specifications to deliver the system needed. They were told to provide a value and realistic lists such that they would indifferent (matching specification to business requirements, not the other way round). Subjects told to be precise and to avoid vague or un-workable requirements.

5.10.6 Task 1

Participants were presented with 36 pairs of options (requirements and specifications) and required to match the ones they think will match best. The options in each pair were labelled as "BR" or "SS" (see Chapter 6). Subjects simply circled and match "BR" with "SS". Options in a pair were always matched, no options left unmatched. The first group involved comparing vague requirements/specifications options. The second group involved comparing precise requirements/specifications options. Each group 18 pairwise comparisons.

5.10.7 Task 2

Participants were presented with 10 all-vague requirements/specifications options, and were given an opportunity to use additional information from their specialised peers (department) to increase the precision of the outcome (matching BR to SS). This task had two versions. In the choice version subjects could choose either to narrow the outcome range of requirements/specifications or indicate no preference and asked to decide how to allocate BR and SS to increase the precision of the outcome.

5.10.8 Documentation: Procedure and Instructions

Participants were run in small groups of 4-6 subjects in class settings. The two tasks mentioned above were presented in a paper-and-pen. The groups went through the KRF model which presented in figures 6.13 and 6.14. The task was always the last in the sequence and it matched the previous task as indicated in Figure 6.14.

After a brief verbal explanation of the tasks, participants were given five minutes to read the general instructions. Participants were told that at the end of the experiment on pair would be selected at random. In this pair the participants would get to play the game that s/he valued more, i.e. either select task 1 or task 2. On the average, participants required an hour to complete the experiment. Many forms of representation have been used or recommended for use in systems development. These include representations such as:

- Sketches or storyboards.
- Chapter prototypes or mockups.
- Diagrams using prescribed notations.
- Diagrams with dynamically negotiated notation.
- Text in natural, semi-formal and formal languages.

These representational forms may be combined in systems development work, either on a dynamic, ad hoc basis or through a prescribed method. Surveys, case studies and anecdotes all provide illustrations of successes and, too often, failures of these diverse forms of representation in supporting communication amongst users and developers. Most of the techniques used in KRF are based on a *workshop-participants scenario* (see section 5.13 -customer and developer "knowledge and understanding gaps"). Participants were grouped according to their work experience and background into two teams, they will tackle a set of related questions such as:

- What features of user-developer communication can or should be supported by such representations?

- What properties of a representation contribute to making it an effective communicative aid?
- Which forms of representation exhibit these properties and in which contexts?
- How are representations transformed in the course of use for communication?
- What relations are there between effective representational support for communication within user-developer Cupertino and for communication outside those collaborative activities, e.g. in communicating the results of their work to system implementers or others who may not have participated in the creation of the representations?

5.11 Results

We report first responses from task 1, followed by the results of task 2, and finally the results of both tasks combined. Preliminary analyses found no differences between the two orders, so we combined results across presentation orders. The results presented in the following sections are the output of the Sphinx software, refer to Appendix H for relevant questions.

5.11.1 Questionnaire Research and Key Findings

The following sub-sections analyse and present results of the survey questionnaires completed by individuals of organisations that participated in this research study.

5.11.2 Organisation Demographics

35% of the total of the surveyed organisations are from the retail sector this includes the some of the IT departments, where customers' data collection and analysis is emerging as a critical task for planning and monitoring future business targets. The banking and finance organisations (9%). Manufacturing (4%), are other sectors where customer analysis is assumed to be of great importance. The public sector (5%), and other unspecified retail organisations (16%) are also included. Results are shown in Figure 5.1.

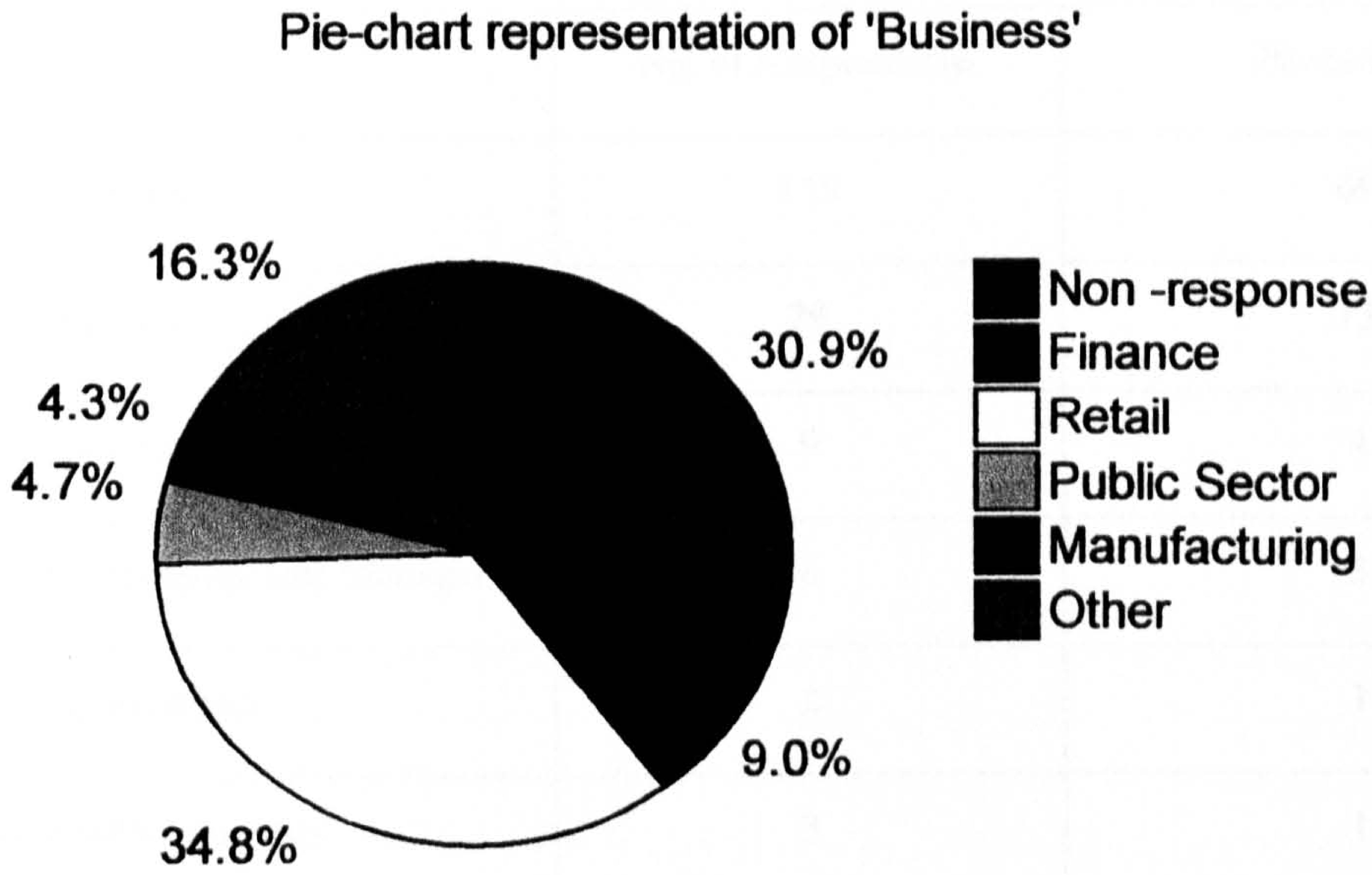


Figure 5.1: Type of Organisations Surveyed (Question 29)

5.11.3 Individual Demographics

The research survey was completed by IT/IS executives, managers and other individuals of Retail organisations who participated in this research study. This includes departmental or functional manager, business unit or divisional manager, systems staff, workgroup or project managers. These results illustrate in Table 5.3.

Job Title	No. of Respondents	Percentage
Non-response	158	69
IT Executive	29	13
Project Manager	9	4
System Development Manager	6	3
System Architect	2	1
Analyst/Programmer	3	1
Software Engineer	3	1
Other	20	8
Total Observations	**230**	**100%**

Table 5.3: Positions Held by Respondents (Question 4)

5.11.4 System Development Methodologies

The results from the respondents who completed the survey show that some companies assume that the applications they are using system developments approaches that deals with requirements' solutions, but in reality most of these organisations advocate an approach to requirements' definitions. This is because of their need for a specific ITS application and the 'quick' benefits these methodologies can bring to their organisations. However, the most popular applications found to be used by most of these organisations are: Object Oriented (OO) in (21) of these organisations, own methodologies (9), and other OO (8). These figures are derived from results representing more than 1/3 of the 42% responses from the overall received questionnaires. Table 5.4, presents the results.

Software Development Method	Frequency
C++	1
COBOL	1
DSAM (IS09001)	2
Jackson	2
JAVA	2
Niam, Usoft approach DSOM	1
No formal method (use own methodology)	9
None	3
OO	21
OO (0ther)	8
OO (UML)	2
Prototype	1
RAD	2
SSADM	1
Use the product development tools, Psenderpoise	2
Volcano	1

Table 5.4 : Software Development Methods Used by Respondents in Retailing (Question 7)

5.11.5 Customers and System Developers Data Collected

Customers and system developers data used for ITS project failures and specifically for customer requirements is usually collected from multi-internal or multi-external sources. Multi-Internal sources are those that are generated through organisation activity such as customer and department records, Web site, from mail or phone contacts, and customers. Multi-external sources of data include organisations such as the corporations with large customer databases like publishers and cataloguers.

From the individuals of business and IT departments in the retail organisations that completed both of the survey questionnaires, it clearly appears that the amount of customer data that reflects the tactical nature of ITS projects and the unhappiness of both customers and system developers is significant (see Appendix G). Just below quarter (23%) of the system developers admitted that they do not spend much time in testing and they let customers carry out the task (Table 5.5).

Monitoring Time	**No. of Respondents**	**Percentage**
Non-Response	158	68.7%
Yes	19	8.3%
No	53	23.0%
Total Observations	**230**	**100%**

Table 5.5 System Developer Monitoring IT/IS System -Testing Time (Question 12)

Despite that, above half (58 percent) of the customers participated in the survey said that they are happy with their IT/IS (Table 5.6).

Computer System	**No. of Respondents**	**Percentage**
Non-Response	72	31.3%
Yes	134	58.3%
No	24	10.4%
Total Observations	**230**	**100%**

Table 5.6: Customers Happiness with IT/IS (Question 31)

5.12 Further Exploration of the Results

In this section we present additional empirical results and we provide further interpretation of some of the results presented before. First, we evaluate the performance of the evaluation models in the sample by re-estimating the models every month. Subsequently, we use our empirical results to further explore the relationship between the physical and risk-failure densities. We use these results to comment on the quality of the risk-failure procedure and the likely source of error in the class of models under study.

5.12.1 Results: Evaluation with Monthly Updating

The conclusion from the out-of-sample exercise is that one should use the parsimonious leverage model rather than the more richly parameterised models. However, it may be argued that the out-of-sample exercise we conduct is very different from the way these models are typically used by practitioners. It may be unrealistic to assume that model's parameters are constant over the entire sample period. We now investigate the robustness of our conclusions in a situation where we allow the model parameters to change over time. We work exclusively with data in the sample (March 1, 1996 to February 30, 1998) and conduct the following exercise: For each model we estimate different parameters values every month and use these parameters values to weigh and evaluate the option next month.

Continuous Communications	**No. of Respondents**	**Percentage**
Non-Response	72	31.3%
Yes	149	64.8%
No	9	3.9%
Total Observations	**230**	**100%**

Table 5.7: Role of Communications between Customers and System Developers (Question 54)

The results in Table 5.7 above provide strong support for Hypothesises H1, H2 and H1 mentioned in Chapter 1. Surveyed customers and system developers also plan to optimise customer interactions and communications. Interestingly, 65 percentage stated that they communications between the customer and the system developer play a vital role in the requirements stage of the system development process and it will lead to improve the success rate of IT/IS, Table 5.7 summarises the results.

Clearly, one of the key success factors of an IT/IS project is to have a close and productive communications between the customer and the system developer to bridge tacit business knowledge (TBK) and tacit technology knowledge (TTK) which resulted in the **professional and intellectual gap** stated in chapters 1, 2 and 6. Bridging this gap(s) in order to support ITS developments within the business and an enterprise-wide strategy. This is because (as concluded in chapters 2, 3 and 6) with out any doubt, one of the key strengths of successful business-led ITS strategy is to bridge the gap(s). To bridge the gap(s) between the customer and the system developer at the initial stage of requirements, continuous involvement and communication between the two groups at the initial requirements stage of an IT/IS project is vital. More than half (65 percent) of the respondent who participated in the survey agreed and only 4 percentage disagree. The results are shown in Table 5.7. However, this is an interesting observation, at this point, these results come mainly from large retail organisations that having invested hugely in IT/IS to improve their business strategy.

5.12.2 The Importance of Communication in the Initial Requirements Stage

As illustrated in Table 5.7 above, the results show with no doubt the significance of communication between the customer and the system developer.

The communications issue was reported in Chapters 2, 3 and 4 that the role of communication is of a tremendous importance to the system development process in particular and for the business organisations, and IT/IS department in general as they build the necessary ITS components, and focus on how to improve and 'harness' the quality and the success of their ITS applications to support business goals and to help organisation to increase sales revenue, deliver quality customer service, and most of all make the right and informed business decisions.

Communications	No. of Respondents	Percentage
Non-Response	158	68.7%
Yes	44	19.1%
No	28	12.2%
Total Observations	**230**	**100%**

Table 5.8: Communications Breakdown -a Problem (Question 22)

Overwhelmingly, the results show that all respondents who completed the questionnaires survey (19 percent), agreed that communication issues are very important to their organisations as they develop and build ITS projects and focus more on harnessing their customer information for strategic advantage, Tables 5.8 and 5.9, summarise the results.

Code of Respondent	With Whom	Frequency
10	End-user.	16
11	Across business divisions & IS.	
13	End-user/software design.	
15	Sales customer + between development installations.	
19	Colleague and customer.	
23	Usually colleagues.	10
24	Other parts of the organisation.	
28	Within customer and within Development team.	
30	Customer.	
33	Colleague, customer.	
35	Customer (with client).	
38	Customer.	
40	Customer (internal).	
46	Sometimes with long distance customers.	
47	colleague and customer.	
50	Anyone.	
59	Colleagues.	
60	Project manager/customer.	
61	Colleagues.	
62	Colleagues & especially Directors.	
79	Between developer, system analyst, and business user.	
Total Observations	**21**	

Table 5.9: Communications Breakdown from the System Developers Viewpoint (Question 23)

5.12.3 The Use of Data, Communication in Requirements Identification and Tools, and Techniques to Support ITS Success

Once the customer and the system developer requirements-specification is in 'better shape,' retail organisations have an opportunity to make more effective use of it in supporting their ITS development through the adoption of KRF. Clearly, only 57% of the overall retail organisations and IT developers surveyed support KRF initiatives with quality data, integration tools and techniques. However, these are mainly large organisations who favour supporting their ITS developments by 'integrating best-of-data quality and integration tools and techniques.' The overwhelming majority (57%) of individuals from retail organisations that completed the survey questionnaires were clear in their responses in support of the adoption of KRF, Table 5.10 illustrates the results.

Easy Flexible Development	**No. of Respondents**	**Percentage**
Non-Response	73	31.7%
Yes	131	57.0%
No	26	11.3%
Total Observations	**230**	**100%**

Table 5.10: KRF : Customers and System Developers Prefer an Easy and Flexible Unconventional Development To Establishing Requirements (Questions 14 & 39)

It appears that they are either using 'in-house tools and techniques' (see Table 5.4), starting from scratch, pretending that using such processes are ways to deal with the quality ITS, or organisations using 'all-in-one' ITS packages, in which case they think this process will replace the 'hard job' that is normally done using smart requirements and integration, tools and techniques. In many cases, however, these retail organisations class themselves as -likely- to use such tools in the near future.

5.12.4 Requirements, ITS Developments and Challenges

There is not doubt that smart requirements leads to a good reliable ITS that supports business aims and objectives and leads to satisfy internal and external customers. As previously reported in chapters 2 and 3, ITS developments in retail face big challenges of both business organisation and technical. The top technical challenges identified in the normative literature are the complex process of elicitation, capturing, managing, clear and rigorous requirements and integration business requirements with technical specifications involved. Clearly, the results of the overall respondents, who completed the questionnaires survey, show that on the close user involvement in the initial requirements stage, 'elicitation, managing, clear and rigorous requirements and integration business requirements with technical specifications and quality and consistency' are the top challenges. This challenge was marked by 66% percent and just 3% as it is not important. Table 5.11 presents the evaluation results when questionnaires and interviewees used KRF as evaluation criteria.

The research study results in Table 5.11 shows that both groups strongly agreed that getting the requirements right first time will have an important effect at the initial requirements stage and the development and building process of an ITS.

Customer (User) Involvement	**No. of Respondents**	**Percentage**
Non-Response	72	31.3%
Yes	152	66.1%
No	6	2.6%
Total Observations	**230**	**100%**

Table 5.11: Closer Customer Involvement at the Initial Requirements Stage of the ITS Project (Question 36)

Based on 230 responses, the analysed results indicate that a significant percentage of ITS projects aren't doing as well as expected over a one year period. Twenty eight percent (28%) were considered as 'failed ITS project'. With sixty nine percent (69%) did not want to admit teething or failure of ITS projects (most of which are large retail organisations). Twenty percent (45 respondents) said that they experienced ITS failure of less than 4 ITS project and one percent (3 respondents) admitted a higher number of more than 21 ITS project failures. The results are shown in Table 5.12.

Based on the results below, the author established and identified a general picture of what is happening in practice. The surveyed retail organisations could be:

• Retail organisations 'facing ITS failures'.

• Retail organisations experiencing ITS teething and failure problems.

• Retail organisations satisfying with their ITS that meeting business needs.

No. of Failed Projects	**No. of Respondents**	**Percentage**
Non-Response	158	68.7%
Less than 4	45	19.6%
4-8	3	1.3%
8-13	10	4.3%
13-17	3	1.3%
17-21	8	3.5%
More than 21	3	1.3%
Total Observations	**230**	**100%**

Table 5.12: Percentage of Failed ITS Projects Per Year (Questions 19 & 50)

Then, interviewees were asked who is fault it is, customers or system developers? each group accused the other. The results of the surveyed retail organisation showed that the 'blame' culture between customers and system developers exists and much in evidence. System developers stated that seventeen percent (17%) of customers keep changing their requirements. While a high percentage of fifty two (52%) of customers accused system developers of being too techies. This confirms previously reported literature in chapters 2 and 3. This, also tests the hypothesis put forward in chapter. Table 5.13 illustrates system developers viewpoint, while Table 5.14 reflects on customers' viewpoint. Tables 5.13 and 5.14, summarise the results.

Question 26: Do end-user change their requirements?

Customer Change	No. of Respondents	Percentage
Non-Response	159	69.1%
Yes	38	16.5%
No	29	12.6%
Sometimes	4	1.7%
Total Observations	**230**	**100%**

Table 5.13: System Developers Viewpoint (Question 26)

Question 57: Do you think that the software engineer concentrates more on IT aspects rather than the business goals?

System Developer	No. of Respondents	Percentage
Non-Response	74	32.2%
Yes	119	51.7%
No	37	16.1%
Total Observations	**230**	**100%**

Table 5.14: Customers Viewpoint (Question 57)

Based on the above results, the author established a general picture of what is happening in real world. Some of the interviewees (both customers and system developers) in the surveyed retail organisations do can not visualise the outcomes (capabilities and facilities) of the ITS in developments until after 'road-testing' the ITS in question. Also, the results show that most the ITS developed did not meet business requirements for one reason or another. But requirements was highlighted as the main factor contributes to unsuitable ITS (Appendix D, D2-C6 and Appendix H, Question 33).

The author then started to study each group separately, i.e. customers and system developers. In doing so, the author attempted to identify the problems and assigned the main root causes of the *complex requirements issue which is a sociotechnical* reported in Chapters 1, 2, 4, 5 (section 5.11.1) and 6 involved in ITS developments. The stages for conducting the final analysis of the data related to the two groups under investigation are presented in the following sections, and the lessons learned are discussed in the following chapter (Chapter 6).

Quantitative and qualitative analysis are statistical procedures used to uncover relationships among many variables. This allows numerous identification of variables to be condensed into fewer dimensions including general underlying attitudes. The analysis for this research is conducted using the statistical package Sphinx for Windows, version Plus2. Accordingly, the two questionnaires are divided into *five* categories of questions that are represented in Table 5.15 as follows:

- *A: Retail Organisation background.*
- *B: Business Applications Used.*
- *C: System Developer &Customer Information Infrastructures.*
- *D: Technical and Retail Organisational Issues.*
- *E: Communication and Requirements as technology Enablers.*

As shown above, in this research study the focus of analysis is on ITS failures and identification of smart requirements involved in ITS development process.

CATEGORIES	ANALYSIS APPROACH USED	QUESTIONS
A: Retail Organisation background This section of questions attempts to collect general information regarding the organisations surveyed. Such data may include: Size of the organisation; the business nature of the organisation; Number of departments; the nature of the organisation (e.g. Retail, Financial, Public). Also, about Senior individuals in IT and business departments.	Descriptive Analysis	S1, S2, S3, S3 C1, C2, C3 ***S: System Developer*** ***C: Customer***
B: Business Applications Used This section of questions attempts mainly to collect data about platforms used. The objective is to identify organisations using ITS applications from those who are using other Applications.	Descriptive Analysis	S4, S5 C4
C: System Developer &Customer Information Infrastructures This section of the questionnaire aims at collecting data about system developers and customers with regard to the important factors and issues of successful ITS developments, which have been identified and discussed in chapters 1, 2 & 3.	Descriptive Analysis	S6, S7, S8, S9 C5, C6
D: Technical and Retail Organisational Issues This section of the questionnaire aims at collecting data that deals with the ITS developments, such as: Types of methodology used, Length, Number of failed (abandoned) ITS or succeeded projects, Involvement in initial requirements, Business requirements met or not.	Descriptive Analysis, quantitative &qualitative	S10, S11, S12, S13, S14, S15 C7, C8, C9, C10, C11, C12, C13, C14, C15
E: Communication and Requirements as technology Enablers This section of the questionnaire aims at collecting data that deals with factors, such as: understanding, communication breakdown, Requirements as a vital factor in business-led ITS projects.	Descriptive Analysis, quantitative &qualitative	S16, S17, S18, S19 C16, C17, C18, C19

Table 5.15: Questionnaire Categories and Classification of the Analysis Used

5.13 Workshops: Support for User-Developer Communication in Information Systems Development

The research work will address topics about which users and developers may wish to communicate include, the user tasks, requirements for systems to support the users work, envisioned system designs, and usability and acceptance evaluations.

User-developer communication often relies upon external representations of the above topics. In addition to supporting communication about these foci of the systems development activities, the representations must (often simultaneously) support the development activities themselves, aiding communication amongst the participants about the ongoing activities. In fulfilling these roles, multiple representations are often used in combination and in series, demanding frequent transformations between representations. KRF is a flexible management and IT framework which neither needs to create a new system development methodology nor replace an existing methodology. KRF fill a gap in the way requirements has been dealt with. It is a simple idea that many system developers and software engineer did not take the time to deeply think about it.

The workshop discussions between user-developer shall provide initial answers to the above questions, identifying gaps in our current understanding of the communicative role of representations in systems development and laying the groundwork for a research agenda to produce further answers to these and other questions which arise through the discussions. The workshop discussions should also lead to recommendations for the selection and use of a range to support user-developer communication in systems development practice. This in turn should lead to proposals for technologies to support communication through representations. The prevalent view is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. This Current research work includes stakeholders' rights and responsibilities, the specification and reuse of requirements and techniques for assessing requirements specifications. The product of this research is a complete requirements process for assessing requirements quality, and for specifying business requirements. Requirements evolve with time. This necessitates managing requirements evolution and aligning requirements to organisational changes.

5.13.1 Human Aspects of Change Requirements: What is Critical about Critical Requirements in ITS?

During our interactive workshop, discussions included a variety of techniques for discovering requirements. We also identify the components of a requirements specification, the characteristics of each type of requirement and their relationships to each other. We discuss how to use the concept of fit criteria to make requirements measurable. We talk about a number ways of clustering the atomic requirements to help in making project management decisions. We introduce the KRF requirements template as a discipline for identifying and linking business event responses, product use cases, business goals, constraints, stakeholder profiles and data.

Learning points:

- To introduce a detailed requirements process.
- To understand a wide range of trawling techniques and how to use them to discover requirements.
- To be able to identify the components of a requirements specification and the relationships between them.
- To be able to review real constructive requirements based on objective fit criteria.

Requirements management needs are contradictory. On the one hand we need to be flexible in the way we work with people and the order in which we do things, on the other hand we need a precise and disciplined way of keeping track of requirements. Sometimes people know exactly what their requirements are, but more commonly requirements engineers have to help stakeholders to discover what they really need. The wide variety of requirements sources and the infinite variability in stakeholders' knowledge, viewpoints, attitudes and experience means that we need many different trawling techniques for discovering the requirements. And these techniques need to be flexible enough to cope with differences between projects. However, along with the need for flexibility we also have a need for formality. In order to be able to manage a project we need to be able to have some consistent way of expressing the components of a requirements specification and the links between them.

5.14 Using Scenarios to Organise Requirements Effectively

5.14.1 The Culture Gap

The view of two cultures, that of IT and the business, is in evidence in many organisations. The culture of system developers is typically technically oriented and is based on an understanding of technical issues (Kavanagh, 1998; Price Waterhouse, 1991, 1992). In systems development this is reflected in a focus on issues such as the functionality of the system, its performance, the response rate, the type of programming language that should be used, etc. (Sturt, 2000; Flood, 2000). On the other hand, the business culture and focus is rather different and is more concerned with business issues and the system as support for business and management processes. Many of the technical terms and issues, particularly when expressed in "IT jargon", mean little and are frequently misunderstood by the business side and the implications often missed completely. These two cultures have been identified by many, for example Nuseibeh (1996), Sommerville (1992), Cavell (1999), Griffin (1998), and Sabbagh (1999). However, we go beyond this and identify two elements to the gap. We suggest that there is frequently a *knowledge gap (KG)* and an *understanding gap (UG)* that exists between the customer and the software developer. As indicated the customer's knowledge is mainly "business" knowledge with limited IT knowledge, on the other hand the developer's knowledge is "technical" knowledge with limited business knowledge. This is the knowledge gap. We believe that this gap is a result of the different backgrounds, experiences and working environments of the groups with both sides talking a somewhat different language. Further we identify an understanding gap, which is to some extent a result of the knowledge gap, but is a whole set of differing understandings, meanings, assumptions and values, see Figures 5.2 and 5.3. The business culture typically views the IT department as a cost centre rather than an investment and contributor to the success of the organisation. As a result customers and developers have different expectations of each other and particularly of any system to be developed which is not just about following rules and procedures but must take into account these differing cultures (Howard, 1999).

It is argued that the view of two cultures is in evidence in most organisations although it is true that some organisations have made efforts to overcome these different and conflicting cultures, usually by trying to mix the participants in 'seamless' teams and by co-location of the two groups when developing systems (Figure 5.2). However, although this can help the differences are still deep-seated and not easily resolved. For the purposes of this chapter we shall assume that there are two separate groups of people involved. Firstly, the business users and customers of the system, which we will for shorthand purposes call the 'customer' and secondly the developers of the system which will include business analysts, systems analysts, programmers, software engineers, network specialists, security specialists, etc., which we shall call 'developers'. Usually the developers are the internal IT department although increasingly it is a third party organisation, such as an outsourcing vendor or consultancy company. This can exacerbate the communication problems due to the physical separation of the organisations. For convenience we will talk about the two sides but this terminology should not indicate that there is only one of each or that they are not a diverse set of people. Nevertheless it is crucial for systems to be successful that the problems created as a result of these different cultures are minimised.

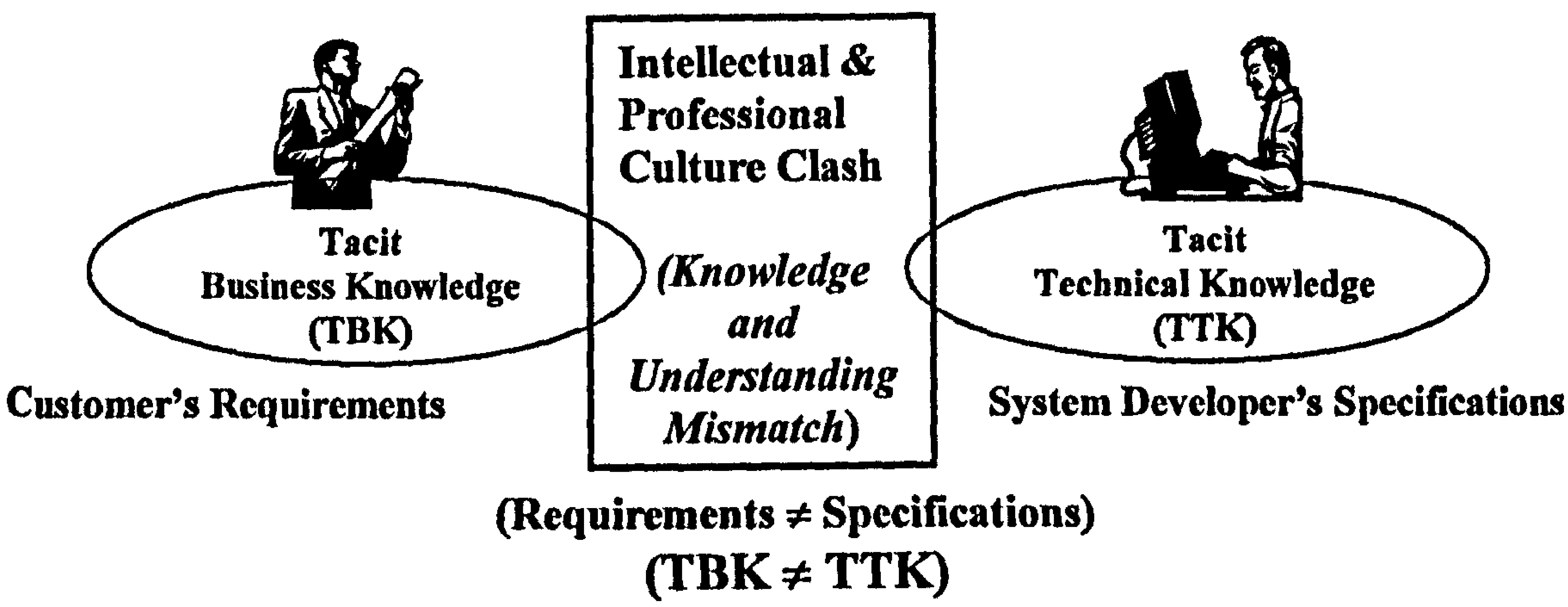


Figure 5.2: A Culture Clash: Business Knowledge (TBK) vs. Technical Knowledge (TTK)

We believe that the determination of clear and adequate understanding of the requirements is a socio-technical process and that human communications and interaction are important ingredients in determining effective requirements. Intensive and sustained communications between the customer and the system developer leads to a clearer understanding of the requirements and is likely to result in a better and more useable system for the customer (Lipnack, 1997). It is also likely to improve the situation if the requirements are more right first time, i.e. before any development is undertaken (Lee et al., 1995). This is not to say that we believe that requirements are always 'out there' waiting to be discovered. Often the notion of a full set of requirements existing in the minds of the customers is just not true. Frequently the customer has to learn and evolve their understanding of the requirements as part of the elicitation process, particularly in complex and new application areas.

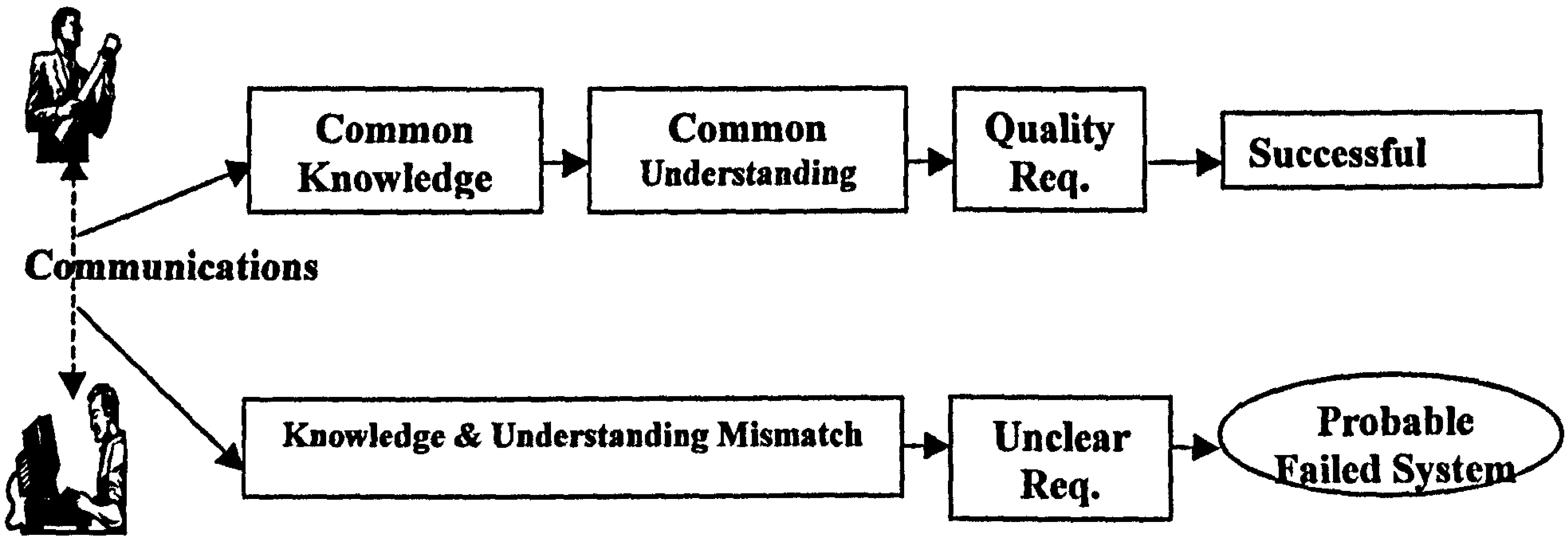


Figure 5.3: Requirement is a Socio-technical Process (Human-Human)

High and unrealistic expectations of a system prior to development are well known problems and can contribute to disenchantment with the system when it is implemented. Customers can get too enthusiastic about technology and hopelessly over-estimate the technology's capacity to change their world (Mirl, 1998). This is an important issue which can lead to system failures (Duffy, 1993; Norman, 1998) and some recent examples of system failures in the UK seems to support the assertion that managing expectations is an important part of the requirements elicitation process (Groom, 2000; Ranger, 2000, and Kelly, 2000). If both groups initially agreed practical requirements and understood what the system is going to do when it is built, then their expectation will match the system performance. On the other hand, if both groups fail to discuss and evolve the requirements then this kind of mismatch of expectations is a possibility.

KRF is proposed as an approach to determining the requirements of IT enabled business systems that addresses the problems and issues described above, particularly the knowledge and understanding gaps between developers and the business customers that have proved such a significant barrier in the past.

5.14.2 Knowledge Diversity

Acquisition of business and technical knowledge is very important to any organisation. Equally likely, continuous communications (Sturt, 2000, Harrington, 2001) are also vital to the progress of any organisation, in most organisations there is a clear division between the customer and users (both business users and end-users) of the proposed system and the developers of the system, i.e. different knowledge and perception of knowledge (see Figure 5.2). Usually the developer is the internal IT department although increasingly it is a third party organisation, such as an outsourcing vendor or consultancy company. This can exacerbate communication problems due to the physical separation of the organisations. Some organisations claim a more integrated environment where the customer and the developers are not seen as separate elements of the business but they work seamlessly together with shared objectives. Even in this environment there is usually a separation in the roles of customer and developer, it is just that they work in a coherent team or project (Tenkasi and Boland, 1996; Sieloff, 1999).

Business users and customers of the system, which we will for shorthand purposes call the 'customer' and secondly the developers of the system which will include business analysts, systems analysts, programmers, software engineers, network specialists, security specialists, etc., which we shall call 'developers'. For convenience we will talk about the two sides but this terminology should not indicate that there is only one of each or that they are not a diverse set of people and levels of seniority involved. Further the term customer is usually taken to mean the person or people (internal customers) within an organisation who require the system to support their part of the business (or the business as a whole).

The current concept of a system requirement is ill suited to develop clear "smart" requirements for large systems. The received concept follows a technical rationality, which regards requirements as goals to be discovered and solutions as separate technical elements (Cavell, 1999; Regnell et al., 1995). In contrast, we advocate a view where a requirement specifies a set of mappings between problem and solution spaces, which both are socially constructed and negotiated (Figures 5.2 & 5.3).

5.14.3 Understanding

A major contributor to the failure of information technology based systems is the problem of understanding user or customer requirements in the initial analysis and requirements identification stage of development. This chapter identifies and describes an approach to help overcome some of these problems, particularly the mismatch or understanding gap between the customer and the developer. The approach is intended to be used at the early stages of requirement determination and introduces techniques from operational research (OR) into the process. In particular Set Theory and Venn Diagrams are used as a way of graphically representing the relationships and gaps in understanding that may exist. The benefit obtained from the use of the technique is partly in the graphical representations themselves but mainly in the dialogue and negotiation that results from the construction of the diagrams. The technique has been developed in a research study of retail organisations use of IT in the United Kingdom and an example case study from the sector is used to illustrate and discuss the technique.

Chapter 6 describes KRF (Knowledge Requirements Framework) which is an approach to determining the requirements of IT enabled business systems. KRF is the outcome of a research study conducted in the retail sector that identified serious problems and a knowledge and communication gap between developers and the business that has proved a significant barrier to the successful development of information systems.

The requirements process is a **socio-technical process** which relates to human-human interaction in the form of communication and understanding of the customer needs and the system developers, it is not a human-machine relationship. The view adopted in KRF is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. Requirements evolve over time and cannot be elicited as a snapshot. This necessitates managing requirements evolution and aligning requirements to organisational change. In any business, effective IT systems require detailed and specific requirements which need to be achieved through intensive and rich communications between the different stakeholders (Sanghera, 1999). Unfortunately the determination of requirements and the development of specifications is frequently not seen in this way but simply as something to be established and got out of the way as soon as possible. Any inherent problems and misunderstandings are thus only discovered late in the development process, often only at implementation, and it then requires immediate modification with the result that the system is often regarded as a failure. In many large and complex information technology systems projects, the need for a clear understanding of customer requirements has long been underestimated (Al-Karaghouli et al., 1999a & 1999b) and this has led to the failure of vital and expensive projects. In the UK, for example, the London Stock Exchange automated trading system, Taurus after great expenditure had to be withdrawn before ever going live (Computing, 1989), (August, 2000), the London Ambulance Service computerised despatch system, which failed disastrously forcing the Service to revert to the old system (Page et al., 1993) and more recently the Passport Office 'fiasco' (Parker, 2000) and the new UK air traffic control centre at Swanwick, which is still not operational three years after its planned completion and is very greatly over budget (Computing, 1998; Hatton, 1999; Computer Weekly, 2002).

5.15 Bridging the Gap Through Communications

An important part of getting the requirements right is communication between the various groups involved in systems development. Systems Development is conducted in various different ways in different organisations. Some adopt a very formal approach strictly adhering to a relevant methodology, such as SSADM or Information Engineering (IE), whilst others adopt a softer method such as SSM or Multiview. The most common approach appears to be the use of an in-house method designed and evolved to suit the needs of the particular organisation, loosely based on one or more commercially available methodologies. A recent approach is the use of Rapid Application Development (RAD) which as its name suggests focuses on improving the speed of development but also adopts a more evolutionary development path. In this chapter it is not the intention to comment on the efficacy of particular approaches but to argue that all approaches could benefit from an improvement in communication between the groups concerned with determining and specifying requirements. Each approach usually has some recommendation concerning the people who should be involved in the process at each stage. Again it is not the purpose of this chapter to comment on what arrangements should be made. Suffice it to say that the involvement of the widest range of stakeholders is advisable. It is often the case that too few people are involved and that they do not have the necessary knowledge or seniority to make, and adhere to, decisions. In most organisations there is still a clear division between the customers and users (both business users and end-users) of the proposed system and the developers of the system. Usually the developer is the internal IT department although increasingly it is a third party organisation, such as an outsourcing vendor or consultancy company. This can exacerbate communication problems due to the physical separation of the organisations. Some organisations claim a more integrated environment where the customer and the developers are not seen as separate elements of the business but they work seamlessly together with shared objectives. Even in this environment there is usually a separation in the roles of customer and developer it is just that they work in a coherent team or project. Whatever the situation, and we readily admit that the distinction between customers and developers is sometimes blurred, for the purposes of this chapter we shall assume that there are two separate groups of people involved. Firstly, the business users and customers of the system, which we will for shorthand purposes call the 'customer' and secondly the developers of the system which will include business analysts, systems analysts, programmers, software engineers, network specialists, security specialists, etc., which we shall call 'developers'. For convenience we will talk about the two sides but this terminology should not indicate that there is only one of each or that they are not a diverse set of people and levels of seniority involved. Further the term customer is usually taken to mean the people within an organisation who require the system to support their part of the business (or the business as a whole). However, increasingly and importantly the customer of the system is today often also external to the organisation, i.e. the end customer. For example in the recent development of new technology in connection with mobile phones the wireless application protocol (WAP) is becoming important to provide additional services such as internet connection, e-mail, video services, traffic information, music on demand, news, weather, financial information. With such new and innovative applications nobody really knows what the requirements are and what the customer actually wants. In such situations the end or external customer is as important as the internal customer in the determination and negotiation of requirements.

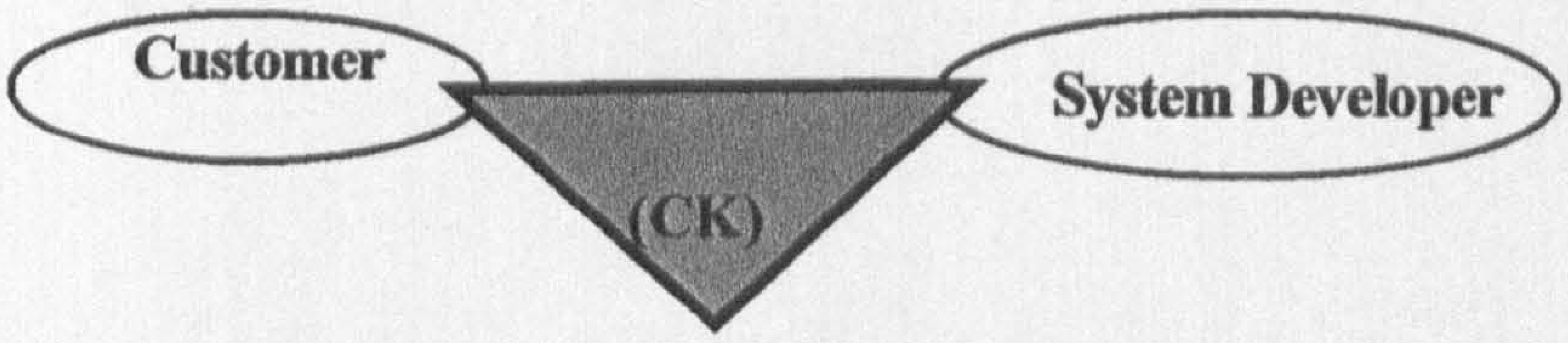
Thus, intensive and continuous communications between all customers and developers is extremely important to help establish a clear understanding of the needs which the proposed system must support in order to get things as correct, first time, as possible. However, in most cases this is not happening, as is indicated by Kelly (1999) who quotes Ivar Jacobson as saying:

"Two generations of developers have been lost to bad habits. They do the coding and then debug. They should get it right from the beginning".

5.15.1 Identifying the "Knowledge" Gap (KG) and the "Understanding" Gap (UG)

The customer's business knowledge and acquired knowledge through experience is very important. On the other hand, the developer's technical knowledge is also important, but the knowledge the two groups have is significantly different, which leads to misunderstandings. Also there is often a cultural gap with different backgrounds, experience, management styles and focus being evident. These 'gaps' have often contributed to the failure of projects [The reader is referred to Cavell (1999), List (1999) and Knights (2005a, 2005b, 2005c, 2005d] for recent work on systems in the retail sector and the problems encountered. Land (1982) and Abdel-Hamid & Madnick (1990) highlight the importance of learning from failures, and of the vital need of the developers to clearly understand the customer's requirements. We take a slightly broader view in that we see the problem not only being that the developers often fail to understand the customer's business and needs, but that the customers in turn often do not sufficiently appreciate the realities of software development, or what the software people are offering. Our aim is to develop techniques to help overcome these problems. On the one hand we are developing methods to help identify and make mutually apparent the gaps that exist between the understanding that each side in the project has, and on the other hand we have techniques aimed at facilitating and accelerating the generation of understanding to close these gaps, see Al-Karaghouli et al (2003 & 2004).

The main part of the research study focused upon the development of information systems in the organisations and the significant issues of requirements elicitation and specifications. The following is based on understanding developed from the study and discussions with two of the participating organisations. One was well known high street retailer and the other was the retail arm of a larger financial institution both based in London. There has been much talk of a 'gap' or 'gaps' between customers and developers in information systems development but the author identified two elements to these gaps. It is suggested that there is a potential for a knowledge gap (KG) and an understanding gap (UG) to exist between the customer and the software developer. The customer's knowledge is mainly "business" knowledge with limited or non-IT knowledge, on the other hand the developer's knowledge is "technical" knowledge with limited business knowledge. The gap between the customer and the system developer can be bridged if we have more specific information about the customer (Sabbagh, 1999). The KG is essentially the mismatch of knowledge that the customers typically has concerning IT capabilities and limitation. The hypothesis is illustrated in the diagram below:



Common Knowledge (CK)

Figure 5.4: Bridging the Knowledge Gap

The emphasis on the customer's business knowledge and acquired knowledge is very important. On the other hand, the developer's technical knowledge is also important, but the knowledge the two groups posses are different. This will lead to mismatch of their interests, which in most cases contributes to the failure of projects. Land (1982) and Glass (1998 & 2001) highlight the importance of learning from failures, and of the vital need of the developers to clearly understand the customer's requirements. We take a slightly broader view in that we see the problem not only being that the developers often fail to understand the customer's business and needs, but that the customers in turn often do not sufficiently appreciate the realities of software development, or what the software people are offering.

5.15.2 Bridging and Closing the Gap: Requirements Mapping Techniques

Our research on requirements provides a forum for researchers and practitioners to raise the important topic of engineering and managing requirements. Requirement is the initial stage of system development concerned with methods, techniques, and tools for eliciting, specifying, and analysing system requirements.

Intensive and continuous communications between all customers and developers is extremely important to help establish a clear understanding of the needs which the proposed system must support in order to get things as correct, first time, as possible. This does not mean that all requirements can be known and elicited. There are clearly some that will only evolve and develop over time but the objective is to make a better and richer attempt to address those that can potentially be elicited. At this point it should be stressed that many factors contribute to systems failure, for example see Myers (1994), but we believe that improving the initial specification and eliminating errors and problems at an early stage of the design process of software, i.e. the requirement stage in the Life Cycle, will be very beneficial.

5.15.3 Beyond the Intellectual and Professional Culture Gap

Part of the research study focused upon the development of information systems in the organisations and the issues of requirements elicitation and specifications. The following is based on understanding developed from the study and discussions with two of the participating organisations. One was well known high street retailer and the other was the retail arm of a larger financial institution both based in London.

There has been much talk of a 'gap' or 'gaps' between customers and developers in information systems development, see Nuseibeh (1996) and Sommerville (2000) but the author identified two elements to these gaps. It is suggested that there is a potential for a knowledge gap (KG) and an understanding gap (UG) to exist between the customer and the software developer. The customer's knowledge is mainly "business" knowledge with limited or non-IT knowledge, on the other hand the developer's knowledge is "technical" knowledge with limited business knowledge. The KG is essentially the mismatch of knowledge that the customers typically has concerning IT capabilities and limitation, see Appendix I for more on the knowledge gap. Customer requirements engineering (CRE) is the process of determining a complete, correct and clear specification of a future software-intensive system from the incomplete, inconsistent and ambiguous statements of need from stakeholders as diverse as end-users, managers and members of the public. Whereas conventional software engineering (SE) approaches focus on models and languages to express system specifications, there has been a recent shift towards a focus on customer requirements engineering processes (CREPs) see Kotonya and Sommerville

(1998). The prevalent view is that requirements emerge from a process of learning in which they are elicited, prioritised, managed, negotiated, evaluated and documented.

5.15.4 Graphical Representation of the Knowledge/Understanding Gap

The Venn diagram of Figure 5.5 illustrates how set theory can be applied to the understanding of customer requirements. Venn diagrams, however have many additional uses in the requirements definition process. For example, they can be used by the software engineer to illustrate various undesirable situations that may arise and which both sides need to avoid. Two such cases are shown in the diagrams below.

CASE 1:

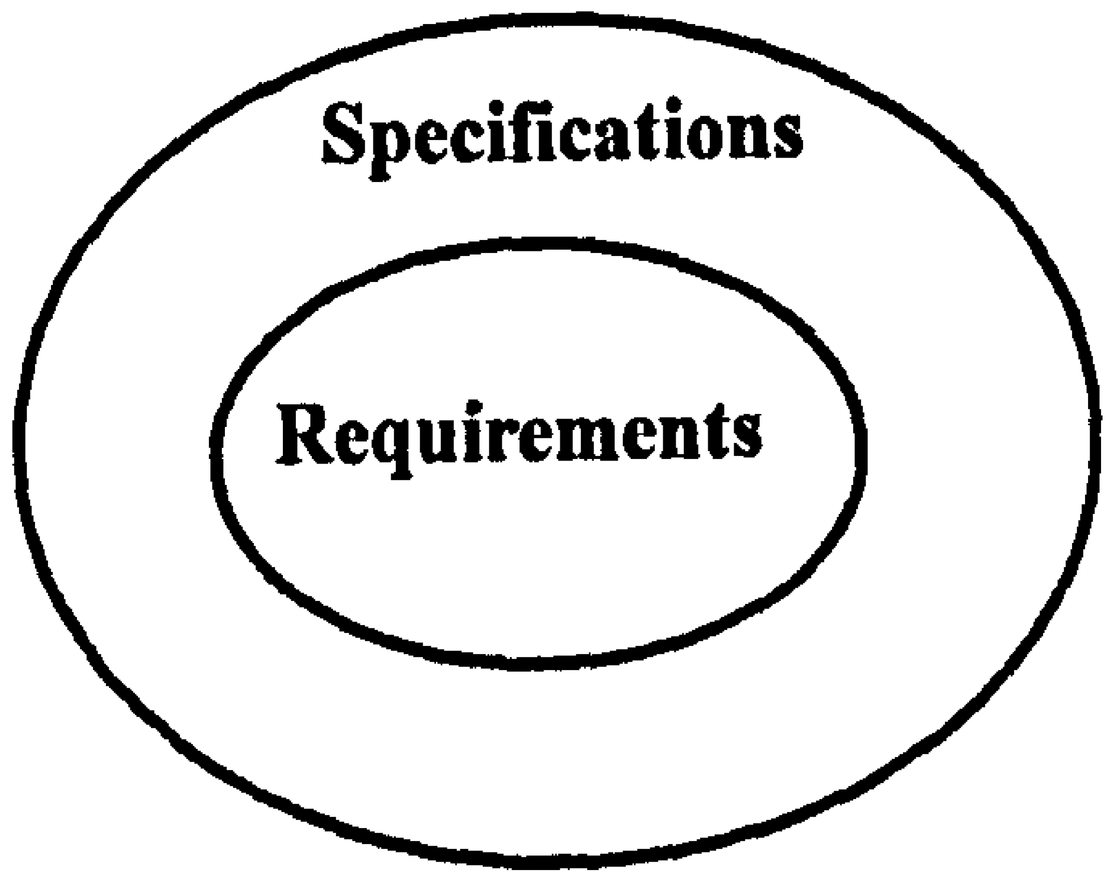


Figure 5.5: Specifications Greatly Exceeds Requirements

This may lead to the customer greatly over spending on the project for facilities and equipment that are not needed.

CASE 2:

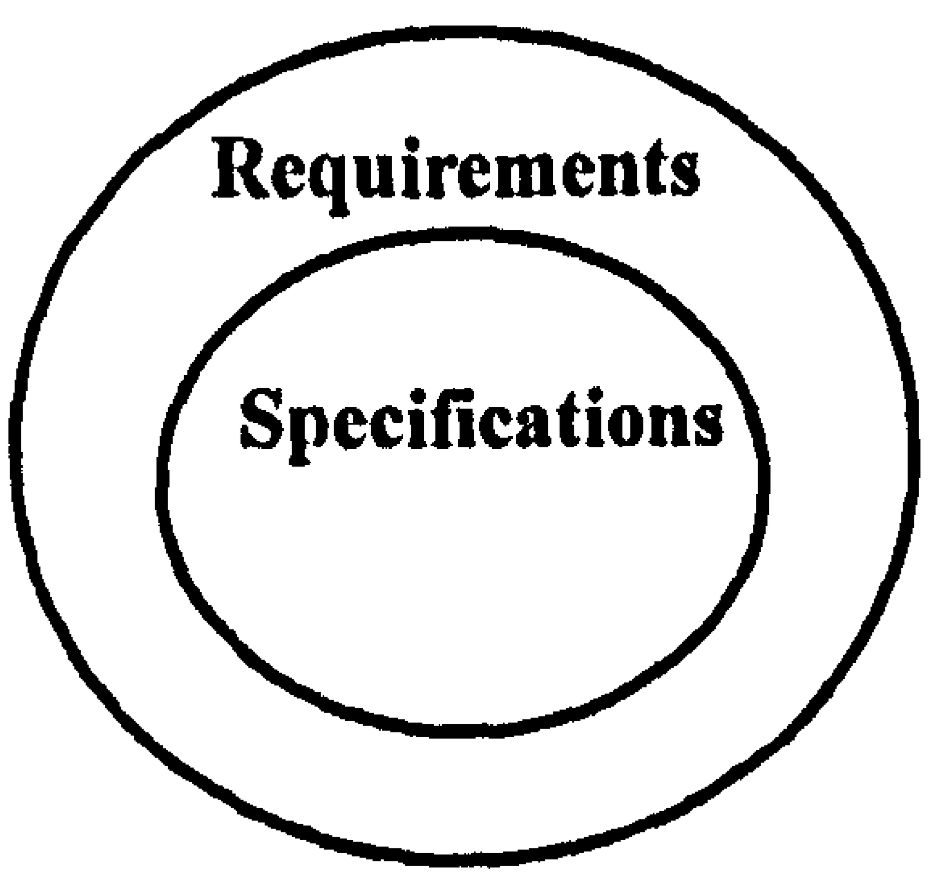


Figure 5.6: Specifications Meet Only Part of the Requirements (but does not include any unneeded facilities and equipment)

This is a less worse situation than Case 1, but it is still unsatisfactory since there are important customer requirements that have not been met.

5.16 Coping with Mission-Oriented Requirements Changes

This research work explores the problems of and solutions for managing changing requirements. In particular, we will explore the relationships and interplay between changing requirements and system development.

We believe that the requirement stage in the life cycle approach is the most important stage which contributes to the success or failure of an ITS. A conceptual modelling can be used in the requirement stage. Conceptual modelling is in the broad view of information systems requirements engineering. Requirements Engineering (RE) explores the objectives of different stakeholders and their activities to meet these objectives in order to derive system requirements and therefore lead to better quality systems i.e. systems that meet the requirements of their users. Thus RE product models use user concepts for modelling instead of concepts like data, process, events etc. used in conceptual models. Since the formers are more stable than the latter, RE manages change better. Our research work will give the rationale for extending traditional conceptual models and introduce some RE techniques. Also, in contrast to conceptual modelling, RE lays great stress on the engineering process employed. This research will introduce some RE process models and consider their effect on tool support.

5.17 Summary of Findings in Retail

Developing and establishing new ITSs, especially ambitious large retail integrations, is a fraught and risky process (Knights, 2005). Our finding is that integration and migration issues of ITS suffered by many retails due to the large inherited systems. These problems are apparent during the conversion process especially when a retailer takes over or purchases another retailer is significant issues in system failures in the retail sector. At the time of conversion, the duplicate costs of running both IT systems will remain higher and take longer to eliminate than anticipated.

Another finding is that the IT systems of many retailers are pretty rudimentary. In addition, laying off IT related staff early on in the merger process has left the retailer concerned with a lack of in-depth knowledge of both IT and business issues alike. This can make migration very complicated if the new systems are to deliver significant and tangible business advantage, they need to be part of a wider business transformation. The

ITS that enables and supports this transformation has to be flexible -allowing for change over time and the full diversity of international markets, careful alignment of the organisation and business process change to create the necessary receptive environment in which major business change can flourish.

On the skills shortage in the IT/IS area, the IT/IS industry is characterised by rapid growth and constant change. It is the fastest growing employment sector in Europe and new developments are taking place all the time. However, a large number of IT/IS jobs are not being filled because of shortage of skills in many areas. This is a problem for both businesses and employers. The lack of practical experience undermines the confidence of IT/IS staff. Employers like to be confident that their IT/IS staff not only know what they are doing, but why, how and when they should do it. Those needed skills will benefit businesses and employers as well as individuals. No retail organisation can function effectively without information technology systems, and it is vital that IT/IS workers have the necessary and comprehensive knowledge and abroad skills. Also, business and IT/IS need to harness the tools and techniques to survive in a world where sophisticated IT/IS are the key to competitivness.

5.17.1 Major Findings from the Empirical Research

Making the most of information technology systems (ITS) is not just about having the latest, most expensive systems. It's about making effective use of technology within the organisation, and using the technology to increase productivity, without hurting the bottom line (Hayward, 1996). But with the wealth of IT products on the market, it's becoming increasingly difficult for managers to decide which system (product) will deliver maximum business benefit. The central premise of our research is that ITS projects, especially big ones, fail because of human (people) different knowledge, and understanding at the initiation and definition stage of requirements. In other words, we are not seeking the perfect tools or methodologies, but instead address the vagaries of human nature! We believe that the human problem is a major factor that contributes to ITS failures. In addition to the human problem, many ITS projects fail due to a lack of management and organisation skills (Ackling, 2004). Many organisations with positive involvement of management can turn failure into success.

Figure 5.7 shows the main factor of system failures in retail. These factors include many of the traditional ones that contribute to many IT/IS failures. Our research highlighted new factors which are shown in bold. The darker the border of a factor, the higher influence that factor contributes to the problem of system glitch and failure to the ITS. It is worth mentioning here that, through the research and interview process, the factor that effects many IT/IS failure is the "change of project management". A good manager in a retail organisation will be headhunted, there are like "Gold-dust" in the retail sector. The majority of these manger posses both business and technical knowledge. Many projects terminated or abandoned when a project manager moved to a competitor. This is a new finding this research addresses. In addition the organisation, BASD (Business Application Software Developers Association) that regulates the software used by the retail sector including banks contributes to the delay of the implementation of software if the software does not meet certain criteria.

In addition, capturing, understanding and managing complex customer requirements is an essential process in all development of ITS projects especially in the early stage of requirements (MacLeod, 2004) as the following issues contribute or relate significantly to the finish product (system):

• Capturing and validating Customer/user requirements.

• Bridging the communication gap between customer/users and developers.

• Management of an evolving specification as a result of changing requirements.

• Maintenance and retrofitting.

Initiating ITS projects quickly is always dangerous and risky. Not only will they be costly, not easy to implement, difficult to evaluate, and in many cases unlikely to be brought to a successful conclusion. Such ITS projects will also commonly be poorly defined in the first place and aimed at the wrong objectives, even if they are successful, these projects may successfully achieve the wrong goals. In this thesis, fortunately, we have considered the knowledge and understanding gaps in initiating requirements, building, testing, and successfully implementing the ITS projects that may be helpful for both the customer and the system developer in these circumstances.

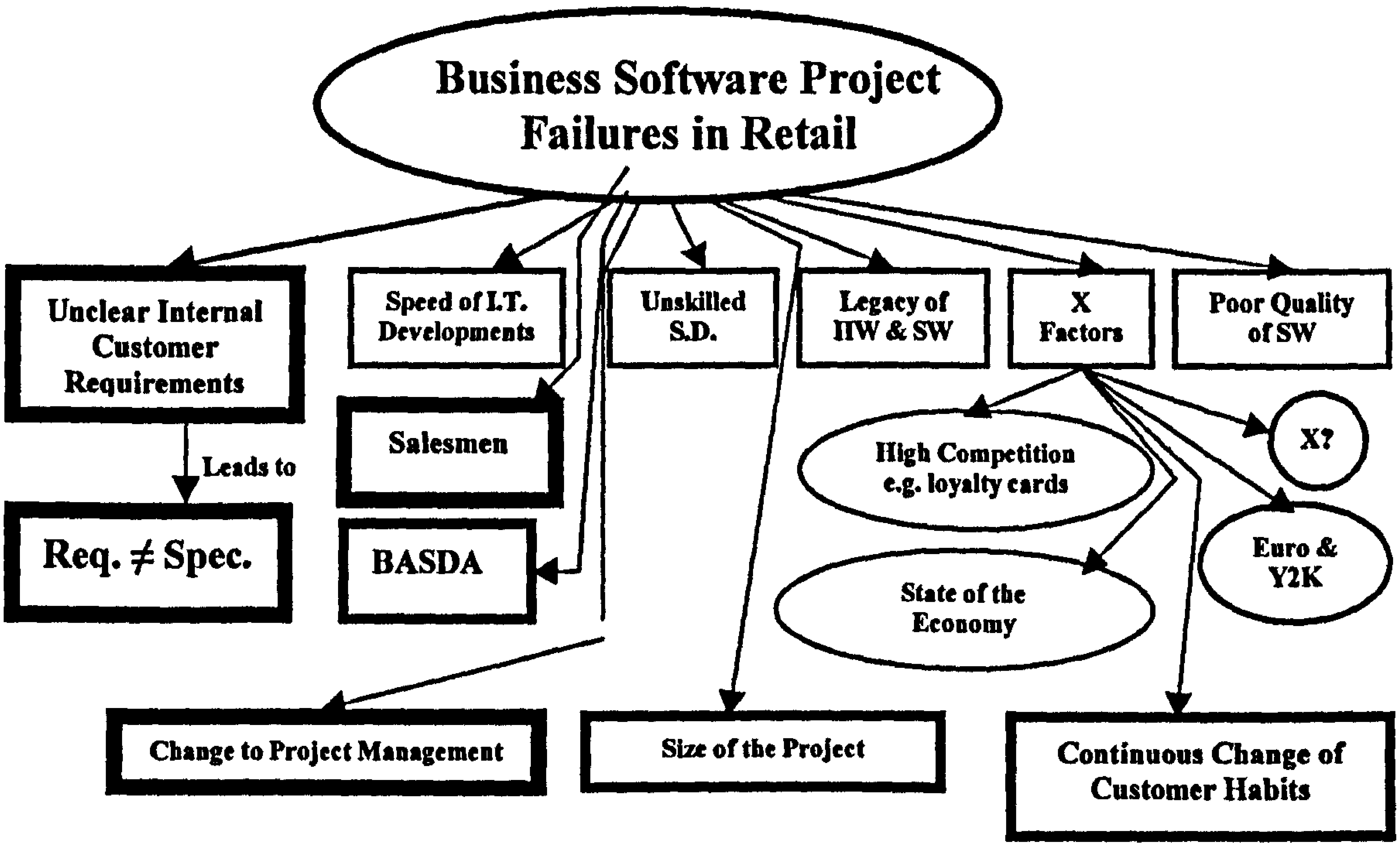


Figure 5.7 An Iconic Model: Major Factors Contributing to the High Rate of Business Software Project Failures in Retail *(in Bold)*

Other reason mentioned in the literature that contributed to information system failures in a big way is the mismatched of ITS and different skills when two business organisations merged (Farrell, 1997).

5.17.2 Factors of Information Technology in Traditional Failure

• Lack of technical expertise.

• Lack of communications between business and IT personnel.

• Human error.

• Size of the project.

• Legacy of the system.

• Speed of I.T. developments.

• Continuous change of customer habits.

5.17.3 Factors of Information Technology in Retail Failure

• Lack in the understanding of the business nature.

• Mismatch of business knowledge and IT knowledge within the retail organisation.

• Lack of communications between business and IT personnel.

• Misunderstanding between business and IT personnel within the retail organisation.

• Speed of I.T. developments.

• Human error.

• Salesmen.

• Business Application Software Developers Association (BASDA).

• *Project managers do not stay in the job for long.*

• Size of the project.

• Legacy of the big system owned by the retail organisation.

• Continuous change of customer habits.

• Y2k.

• The Euro.

• X Factors.

5.17.4 Requirements: The Non-functional Architecture Within Methodologies

According to O'Callaghan (2002) the requirements should be "signed in blood" to reduce iterations during the requirements stage to speed development and reduce the system development life cycle. High and unrealistic expectations of a system prior to development are well known problems and can contribute to disenchantment with the system when it is implemented. Customers can get too enthusiastic about technology and over-estimate the technology's capacity to change their world.

In addition to unclear requirements, several factors contributed to the ITS project failures (see Appendices A, B, C, and D on ITS project failures), which might include the following:

• The biggest killer that most big ITS projects fail to deliver their goals because the objectives in the early requirements stage were never clearly initiated or defined in the first place (Arnott, 2003c; Nairn, 2003; Felsted, 2003). Taking action too often, pondering on the problem or opportunity, gathering opinions, asking customers for advocate positions; all this helps better define and understand the goals and tasks of the ITS project. But things take time, and in business and political arenas where image is all-to-important, taking time can be deadly. Productive thinking saves money. Thinking wisely about what a business really want to gain from the future system can save massive effort and costs throughout the project, not to mention regret. Customers should avoid the "wish list", it is commonly said: "Be careful what you wish for. You might get it". Also, customers should make sure that their goals are what they indeed really need, and leave the emotions at the door. Customers and developers should really ask themselves, are there other ways to achieve these goals? Are other objectives realistic, more cost or time effective?

• An important major killer of ITS projects is insufficient business model planning. Planning takes time and time is often in very short supply. It is always said, if you do not use time wisely, it will use you. It is human nature to want to start making progress, and if the tasks are hazy or difficult to discern, also our human nature is to jump in and see what happens and then back up to re-plan the activity after we know what not to do. But not only does this waste time, effort, and expense which may inflict irreparable damage. The more poorly defined the project and its activities are, the more important it is to conduct complete and through planning and checking up front. The extra planning in the beginning will save ten times the effort at the end. And if changes need to be made in the project, the effort required to achieve them escalates exponentially the further into the ITS project they are delayed. These days, the way each ITS project planning conducted is well known and includes techniques such as project management, Gantt and PERT charts, action plans, linear responsibility charts, master schedules, project budgets, Fishbone (cause-and-effect) and so on. Fortunately, nowadays, there are many software packages to help with these techniques also. The resources issue is the next most important for ITS project success to achieve the project's objectives. Too often management tries to substitute enthusiasm, motivation, and excitement, we hear familiar statement "I know you will do a good job!" for what is really needed is "adequate resources". The management does this, is not because they are not willing to spend the money but because they are unsure what resources are required to achieve the ITS project goals. Often management is unsure because through project planning is side-stepped in the first place. The most important factor to the success of any ITS project is the selection of the project team and the assignment of a qualified and able Project Manager (Branton, 1999). Unfortunately, this important task is often executed improperly, choosing the project manger is not an easy task when internal politics involved.

According to Barnett (2002) that "there's no point in using new technologies if they make your life harder-no matter how cool the picture on the box looks". Barnett go-on by saying "99% of all innovations that I've been suckered into looking at aren't innovations at all. Indeed, in the majority of cases, the innovation lies in the crafty new way someone in marketing has positioned some tired old concept. There's one company out there that has re-launched the same product (a rather good OO database) at least five times. It gets my five-star rating for innovative PowerPoint, but at the end of the day, no matter how much lipstick it puts on the product, it's still an OO database. The more you study this industry, the more cynical you're bound to become, since truly innovative ideas are about as common as unicorns."

If software development was a public service then people would up in arms, instead we all accept slipping deadlines on sometimes critical projects. What is going wrong? Information technology system should cater for business requirements and not the other ways around, a business-led, a business-focused rather than a technology-focused (Rosenberg, 2004). The problem is that, unlike last season's clothes, we cannot just throw technology away once organisation gets bored with it. Early PC technology did not immediately result in organisations throwing away their mainframes, and current powerful PCs did not suddenly replace mainframes. The real kick in the head, is that technology innovations can actually make it harder to innovate. The more bits of new code or new addition to the system which might clutter the system, the harder it becomes to maintain and manage. With each new technology, organisations actually making things more complex, and complexity is the enemy of innovation. As the organisation system becomes increasingly complex, it becomes a quagmire. What this research study addresses, is to look at things with fresh eyes. This research study not against innovation per se, but against the rush to adopt every new innovation without thinking seriously about business needs and implication of a new ITS. In the retail organisation, many large systems are consolidating. Consolidation inevitably means that the ITS that makes the final cut would not be a 100% fit for every business requirements, but the cost of complexity out-weighs the benefits of having many of "cool systems".

The secret to successful innovation (that satisfies requirements) lies in the maxim "less is more". Retail organisations should not chase every great new idea, instead, they should begin by asking, "how much will the business benefit as a result of this technology's innovation?". This may seem rather obvious to many organisations, but it is surprising how rarely this question asked, and it is the question that most often separates business-people from system developers. If this great idea is not going to result in a simpler, less complex business environment, then organisation should be careful. Whatever this great new technology, it had better be really good, because in a couple of months or years, the organisation will be paying for it.

Intensive and continuos communications between the customer and the system developer is extremely important to establish a clear understanding of the business needs which the proposed system must support in order to get things right first time (Juran, 1989), but in most of the cases this is not happening in the real-world as it has been indicated by Kelly (1999) who quotes the software guru Ivar Jacobson saying:

" Two generations of developers have been lost to bad habits. They do the coding and then debug. They should get it right from the beginning".

5.17.5 The Human Problems are the Continuing Obstacle to Success in the Development of ITS

The results of the questionnaires and the interviews illustrated in Tables 5.6-5.10 show that many IS/IT failures are due to the lack of constructive and continuous communication between the customer and the system developer which is a critical issue in establishing smart requirements. All of us know that humans are very complex specious. In developing an ITS, system developers need to communicate with end-users, externals customers, suppliers, and collaborate on the process they need (Lee et al., 2000; Macaulay, 1995). This is true even with the largest organisations in the world such Siemens and General Electric (Financial Times, 2002). Managing the change from a people point of view is to fully involve everyone from the word go to ensure that everyone working on an ITS project is up-to-speed at all times.

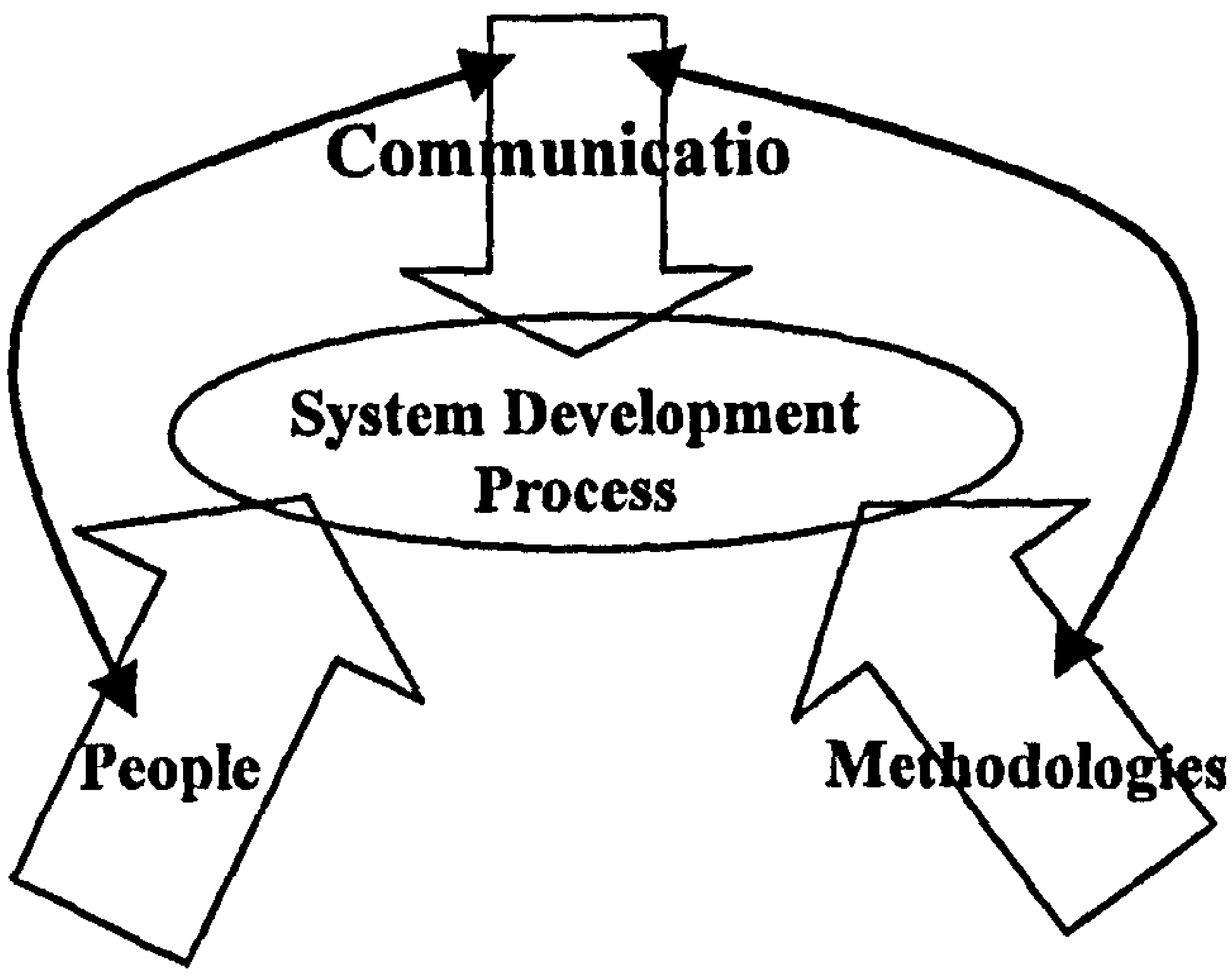


Figure 5.8 Communication is the Key for Successful ITS

Any development of IS depends on three factors, namely people (IT and non-IT), Technology methodology, and communications, see Figure 5.8. The aim of acquiring technology is to empower the end-user to achieving business goals. Often the poor relation in ITS budgets where IS project priority has a natural tendency to favour what can be seen or touched, improved communication really does go to the heart of what any business organisation spends on IT, meeting a real business requirements and needs. The biggest investment an organisation makes is not in its hardware or software, but in bringing people together. By bridging the knowledge and the understanding gaps. Effective communications to support the development process of a future system is not just about rehearsing the manual and explaining the nuts and bolts, but in widening horizons and raising awareness of how the ISs can help endusers and their departments meet their own needs and ultimately improve their business performance.

5.18 Focus on Business, Customers, and Process, not Just IT

From reviewing the literature of systems failure and the facts presented in this research study. The focus was too much on IT/IS aspect, sometimes failing to recognise that any big project is really about organisational change. This is evident in many government projects (Arnott, 2005) which aims to deliver something with technology but it did not look at people and process. There is no such thing as an IT/IS project or a bright shiny hardware and software sitting in a dark room but not actually doing anything useful.

Organisations should think of IT/IS project as a programme with different stages, such budget, training, change people perception to accept change, all those things are critical. With respect to government IT/IS projects, there is a need for more discussion between the three key stakeholders of government, IT/IS industry and citizen. In the private sector including retailing, there needs to be more discussion between the two key stakeholders, namely customers and system developers. The research study suggests there should be a formal way to ensure this takes place. KRF is one approach that accommodates such a change in customer-system developer in approaching the system development process. On a larger scale than KRF, there is a need for a place (even an "e" environment), perhaps a national institute, where industry (including retail), public sector and IT/IS sector come together to address the interface and interaction between business, technology, people, public policy challenges that everybody faces and the needs of everyone too. Many more IT/IS projects would succeed if there was more focus on just what they were meant to do and why rather than try to fit the latest gizmo in a system, which might not contributed significantly to meet business needs. Professional system developers should be flexible towards business-led IT/IS projects (Samuels, 2005b & 2005c). Encouraging knowledge transfer between business and IT/IS professional developers as a key sources of innovation, standards, regulations and design such as KRF will contribute to a successful system delivery. These are positive first steps, but there is still a long way to go.

There are many short-term actions that can be taken to create a sustainable business-IT environment based on collaboration, change of professional cultural, and innovation towards continuous growth. But the full benefits of such actions will only be realised when underlying culture supports and promotes innovation, and use of intellectual property rights.

5.19 Conclusions

This chapter presents and analyses the KRF adoption in two major retail organisations A and B. The justification for selecting only two case organisations is reported in chapter 3.

And based on the rational that these two case studies have provided enough data for this research study.

This chapter presented and analysed the results of the empirical enquiry from both the questionnaires survey and interviews (responses from the retail organisations surveyed – customers) and the questionnaires survey and interviews (with IT departments- system developers). The justification for selecting the research strategy is reported in the previous chapter and it is based on the rational that these two research methodologies and techniques have been justified to provide enough data for this research. As a result, the author suggests that conducting a case study to test the proposed frame of references would be of great benefit for future research. It is reported in the literature that more than seventy percent of ITS projects are failing because of the difficulty to identifying the problems and assigned the main root causes of the complex requirements issue which is a sociotechnical reported involved in ITS developments. To investigate the above issues and observe what is happening in the real world, the author conducted a two-part study. In part one the researcher conducted multiple questionnaires and interviews with customers. The second part consisted of a survey questionnaire and interviews too, where the empirical data is collected from system developers.

The author used the *Descriptive Analysis* approach which included quantitative and qualitative method to complement the analysis and to analyse the empirical data both from the questionnaire survey (responses from the retail organisations surveyed – customers) and the questionnaires survey and interviews (with IT departments- system developers). Based on the on the analysis and the results, the author established and identified a general picture of what is happening in the real world. The surveyed retail organisations could be:

- Retail organisations 'facing ITS failures'.

- Retail organisations experiencing ITS teething and failure problems.

- Retail organisations satisfying with their ITS that meeting business needs.

Quantitative and qualitative analysis are statistical procedures used to uncover relationships among many variables. This allows numerous identification of variables to be condensed into fewer dimensions including general underlying attitudes. The analysis for this research is conducted using the statistical package Sphinx for Windows, version Plus2.

Empirical data revealed from the research results confirm that the factors proposed in the conceptual model in chapter 3, have tremendous influence on the complex requirements process involved in the developments of projects. The presented and analysed results indicate that there are other factors that also have a great influence on the above issues, such as a framework for the evaluation of ITS approaches. Modifications to the proposed framework for the evaluation of requirements have also been reported. All the factors that have been reported and analysed in this chapter are taking into consideration in Chapter 6 to revise the conceptual model proposed in chapter 3. Based on the empirical data reported and analysed in this chapter, the enquiry now is able to draw conclusions. However, before any conclusions can be presented, it is important to appreciate the positioning of such conclusions within the context of the empirical research methodology presented in the preceding chapter. Chapter 4 has distinguished the research issues within the thesis, with the conclusions presented in this chapter now forming final level illustrated in Figure 4.1 and question 4 as presented in Table 4.1. As a result, the next chapter (chapter 6) represents those conclusions derived from the empirical research presented in this chapter.

This chapter has shown that individual case studies provide some support for each of the theories put forward in Chapters 1, 2 and 3 for the existence of IT/IS productivity. The case studies also contribute to the debate by considering the role played by retail organisational structure, business requirements, technical specifications, knowledge, understanding, professional and intellectual culture gaps, and customer-system developer's communication in the new IT/IS projects. Such detailed information would not have been obtained if the traditional quantitative and qualitative methods of studying the existence of knowledge and understanding gaps had been followed. The findings support the work of well-known authors mentioned in Chapter 2 (e.g. Macaulay, 1996; Robertson and Robertson, 1999). Future ITS developments must align IT to business requirements. The elicitation of requirements is a sociotechnical process but it is not the solution for all the problems facing the ITS industry. In this regard, the (KRF) model mentioned in this thesis provides a better set of requirements for the future system, as it focuses on the business and technology, and its insights into the relationship between customers and system developers to improve the chances for understanding what is essential for the development and design of successful ITS projects. It aims at unveiling the framework and meaning of everyday experience, it stresses the importance of details of practical approach, and it shows how modern system developments speak to grand business realities. In presenting this modest effort, it is hoped that new productive research on requirements, and Intellectual & Professional Culture Clash will be encouraged.

To summarise, the limited steps that the retailers studied have taken to facilitate identifying, capturing and managing business requirements in system development have had some success at the individual IT/IS project level, but have not yet instigated a more long-term commitment to professional and intellectual culture change throughout the retail organisations. According to many interviewees, this lack of learning from each other (customer and system developer) and from past experience is not regarded as a problem within the retail sector because the market position of the retailers remains as strong as ever. Whether this position is sustainable over time is remain to be seen and is a question that can only be addressed by a longitudinal research study. It can therefore be concluded from the analysis that this issue is contributing to the continued observance of the information technology system failures.

Chapter 6 - Out Comes: KRF Adoption

Summary

This chapter is all about presenting the tools, proposing the KRF and adopting the KRF in the case studies mentioned in Chapter 5. Chapter 5 presented and analysed case studies in the UK retail sector. The criteria in practice and the empirical evidence that resulted from the analysis indicate the need for modifications and enrichments to the conceptual model proposed in Chapter 3. This chapter takes into consideration the empirical data to update the conceptual model. In doing so, satisfying the aim of this thesis by offering customers and system developers; and researchers a model (framework) of references for identification of requirements and the development of IS/IT projects.

In this chapter we discuss the different methods and methodologies used to estimate parameters for the evaluation models of the customer and the system developer gaps. We first outline the methodology used to estimate parameters of the different knowledge and understanding of both groups. This methodology exclusively uses the business and technical factors on the underlying scenario. Subsequently, we discuss the estimation of the parameters. We estimate the risk that such difference in knowledge and understanding might lead to by combining primary and secondary data. To clarify the relationship between the two groups (customer and system developer), we indicate the relationship between the parameters obtained (knowledge and understanding) under the physical business development of an ITS. The development of information technology systems has been dominated by formal and structured "hard" methodologies from the engineering and economics subject areas.

6.1 Introduction

There has been much discussion on the lack of suitable ITS tools/framework to acknowledge the problem of ITS failure due to the non-functional requirements architecture and the failing of capturing smart requirements. Indeed, the literature presented in Chapters 2 and 3 has emphasised this, with the empirical evidence reported in Chapter 5 exemplifying this further. As a result, the thesis proposing the identification of KRF evaluation criteria and development of an evaluation framework. Therefore, contributing towards a better understanding of the requirements process. The identification of such criteria and development of a framework appears timely, as the adoption of requirement is gaining pace (see Chapter 2-RSEG). This chapter describes KRF (Knowledge Requirements Framework) and its relevance to the crucial requirements issue as an approach in determining the requirements of ITS. KRF is the outcome of a research study conducted in the retail sector that identified serious problems and a knowledge and communication gap between developers and the business that has proved a significant barrier to the successful development of information systems.

The roadmap of this chapter will include the description of the following issues:

• Follow up on the Intellectual and Professional Culture Clash presented in Chapter5

• Description and implementation of the tools (Venn diagram, brainstorming, fishbone and rich picture) with the KRF to capture business requirements sand their relevant to the ITS failures.

• Pilot testing and detailed description on how Venn diagram, set diagram and fishbone implemented in Organisations A and B to evaluate the proposed KRF.

• KRF Architecture and the activities in sub-processes 1-8 in capturing and documenting requirements.

• Evaluation of KRF and limitation of KRF

Requirements engineering is the elicitation, definition, modelling, analysis, specification and validation of what is needed from an IT/IS system. On the other hand the requirements process is a socio-technical process which relates to human-human interaction in the form of communication and understanding of the customer needs and the system developers, it is not a human-machine relationship. The view adopted in KRF is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. Requirements evolve over time and cannot be elicited as a snapshot. This necessitates managing requirements evolution and aligning requirements to organisational change. In any business, effective IT systems require detailed and specific requirements which need to be achieved through intensive and rich communications between the different stakeholders (Sanghera, 1999). Unfortunately the determination of requirements and the development of specifications is frequently not seen in this way but simply as something to be established and got out of the way as soon as possible. Any inherent problems and misunderstandings are thus only discovered late in the development process, often only at implementation, and it then requires immediate modification with the result that the system is often regarded as a failure.

We had to identify benefits based on a few workshops. We ended up organising the process improvement as a typical action research project. The plan was as follows:

1. Analyse existing requirement defects in a base ITS project.

2. Find cost-effective prevention techniques, e.g. brainstorming, fishbone, and rich picture.

3. Use the techniques in a new workshop on a new ITS project.

4. Compare results.

Inadequate requirements cause many problems in software products. This chapter reports on an experiment to reduce the number of requirement defects in both organisation A and B mentioned in chapter 5. We analysed the present defects in a real-life product and estimated the likely effect of 44 prevention techniques. We had hoped a novel combination of techniques would come up, but the best approach was quite well known, although new to the company: study the user tasks better, make early prototypes of the user interface, and test them for usability. This approach was tried out in a new development project in the same company. Due to the new approach, there was no doubt about requirements during programming, and as a result it became the first project in the company that was completed on time and without stress. Usability was drastically improved, and as a result the product sold twice as many units as similar products, and at twice the unit prices.

In this chapter, there is a practical experience about requirements in a large retail ITS projects with communication and understanding problems between the customers (different departments) and the system developers department (or the external system developers). One of our points is that despite the use and implementation of many "hard" approaches and methodologies in the area of software engineering and information technology system projects, some projects failed. Hence, the need for a coherent approach/methodology to handle the process of requirements is more pressing now than even. We believe that knowledge requirements framework (KRF) will fill this role (see Figure 6.1). KRF will not replace any "hard" or "soft" approach, on the contrary, KRF will complement "hard" and "soft" approaches, and it is an addition not instead off. Experience in developing information technology systems has shown that an inadequate understanding of clear system requirements is the single most important cause of customer dissatisfaction and system failure. This has led to the area of Requirements Engineering (RE).

The prevalent view is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. Requirements evolve with time. This necessitates managing requirements evolution and aligning requirements to organisational changes. In any business, effective ITS requires detailed and specific requirements which can be achieved through intensive, and enrich communications between the different groups as shown in Figure 6.3 (Sanghera, 1999).

6.2 Intellectual and Professional Culture Clash

In Chapter 5, the gap of the intellectual and professional culture clash has been identified. Also, there has been much discussion around the lack of suitable framework for the adoption of requirements in IS/IT projects. Chapter 5 has and offered much empirical data that has been used to assess the conceptual model presented in section 3.11 (see Figure 3.2) for the adoption of the KRF model. The aim of this chapter is to take into consideration the empirical data derived from the previous chapter and offer revision to the conceptual model for KRF adoption. The following section summarises the key issues that elicited from the analysis of the case studies A and B. The culture among system developers is mainly based on technical issues (Kavanagh, 1998; Price Waterhouse, 1991, 1992), i.e. what the system needs to perform, how fast the system should be, what programming languages should be used ..etc. On the other hand, the businesses (customer) culture rather different. Many technical terms and issues, i.e.

what is called "IT jargon" do not mean anything or has been misunderstood by business people. In this case we can identify two separate cultures as it has been shown in Figures 6.2 and 6.3, also see (Cavell, 1999; and Sabbagh, 1999). This difference in cultures can be prevented by sharing such information and reach compromised requirements through KRF which satisfy business needs, see Figure 6.1.

This intellectual and professional culture clash is an outcome of both groups talk different languages and terms. They have different expectations of each other and from the system which will be developed. We believe that the latter point resulted from the different working environments, i.e. business system and technical systems respectively. Developing systems are no longer simply about rules, it is about ethics, culture, meeting business goals not IT goals, and taking the risk (Howard, 1999).

6.3 Problem Definition

The problem we address is the significant role of defect business requirements that contributed to the high rate of failure of software projects (Watson et al., 1992; and Lee et al., 1995). Several reasons exist for such failures, for example cost and time overruns due to poor initial specification, inadequate requirements analysis and problem definition, and obsolescence due to rapidly changing work environment. The focus for our research is, however, the first stage in any project which is the establishment and agreement of customer requirements (Juran, 1988).

6.3.1 Reasons and Motivation for Selecting this Particular Research

We can not take back the losses of made software, but we can either reduce or stop the loss of making new software (Taguchi, 1980; Gitlow et al., 1989). Many books and papers written by gurus from the world of software engineering did not strongly emphasise the practicality and application issues of software engineering which our study addresses. We would like to emphasise the **business** usage of the software produced which we will refer to as **Business Software Engineering (BSE)**. We believe that we can achieve this through a better understanding of the business and the user requirements in conjunction with the software engineer (Jones, 1987; and Peltu, 1996).

We quote Peltu as follows:

"IT professionals have a recurring nightmare. It goes something like this: despite horrendous odds, you and the rest of the development team deliver a new system. You have done your best to find out what the users want, all key agreed targets have been met and all that remains is to sit back and wait for the satisfied purring of users. But all you get are grumbles, growls and the occasional howls of protest".

6.3.2 Bridging the Gaps of the Intellectual and Professional Culture Clash

Communication is very important in determining system requirement. On the other hand, intensive, and adequate communications between the customer and the system developer lead to a clearer understanding of customer and system developer specifications, which will produce a friendly useable system (Lipnack, 1997). Recent years have witnessed an explosive increase in global communication and wireless communication, i.e. wireless application protocol (WAP) such as the third generation of mobile phones (3G) which will help in enhancing the process of communications along with the rapid growth of ITS. ITS mainly deployed to optimise efficiency and success, business managers and developers within any retail organisation (including outsourcing "tap on apps"). The recent explosion in communications in terms of the usage of the internet, intranet, extranet, video conferencing, wire, wireless (WAP) technologies and their applications in either e-commerce or business-to-business (B2B); make the communication between different groups more easy and narrow the gap between customers and suppliers. Due to this explosion, there is no excuse for a customer and a developer not to continuously keeping in touch through the different levels and processes of KRF, i.e. though the entire initial requirements process.

6.3.3 High Expectation, Prior to Development of the System

This is an important issue which in many cases leads to system failures (Duffy, 1993; Norman, 1998) including the recent 12 system failures in the UK which have been mainly developed by well known developer companies such as EDS, Andersen Consulting, and Siemens (Groom, 2000; and Ranger, 2000). If both groups initially agreed practical requirements and what they would like the system to do when it is built, then their expectation will match the system performance. On the other hand, if both groups did not furnish their agreed requirements, their prior expectations and the resulted develop system will not match the business requirements, this is due to the difference of perception of requirements during the early stage of specifying the system. Customers generally either get too enthusiastic about technology and hopelessly over-estimate the technology's capacity to change the world, or they never hang around long enough to get "up to speed" with technology (Mirl, 1998). ITS developers must adapt to a world in which many business models are different from those they know. There are several messages to the ITS developers, one would be to look at the development of the product (software) without boundaries. Developing large ITS is complex task, we need everybody to work as developers (the customer plus the system developer), it has to be done this way in order to make things which are complex work (Cavell, 1999).

6.3.4 Knowledge, Requirements, Systems

This chapter aims to bring together ideas from various disciplines such as Knowledge Management (KM), Information Systems (IS), Software Engineering (SE), Business Process Reengineering (BPR), and Human Computer Interfaces (HCI). Knowledge falls in the heart of the initial stage (requirements) of the system development process (BS 6719, 1986). The Requirements Engineering Specialist Group (RESG) of the British Computer Society has clearly emphasised the critical importance of requirements in the IS/IT development process (definition of RESG, Chapter 2).

The theme-map of the discussion in this chapter is shown in Figure 6.1. The diagram illustrates the important role played by knowledge in determining the initial requirement of the information system (IS) required to satisfy business needs. High quality initial and agreed requirements form the basis of any successful information technology system (ITS) development (Al-Karaghouli et al., 2002). The area of applied ITS has been enriched both in theory and in practice by the contributions of those in the fields of hard and soft system methodologies (Avison 1995), and by experiments to improve the quality of designed systems. We quote Lewin's dictum that "the most practical thing in the world is a good theory" which has been practised in its fullest sense by sociotechnical system innovations. Our research is a witness to the fact that applied ITS, e.g. soft system methodology has made significant progress in contributing to organisational change strategies and that experiences in soft systems have provided a particularly viable agenda for the future of organisational change. The soft system methodology (Checkland, 1998) is full of success stories that continues to generate enthusiasm among both academics and business practitioners.

However, no work in the applied ITS subject area can ever be completely comprehensive. Therefore, we have chosen to highlight three topics of the field; one, the points that have been basically responsible for the ITS glitches/failures, two knowledge and its role in requirements, and three, the role of business requirements including the Knowledge Requirements Framework (KRF) and its contribution to ITS developments.

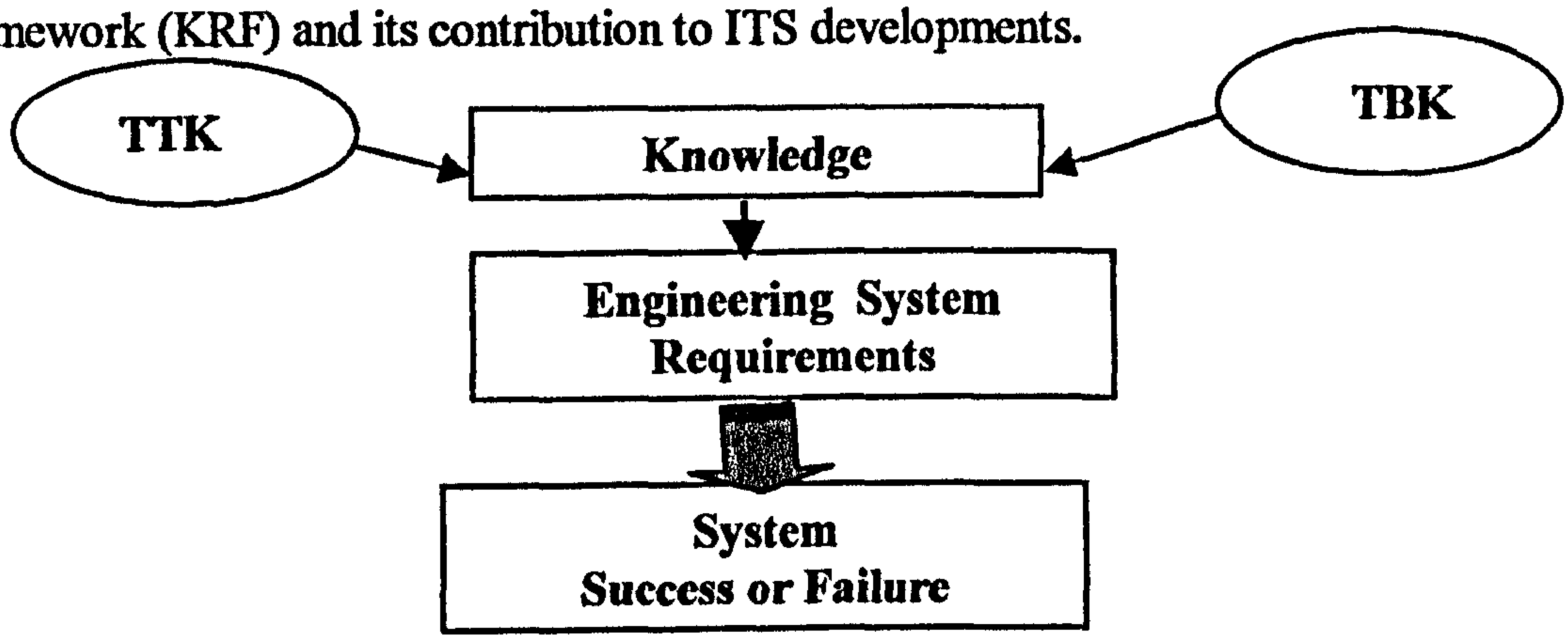


Figure 6.1: The Role of Knowledge in Determining Agreed Requirements

6.5 KRF Adoption in Practice: Description of the Techniques and Tools

In this section we illustrate the early stages of KRF by illustrating and describing of practical examples of the use of three techniques and tools that have been used, **namely** Set Diagrams (or Venn Diagrams), Rich Picture and Fishbone. As mentioned above other techniques may be used in KRF but these are two that hopefully illustrate the nature of the approach. In additional to the use of Brainstorming and Venn diagrams, Set diagram Rich picture and Fishbone have been adopted in the two case studies presented in Chapter 5. More than one technique and tool and most of the times a technique and a tool were incorporated together in establishing smart requirements during the several moths of the trails. Detail of their applications can be demonstrated in the next sections.

6.5.1 Using Venn Diagrams for Identifying Understanding Gaps

The Venn diagram is being used in a logical sense and is essentially a graphical representation of the situation (Feller, 1971; Quin and Bronte-Stewart, 1994). Its strength lies in the discussion it provokes and the negotiation between the groups, both in its original construction and then its subsequent re-drawing as understanding and agreement is reached. Normally no attempt at a graphical representation is undertaken in the process of determining requirements. It usually just involves the creation of a specification by the systems developers which the customer is then expected to agree and too often the fact that the specification was not a good statement of the requirements is not discovered until much later, sometimes only at implementation.

6.5.2 Venn Diagrams and Set Diagrams

On the Venn diagram question: What given sets are needed for both the requirements and the specifications?

As it can be seen from the diagram above that each set (customer requirements) and (system developer specifications) includes a number of distinct sets (called given requirement sets and given specification sets) for subsequent use in both requirements and specifications. The sets are potentially infinite unless limited to being finite later in the smart requirements sub-stage (see KRF, Figures 6.13 and 6.14), this is a standard mathematical theory (Feller, 1971). Here we define sets of requirements and specifications, the exact nature of the elements of these sets is important to the requirements-specifications and is thus not elaborated further.

6.5.3 Practical Applications and Case Examples in Organisations A and B

In the work with both the retailing organisation A and the financial institute B the author used Venn Diagrams to facilitate discussion and understanding of requirements of a new system that had been agreed in principle to be developed between the Business Departments and the IT Departments in the retail organisations understudy. The case relates to the perceived need to 'enter the internet world' and to have a web based information and sales channel for the companies existing products. Beyond this, the case is simplified and does not reflect the detail of the organisations nor their actual requirements. It is purely illustrative of the situation and the processes.

6.5.4 Implementation Issues of Requirements and Specifications

During the process of capturing, elicitation and managing business requirements-system specification (BRSS), questions will inevitably be raised. These should be discussed within the customers-system developers teams, with other colleagues and with other stakeholders as appropriate, normally in that order, to resolve the issues. Inevitably this have to be changed in the course of producing the rest of the requirements-specifications but that is part of the learning process by which build, share knowledge and deep understanding of the ITS is gained by both groups. The build-share knowledge in the initial requirements stage of the system is critical for the ITS design, without it, many important aspect cannot be adequately modelled.

Most system specifications (SS), formal or otherwise, are presented in a general form, normally with no hint as to how the specification has been produced. Even most textbooks tend to concentrate on finished specifications rather than the progress specifications from initial concept of requirements to completion. In real world, the process of capturing, elicit and mange business requirements (BR) can be as important as or even more important than the requirements-specification itself as presented in the next sections. The knowledge gained by the customers-system developers team in preparation before consideration of implementation details can be invaluable in resolving errors (as a result of defect requirements) before the detailed design and subsequent stages, prevention is easier and cheaper than correction. In this chapter we consider typical questions posed during the requirements-specification process when using the case studies.

6.5.5 Graphical Representation of Matching and Documenting the Gap in Retail

The Venn diagram of Figure 6.2 illustrates how set theory can be applied to the understanding of customer requirements (Pisano, 1994). The two circles represent different areas of knowledge and understanding; one represents the understanding of the system developers, the other the customer. The matching or common understanding of the requirement is where the two circles overlap (BRSS).

Venn diagrams have been used successfully for some time in management science (Anderson et al., 1995), as well as, of course, in their traditional areas of logic and computing. In this research they were found to be highly effective as a graphical or pictorial technique for illustrating any gaps in understanding that existed at the requirements stage. They are extremely easy to understand and can be manipulated by both sides to make particular points. For example, by re-negotiating the overlaps it is easy to indicate how good or bad current agreements are on particular matters. The technique can be made more precise and quantitative by, for example, creating a matching score of specific terms noted in attribute lists drawn up by the two sides.

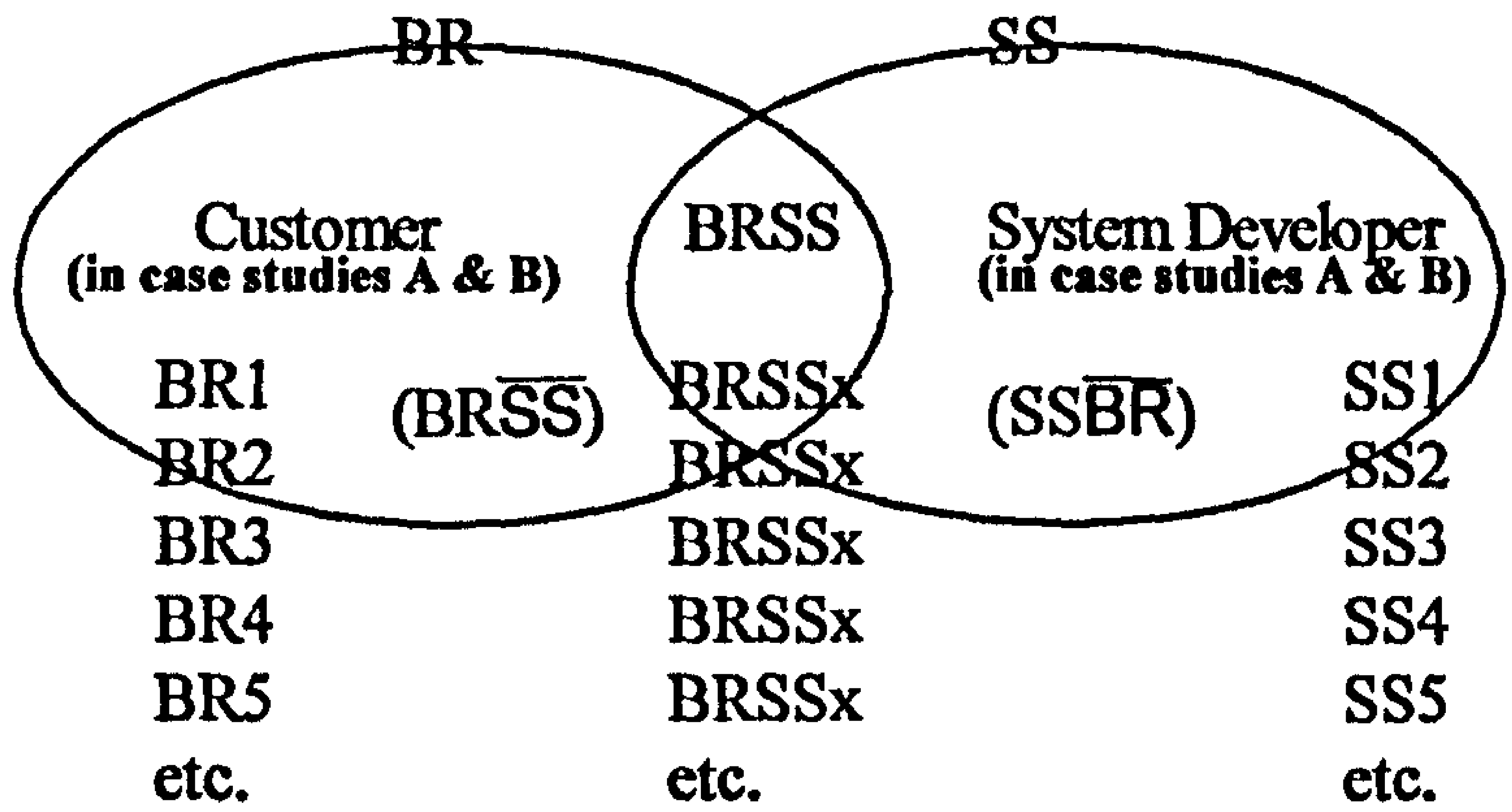


Figure 6.2: Business Requirements (Customer) ≠ System Specifications (System Developer)

6.5.6 An Application and Illustrative Case Example - *First Stage*

Notations: Customer Requirements

In the Venn diagram of Figure 6.2, let (BR) denote the set off all possible customer requirements space which contains the individual (fragments) business requirement as sub-sets viewed by the customer:

BR contains a set of individual requirements, e.g.:

(The fact that there are 10 instances in this set is purely arbitrary)

BR1= we would like to offer an e-commerce facility for our external customers.

BR2= the image required for this business is one of trust.

BR3= the new system must be operational by the end of the year.

BR4= the system must be easy for internal and external customers to use.

BR5= the system must provide quick response for customers.

BR6= the system must be totally secure.

BR7= the system must provide enough information for customers so that they do not put an additional burden on the existing help line.

BR8= a maximum of 8 people (from the business side) will be available to support the development of the new system.

BR9= the new system needs to fit very closely with the existing business processes.

BR10= the system should attract additional customers, not just be a different channel for existing customers.

Notations: System Developer Specifications

Let (SS) denote the set off all possible system developer specifications space which contains the individual (fragments) suggested specification design as sub-sets viewed by the developer:

SS contains a set of individual specification elements, e.g.:

SS1= an electronic retail channel is required.

SS2= the development of the system is a major new undertaking for the ITS department.

SS3= the time scale is extremely tight.

SS4= the skill required are in short supply.

SS5= the development environment will be Unix.

SS6= a mirror environment will be required.

SS7= absolute security is impossible.

SS8= the development language will be Java and C++.

SS9= response times depend on factors outside of our control.

SS10= the system can utilise the existing processing systems for the underlying functions, which will shortcut the development.

- ***Details of the First Stage***

Let (BR) and (SS) be two sets of points (interests) having points in common represented by (BRSS). Therefore (BRSS) will represent only the matching (common), and agreed systems functions. They do not necessarily have to equally match the number of requirement elements, e.g. BRSS= {BR1:SS1, BR9:SS10}.

In this case the common understanding (overlap) is relatively small and the diagram reflects this. The common factors concern the fact that they are both talking about an internet channel (BR1:SS1) and that the existing processes will be utilised which will obviously make them a close fit to the new system (BR9:SS10). The non-overlapping sector is represented by $BR\overline{SS}$ and $SS\overline{BR}$. There is obviously a far greater degree of mismatch than match of requirements between the two groups. The diagram is obviously only illustrative but nevertheless powerful in its ability to convey the size of the gap. In use the diagrams could have the specific elements, i.e. the Rs and Ss written on in the appropriate places. However this makes the diagrams rather messy and unwieldy so it has not been included here. When the elements of the gap are discussed in detail and agreements thrashed out the participants can re-draw the diagrams with the overlap hopefully becoming larger. The point is that the diagram clearly represents the current level of agreed areas of understanding and misunderstanding between the two sides at any stage.

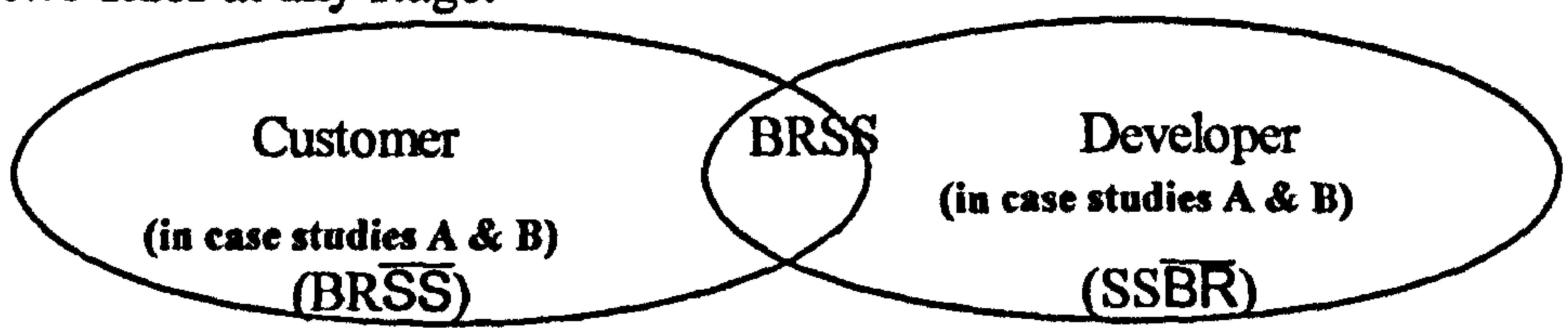


Figure 6.3: Requirements (Customer) ≠ Specifications (Developer)

The non-overlapping sector is represented by:

BRSS = {BR2:SS2, BR3:SS3, BR4:SS4, BR5:SS9, BR6:SS6, BR7:SS7, BR8:SS8, BR10:SS9}

The Venn diagram is important in that it helps focus attention on exactly which requirement instances match with which specification instances, i.e. the BRs and the SSs. Figure 6.3 is the mapping diagram for this first stage of the case. The Venn diagram is a useful graphical representation of the gap in understanding between the two groups. In tandem with this another diagram used in set theory is utilised and that is the set mapping diagram. This is important in that it helps focus attention on exactly which requirement instances match with which specification instances, i.e. the BRs and the SSs. Figure 6.4 is the mapping diagram for this first stage of the case.

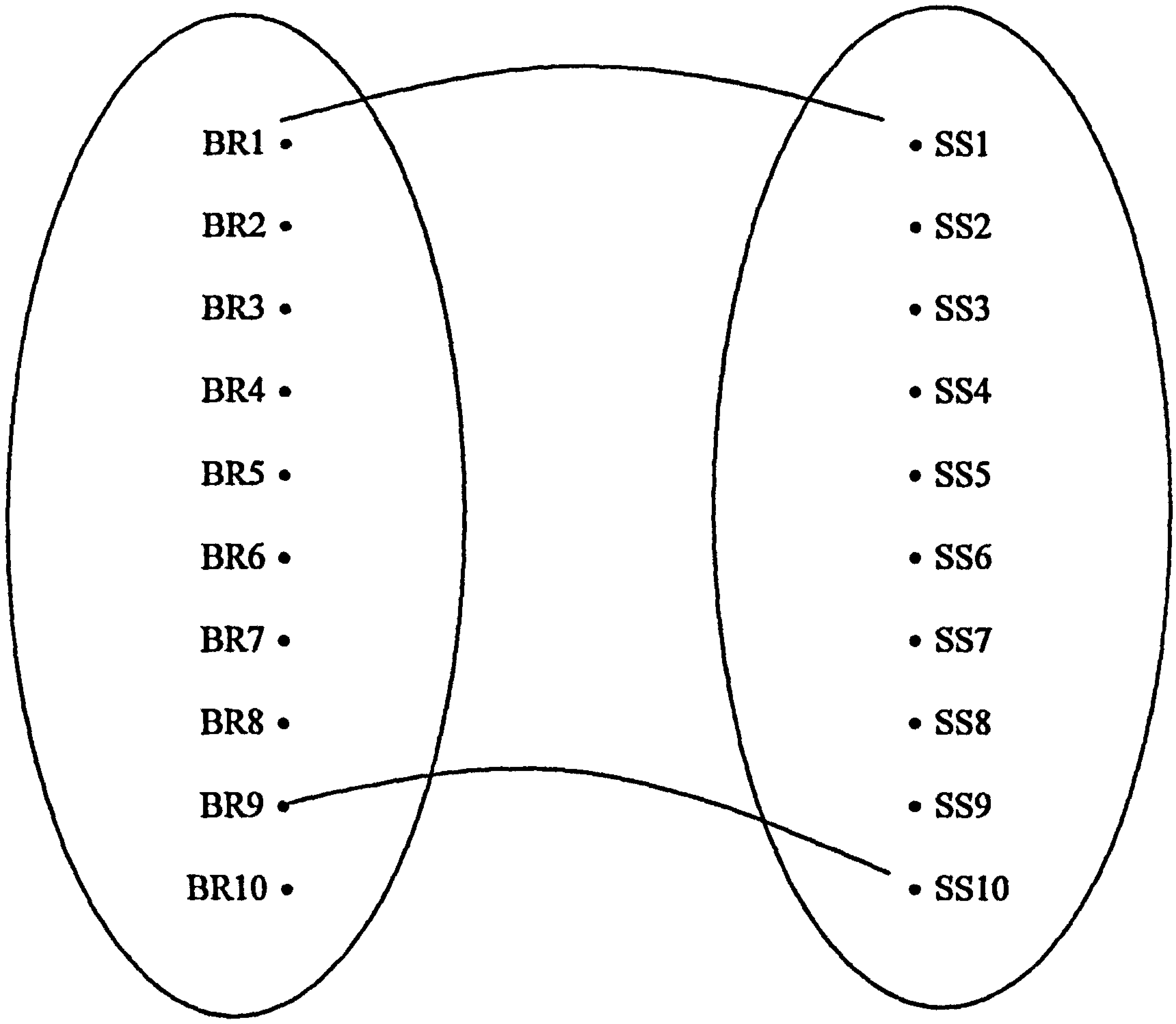


Figure 6.4: Mapping Diagram of BR to SS (*Stage 1*)

When the mapping diagram is examined it can be seen that some instances in one set are mapped to instances in the other set although there are relatively few. In fact only BR1:SS1 and BR9:SS10, i.e. BRS from the Venn diagram as one would expect. However now the focus is on the instances that do not map. There are some potential matches, for example, BR3 and SS3 both concern the implementation date. BR3 relates to the date the new system is perceived to be required by the Customer but this is not agreed by the Systems Developers, they simply state that the deadline is tight (SS3) and this certainly does not indicate a meeting of minds as to the likely implementation date. In fact were this to remain the state of affairs the project would probably be of high risk of not meeting the deadline simply because the two sides have not really come to a serious agreement on the issue indicated by the fact that there is no mapping on the diagram. Having this highlighted early on is obviously beneficial. Similarly BR5 and SS9 concern response rates, which both sides have a concern about, but at this stage there is little common ground with different assumptions being made. Clearly a mapping does not really exist and more dialogue and negotiation is required.

On the other hand the Customer requirement BR2, concerning the image of trust, is not really even on the agenda of the developers, as there is really no corresponding element in their set. This is also the case with BR4, BR7 and BR10 where the Software Developers do not seem to have taken any of the implications of these requirements on board. Equally the specification statements of SS5 and SS8 do not reflect any immediately identifiable requirement of the customer, again indicating a need for further clarification and discussion. A second stage or iteration would now be entered and attempts to resolve the mismatches made.

6.5.7 An Application and Illustrative Case Example - *Second Stage*

Notations: Customer Requirements

Let (BR) denote the set off all possible customer requirements space which contains the individual (fragments) business requirement as sub-sets viewed by the customer:

For the second stage R contains a different set of individual requirements, e.g.:

BR1= we would like to offer an e-commerce facility for our external customers.

BR2= the image required for this business is one of trust.

BR3= the new system must be operational by the end of February next year.

BR4= the system must be easy for internal and external customers to use.

BR5= the system must provide competitive response rates for customers.

BR6= the system must be secure as possible given the nature of the channel.

BR7= the system must provide enough information for customers so that they do not put an additional burden on the existing help line.

BR8= a maximum of 8 people (from the business side) will be available to support the development of the new system.

BR9= the new system needs to fit very closely with the existing business processes.

BR10= the system should attract additional customers, not just be a different channel for existing customers.

Notations: System Developer Specifications

Let (SS) denote the set off all possible system developer specifications space which contains the individual (fragments) suggested specification design as sub-sets viewed by the developer:

SS contains a set of individual specification elements, e.g.:

SS1= an electronic retail channel is required.

SS2= the development of the system is a major new undertaking for the ITS department.

SS3= the time scale is extremely tight. Adequate resources must be devoted to the project. Project management must have top priority.

SS4= the skill required are in short supply. New skills will be bought in.

SS5= the development environment will be Unix.

SS6= a mirror environment will be required.

SS7= the system must be as secure as possible adopting best practice in the sector.

SS8= the development language will be Java and C++.

SS9= response times must be benchmarked to the best of breed.

SS10= the system can utilise the existing processing systems for the underlying functions, which will shortcut the development.

Let (BR) and (SS) be two sets of points (interests) having subsets in common represented by (BRSS). The intersection is larger than in the first stage and there is a greater degree of overlap indicating a greater convergence of the requirements and the specification.

- ***Details of the Second Stage***

The second stage shows (Figure 6.5) more common and agreed system requirements. Let (BR) and (SS) be two sets of points (interests) having subsets in common represented by

(RS). The intersection is larger than in the first stage and there is a greater degree of overlap indicating a greater convergence of the requirements and the specifications.

At the end of the second stage it can be seen that there is a greater degree of overlap indicating a greater convergence of the requirements and the specifications which enhances their business performance. The issue of time scale has been resolved as a result of it having been highlighted in the first stage. The customer has understood some of the limitations and concerns of the Systems Developers and delayed the deadline by two months (BR3). Thus as a result of discussion, negotiation and improved understanding on both sides the content of the requirement instant has changed. On the developer side the issue of resources has been addressed, project management will be addressed (SS3), and new skills are to be bought in (SS4). The sides are now in general agreement over time scales and this is agreed as an element of overlap. It should be noted that in this case one requirement instance has mapped to two specification instances, in fact one-to-many, and many-to-many mappings are allowed.

BRSS= {BR1:SS1, BR3:SS3, BR5:SS9, BR6:SS7, BR9:SS10}

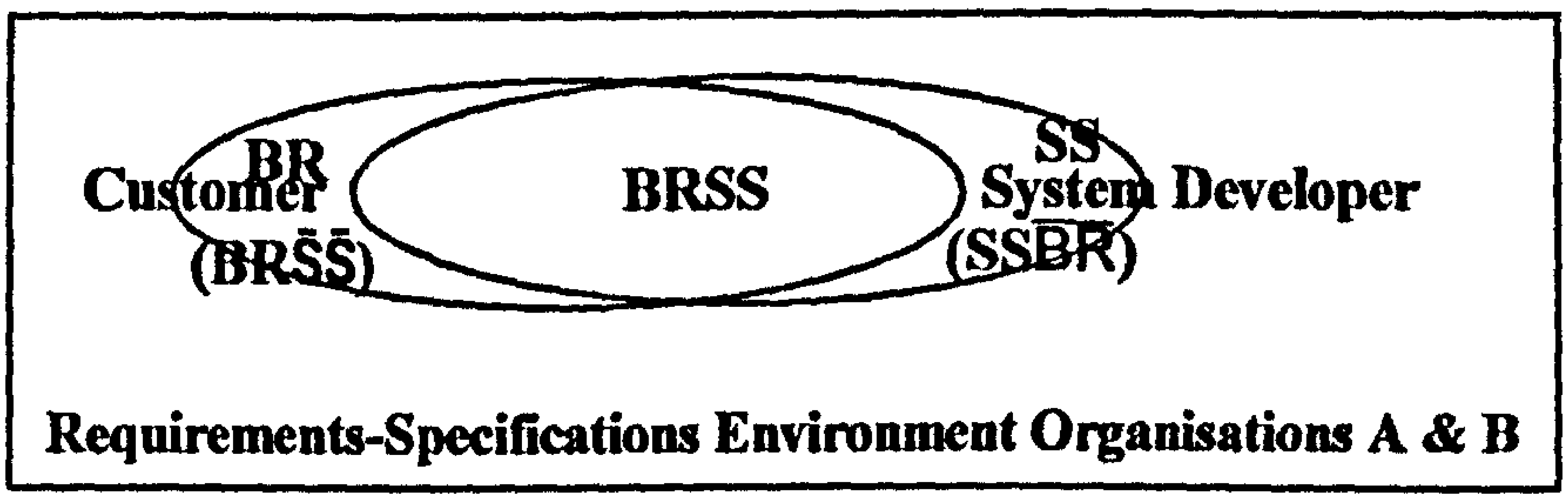


Figure 6.5: Business Requirements (Customer) ≠ System Specifications (System Developer)

Response rates are also now agreed. The customer is happy that they match competitor systems (BR5) and the Systems Developers have agreed to identify and benchmark them (SS9). Similarly the assumptions concerning security have been discussed and agreed. It is understood that total security is unrealistic but the customer has agreed to specific measures that reflect best practice in the sector and the channel (BR6:SS7).

The new mapping diagram (Figure 6.6) now shows the agreed mappings. The diagram helps the groups to now focus on those instances that are not mapped in each set. These are then reviewed, discussed and negotiated as to what they mean, why they are there, and the implications for either side. Ideally a third stage or iteration of discussions are undertaken with the objective of mapping all elements in each set.

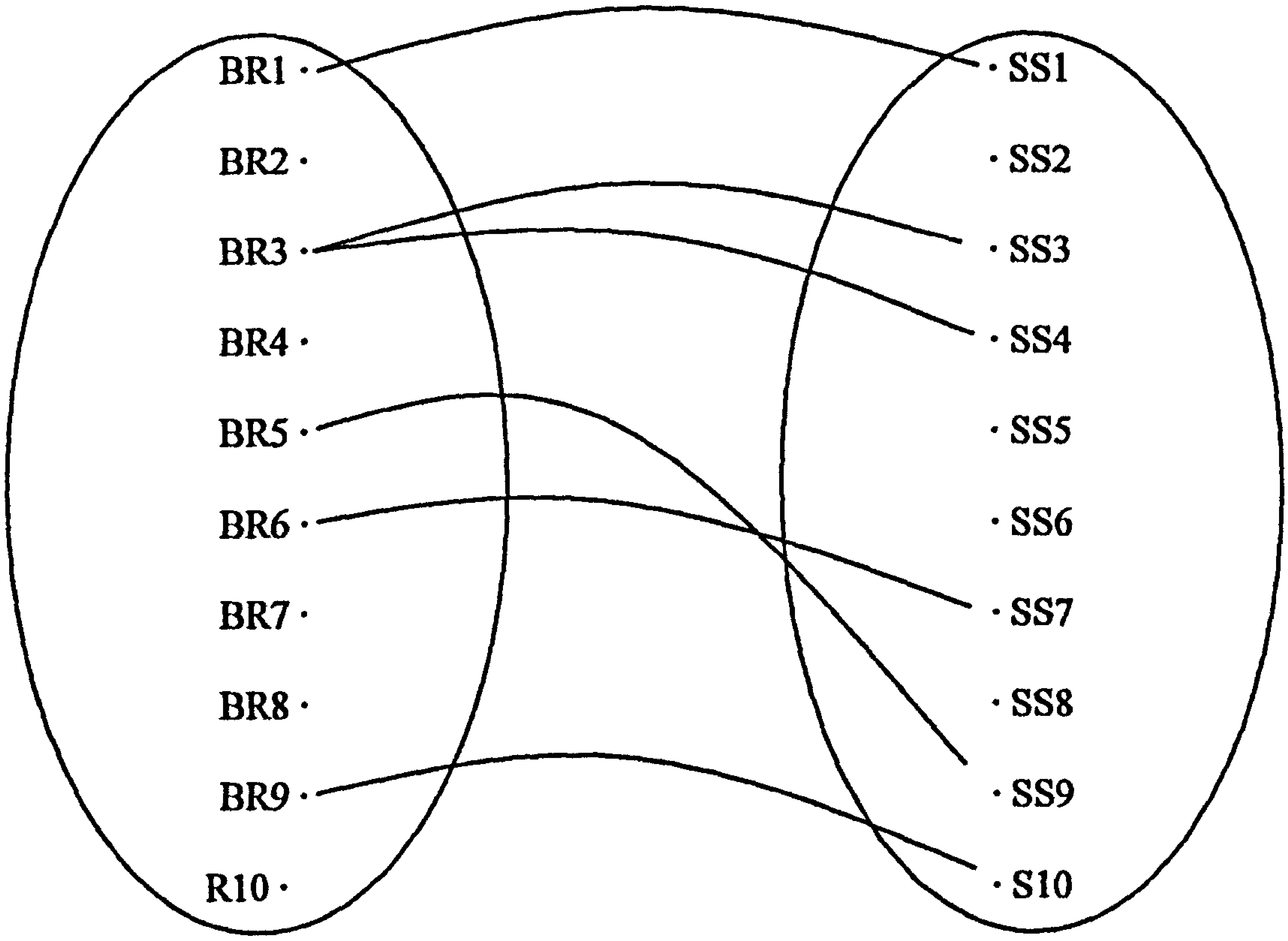


Figure 6.6: Mapping Diagram of BR to SS (*Stage 2*)

In this case there are still a number of instances in both sets that have not been agreed and mapped. For example the issue of the image of trust (BR2) is still not resolved. It might be that there is nothing on the specification side that can be done to address this. If this is the case then this should be recorded and the requirement instance R2 removed from the diagram. Everybody would now be clear that this is not something that the new system can directly deliver and there are no false expectations. Equally there are some specification instances that are not mapped, for example SS8 concerning development in Java and C++. If there is no requirement that maps directly to this then again it should be removed. This would make it clear that there is no requirement that leads to the use of Java and C++, that some other languages could alternately be used and that this is purely a technical decision. The customer should be made aware of the benefits and limitations of using these development languages. In other words dialogue and negotiation ensue. Of course it might be that the use of Java and C++ is in fact mapped directly to some requirement. Either way the developers have to be very specific about the reasons for doing things in a particular way and explain them to the customer so that they understand the implications and vice versa. As indicated above all the agreements should be documented along with the reasoning behind the decisions.

Compromise and trade-offs are inherent in resolving and illuminating differing perceptions and although the technique proposed is the use of Set diagrams it is really the negotiation and dialogue that is key and the way that the diagrams drive the associated socio-technical process.

6.6 The Process and the Use of Relevant Tools

The main feature of the technique proposed is the use of diagrams from set theory but although the use of the diagrams is important, it is really the negotiation and dialogue processes that present the key issues.

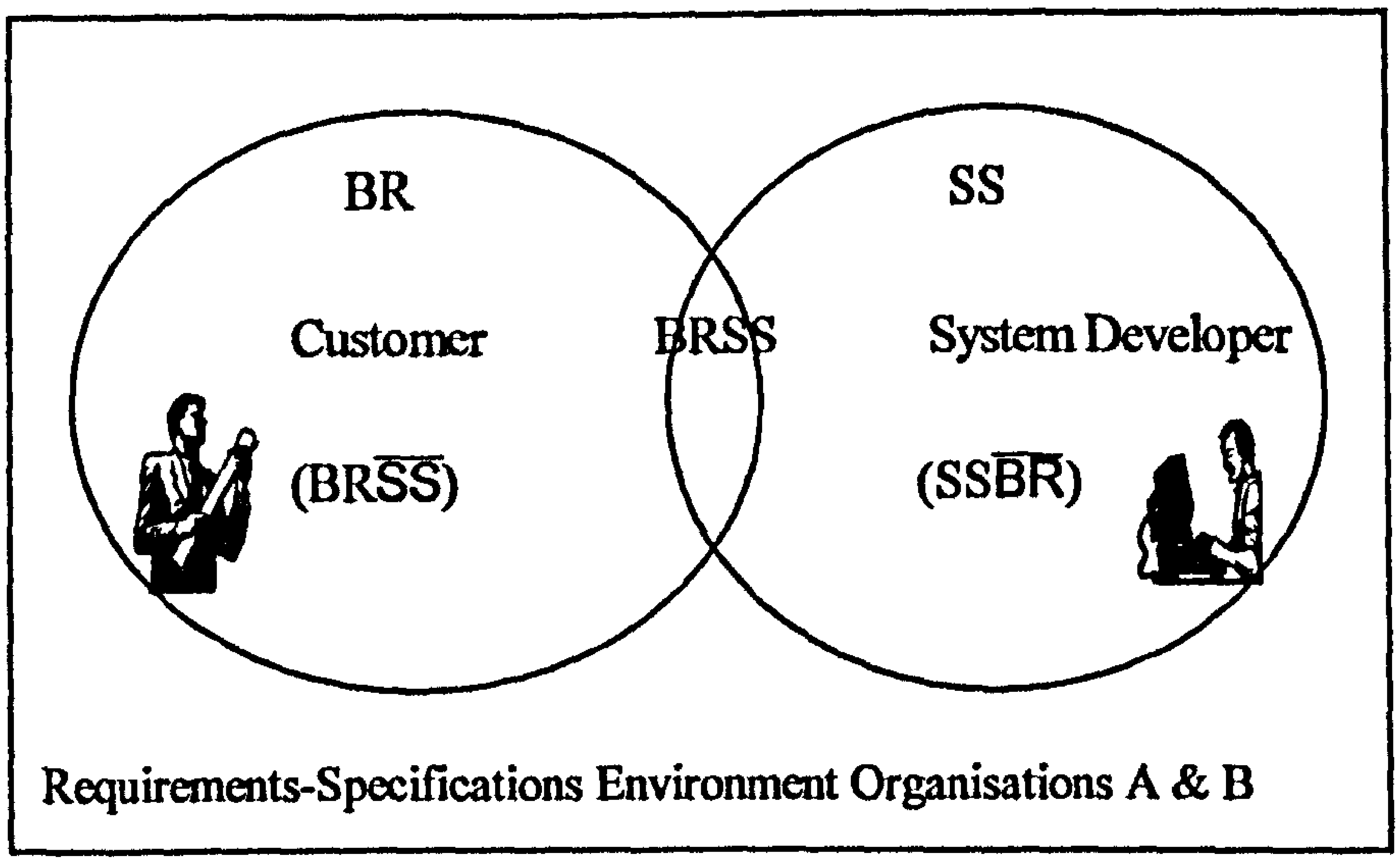
The starting point of the process is arbitrary, it can be after some specifications have been developed or it can be before. There is usually some general agreement that a system of some kind would be beneficial and should be developed. In terms of the systems development life cycle, it is probably most beneficial early in the analysis stage, after feasibility and initial statement of requirements, although there are no hard and fast rules. The stakeholders need to be analysed and the two sides identified (see discussion in professional culture clash section concerning caveats relating to the notion of two sides- **professional culture clash**). It is first recommended that each side independently draw their own list of R or S instances, the number and the way they are described is irrelevant, the important thing is first to get two lists. Then an overlapping Venn diagram is constructed to indicate what they believe the level of mutual understanding to be. This diagram then provides the starting point for further discussion with attention being focused on why there is disagreement between each side's view, and on the nature of the current mismatch between requirements and specification. This discussion should then lead to the development of specific further activities to obtain better understanding so as to increase the overlap and agreement. A scenario approach can be useful to enrich the communications between the groups, (Rudelius et al., 1982; and Tillier, 1999). Because of the simplicity and clarity of the Venn and mapping diagrams, which is especially helpful to the customer, it is recommended that the above process is repeated frequently throughout the requirements definition stage of the project's life cycle. We have illustrated two stages in the example but there will probably be more.

The author suggests that the role of a facilitator in matching and mapping the requirements against the specification is important and will add value to the quality of the final requirement.

A facilitator is an independent person who guides the process and helps overcome the various barriers that are in the way and any problems that occur. The facilitator may also arbitrate at times but ideally should get the groups to agree rather than impose anything. The facilitator is also responsible for the more mundane elements such as getting the right people involved, arranging meetings, setting agendas, etc. The person (or people) needs to be independent so as not to be seen as tainted by any internal 'politics' or bias. It is not a new concept and has been used successfully in a number of areas, particularly in JAD (Joint Application Design) meetings.

- **Applications of Set Diagrams in Retail**

The fist technique within KRF that we applied and shall illustrate is the use of the Set Diagram (or Venn diagram) and how it can be applied to the understanding of customer requirements and the minimisation of the gap. The use of set diagrams is part of KRF and is ideally applied at level 3, after the application of rich pictures and other techniques at level 2, i.e. when the outline requirements and fundamental mismatches have been resolved. Set diagrams have been used successfully for some time in management science (Anderson et al. 1995), as well as, of course, in their traditional areas of logic and maths. It may seem strange that a mathematical technique is used in KRF but they are used mainly for their graphical representation to drive the requirements understanding process. They have been found to be highly effective as a graphical or pictorial technique for illustrating gaps in understanding that exist at the requirements stage.



Business Requirement (Customer) ≠ System Specification (System Developer)

Figure 6.7: Initial Overlapping of Customer Requirements and System Developer Specifications

The diagrams essentially illustrate the degree of overlap between the two groups in their understanding of requirements. They are extremely easy to understand and can be manipulated by both sides to make particular points. For example, by re-negotiating the overlaps it is easy to indicate how good or bad current agreements are on particular matters. Although the set diagram has quantitative antecedents it is used as part of KRF in the context of a socio-technical approach and applied as a driver of a socio-technical process.

6.6.1 The Use of Set Diagrams in the Retail Sector

The above example is based on the research study and discussions with two of the participating organisations. One was well known high street retailer and the other was the retail arm of a larger financial institution, both based in London. The example relates to the perceived need to 'enter the internet world' and to have a web based information and sales channel for the companies existing products. Beyond this the case is simplified and does not reflect the detail of the organisations nor their actual requirements. It is purely illustrative of the situation and the processes.

The two circles of the Set diagram represent different areas of knowledge and understanding; one represents the understanding of the system developers, the other the customer. The matching or common understanding of the requirement is where the two circles overlap (BRSS). The above diagram, Figure 6.7, clearly illustrates that in this case the customer and the developer have different perceptions and understandings of what the system is to deliver and what it will be like as the area of overlap is very small.

- **Customer Requirements -Business Departments**

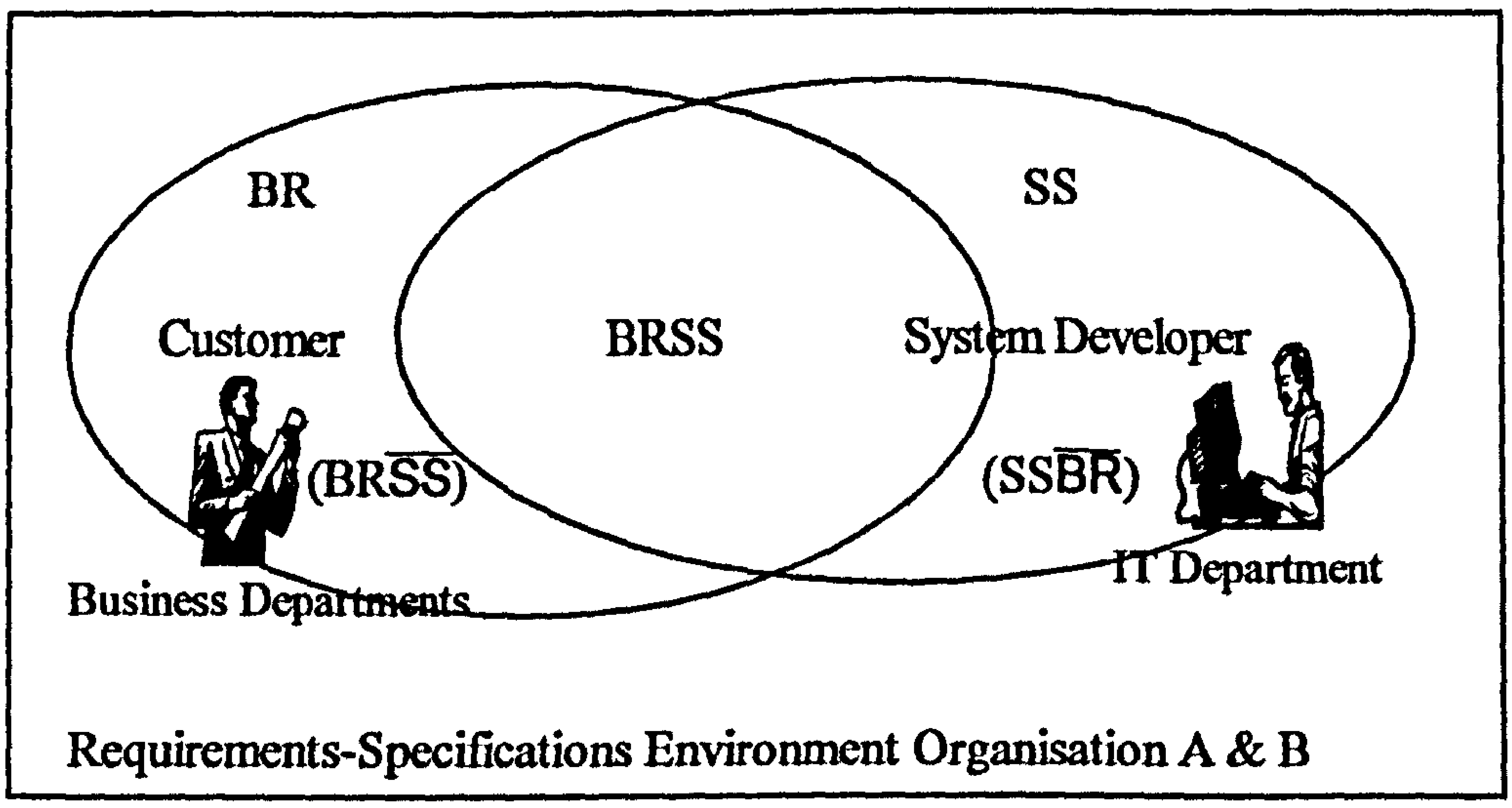
In the Set diagram of Figure 6.8 (BR) denotes the set off all possible customer requirements space which contains the individual (fragments) business requirement as sub-sets viewed by the customer: BR contains a set of individual requirements, e.g. we would like to offer an e-commerce facility for our external customers, the image required for this business is one of trust, the new system must be operational by the end of the year, the system must be easy for internal and external customers to use, the system must provide quick response for customers, the system must be totally secure, the system must provide enough information for customers so that they do not put an additional burden on the existing help line, a maximum of 8 people (from the business side) will be available to support the development of the new system, the new system needs to fit very closely with the existing business processes, and the system should attract additional customers, not just be a different channel for existing customers.

• System Developer Specifications -IT Department

SS denotes the set off all possible system developer specifications space which contains the individual (fragments) suggested specification design as sub-sets viewed by the developer. SS contains a set of individual specification elements, e.g. an electronic retail channel is required, the development of the system is a major new undertaking for the ITS department, the time scale is extremely tight, the skill required are in short supply, the development environment will be Unix, a mirror environment will be required, absolute security is impossible, the development language will be Java and C++, response times depend on factors outside of our control, and the system can utilise the existing processing systems for the underlying functions which will shortcut the development time.

In this case the common understanding (overlap) is relatively small. The common factors are that they are both talking about an internet channel and that the existing processes will be utilised which will obviously make them a close fit to the new system. The non-overlapping sector is represented by $BR\overline{SS}$ and $SS\overline{BR}$. For example, the customers want the system to be 'totally secure' whereas the developers are indicating that they believe that total security is impossible and are talking about a mirror system. This clearly shows an area of mismatch or misunderstanding (possibly on both sides) and in Set Diagram terms there is no mapping between the two sets in terms of security. Another example of a mismatch is that the customers want the system to attract new customers but this does not seem to have been taken on board in any way by the developers. Maybe it is difficult for them to do but the fact that they have ignored this is likely to lead to unfulfilled expectations at the very least. Overall there is obviously a far greater degree of mismatch than match of requirements (or at this stage understanding and perceptions) between the two groups.

The diagram is obviously only illustrative but nevertheless powerful in its ability to convey the size of the gap. In use the diagrams would have the specific elements, i.e. the Rs and Ss, fully defined and possibly written on the diagram in the appropriate places. However this makes the diagrams rather messy and unwieldy so it has not been included here. When the elements of the gap are discussed in detail and agreements thrashed out the participants can re-draw the diagrams with the overlap becoming larger as understanding develops. The point is that the diagram clearly represents the current level of agreed areas of understanding and misunderstanding between the two sides at any stage. In KRF the focus is now on these gaps. There are some potential matches, for example, both groups have defined something relating to the implementation date. However, the Customer has specified a date but this is not agreed by the Systems Developers, they simply state that the deadline is tight (SS3) and this certainly does not indicate a meeting of minds as to the likely implementation date. In fact were this to remain the state of affairs the project would probably be of high risk of not meeting the deadline simply because the two sides have not really come to a serious agreement on the issue. Having this highlighted early on is obviously beneficial. Similarly, there is the issue of response rates, which both sides have mentioned, but at this stage there is little common ground with different assumptions being made. Clearly a mapping does not really exist and more dialogue and negotiation is required.



Business Requirements (Customer) ≠ System Specifications (System Developer)

Figure 6.8: Greater Overlapping of Customer Requirements and System Developer Specifications

At the end of the second stage hopefully there is a far greater degree of overlap and in this case there was a greater convergence of the requirements and specification achieved. The issue of time scale has been resolved as a result of it having been highlighted in the first stage. The customer has understood some of the limitations and concerns of the developers and delayed the deadline by two months. Thus as a result of discussion, negotiation and improved understanding on both sides the content of the requirement changed. On the developer side the issue of resources had been addressed, project management addressed, and it was agreed to buy in new skills. The sides were now in general agreement over time scales and response rates were agreed. The customer agreed to match competitor systems and the developers agreed to identify and benchmark them. Similarly the assumptions concerning security were discussed and agreed. The customer was persuaded that total security was unrealistic but agreed to specific measures that reflected best practice in the sector and the channel.

The new mapping diagram, Figure 6.8, shows the agreed mappings after the second stage. The diagram helped the groups to focus on those instances that were not mapped in each set. These are then reviewed, discussed and negotiated as to what they mean, why they are there, and the implications for either side. Ideally a third stage or iteration of discussions are undertaken with the objective of mapping all the elements in each set.

6.6.2 The Use of Rich Picture: An Approach of Ease in Capturing and Managing Smart Requirements

The author choice of rich picture is due to its ease of use especially from the customer viewpoint by using words or sketches. Rich picture is a valuable learning tool and its relevance. The customer and the system developer can use it to summaries ideas and explore their relationships. There are no established rules for drawing a rich picture as long as it captures the basic structural and process elements in an effective situation. When the level of misunderstanding between the various groups are deep seated and there are serious conflict of goals, values, perceptions and expectations the approach that we have used successfully in the past is Soft Systems Methodology (SSM) and in particular the use of Rich Pictures Checkland and Scholes (1997). Bustard et al. (1995) has shown that SSM can successfully be combined with other requirements analysis methods. SSM is particularly appropriate for complex situations where fundamental underlying difference of opinions and perceptions are encountered. It addresses aspects that are typically not well addressed by most other analysis approaches and methods. It is not the purpose of this chapter to describe SSM or Rich Pictures in detail but simply to indicate its use in KRF.

Why do we use a rich picture? A Rich Picture is a caricature of an organisation or problem area that helps illustrate what it is 'about'. The rich picture should be self-explanatory and easy to understand. A rich picture is constructed by looking for elements of structure and process in the problem situation and representing them in the diagram. Frequently the deep-seated problems are often found in a mismatch of structure and process elements and the rich picture helps to illustrate this. However, the rich picture is simply a diagram and the real benefit is in the discussion and understanding that its construction reveals. The diagrams should also contain 'soft' elements, such as peoples' values, concerns, perceptions, etc. There are few hard and fast rules but some of the notation is particularly interesting, such as the crossed swords that represent conflict, and which is a good illustration of the kind of thing that a rich picture addresses that is typically not even considered in other techniques.

6.6.3 The Implementation of Rich Picture in the Retail Sector

Figure 6.9 was the result of discussions with retail personnel (customers and developers). It shows some of the different issues that were going through the minds of the participants when discussing the initial requirements of a new system.

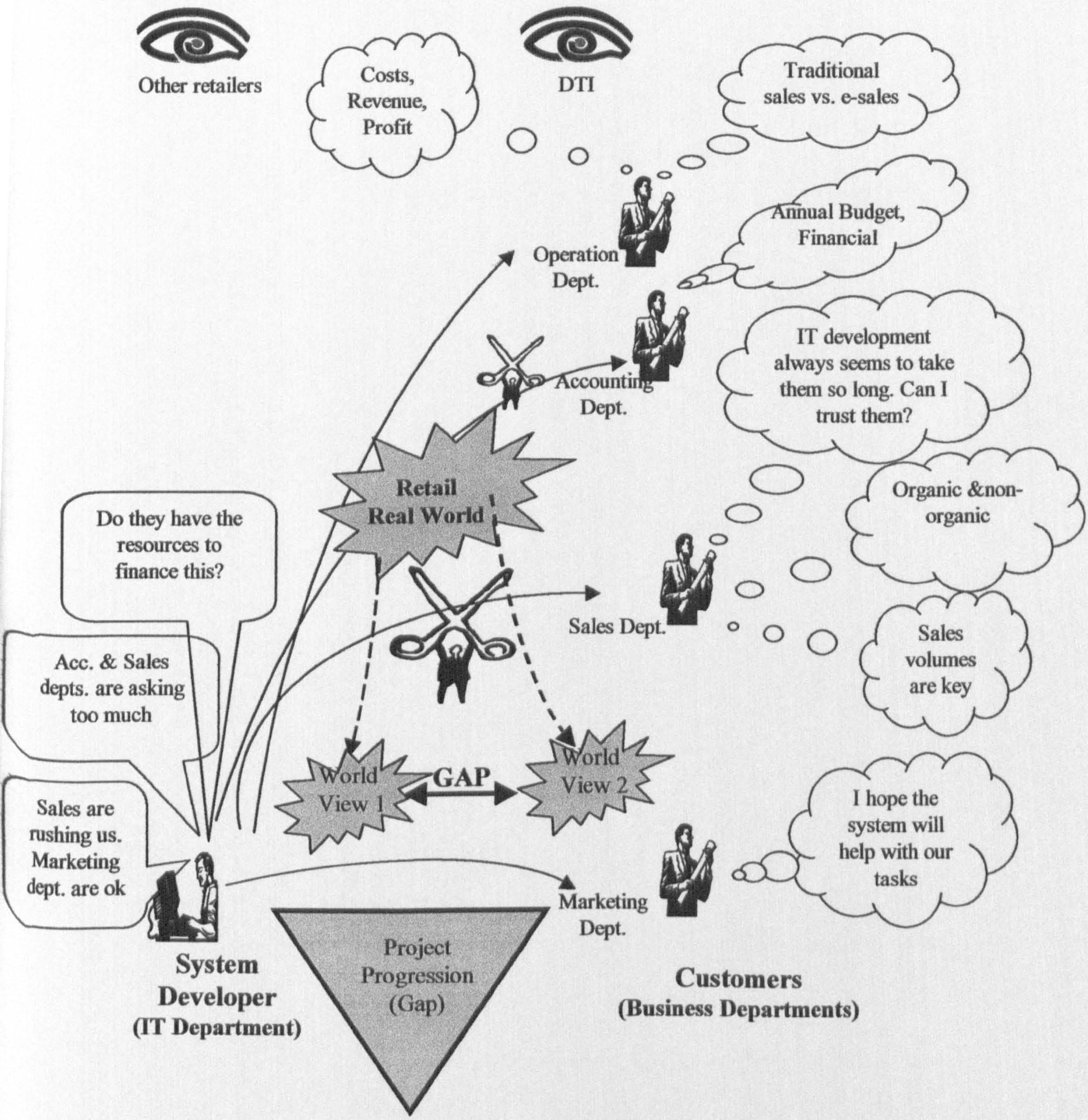


Figure 6.9: Rich Picture of the Initial Situation (*Organisation A*)

The participants found rich pictures easy to use despite not having any prior experience. They also found that they made each side think about the others perceptions and recognise some fundamental problems that needed to be resolved before moving on to more detailed requirements identification. However, they did comment on the time it took to reach any kind of agreement but in the end both groups were happy that it proved beneficial.

6.6.4 Use of Multi-tools to Elaborate Initial Requirements

The use of diagrams from set theory as a technique, although very useful and can help stimulate understanding and reveal areas of disagreement and mismatch, have limitations where the level of misunderstanding is deep, or where there are serious conflict of goals, values, perceptions and expectations. The diagrams simply help illustrate that the degree of the match or mismatch is severe.

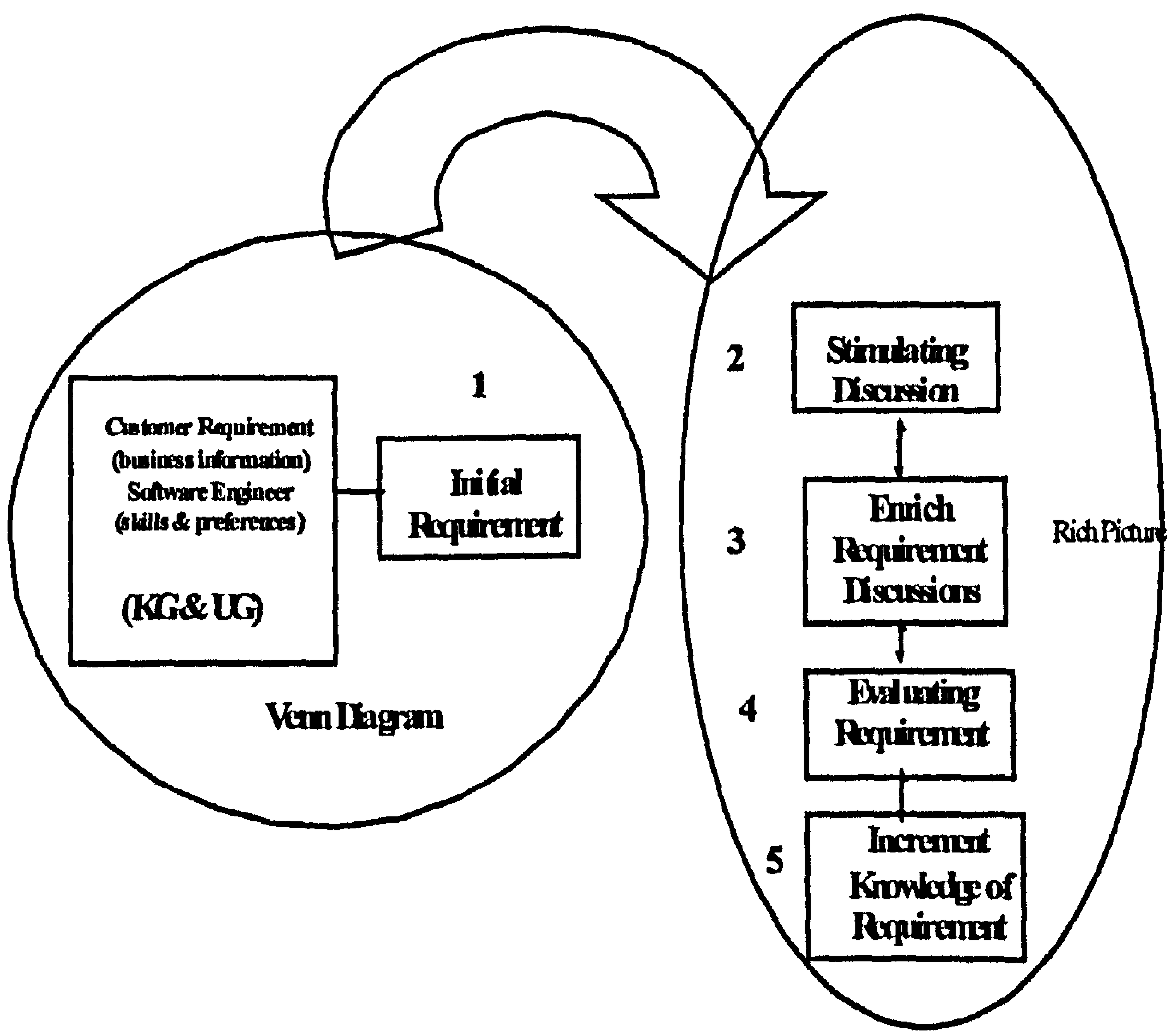


Figure 6.10: The Use of Set Diagram and Rich Picture

In such situations further techniques may have to be used to help address such deep problems of understanding. One technique that we have investigated and used successfully in the early stages of requirements determination is Soft Systems Methodology (SSM) and the use of Rich Pictures (Checkland and Scholes, 1997). Figure 6.10 indicates the relationship between the two techniques. Bustard et al. (1995) have shown that SSM can be combined with other requirements analysis methods. SSM is particularly appropriate for complex situations where fundamental underlying difference of opinions and perceptions are encountered. It addresses aspects that are typically not well addressed by most formal analysis approaches and methods. It is not the purpose of this chapter to describe SSM or Rich Pictures in detail but simply to indicate that it may well be used appropriately in conjunction with the set diagrams. The use of the set diagram technique described in this chapter is part of a wider approach currently under development, which we refer to as the Knowledge Requirements Framework (KRF) approach. The approach will not be described in detail but essentially it is aimed at generating the knowledge and understanding needed in both the customer and the developers to enable the development of a sound, agreed, and fully effective project requirements definition. The key principle that drives our approach is the belief that both sides must work together to generate knowledge and understanding of one another's worlds and that both have a lot of learning to do. We reject the view that the customer already knows fully what they want of the system, and we also reject the view that the developer knows fully the customer's business and what is needed of the system. We believe that the only way to get good requirements definition is through partnership and mutual understanding.

6.6.5 Using the Fishbone Technique to Help Bridge Gaps in Understanding

The fishbone technique "Ishikawa" has been developed by Kaoru Ishikawa in 1943 (Ishikawa, 1983). Fishbone technique has been used extensively in the quality circle (Oakland 1989), the technique help improves problem situations in the industry (e.g. motor; Ford, 1983 and chocolate mousse; Camp, 1986) and the service (e.g. airline) sectors in identifying "cause-and-effect". In order to illustrate what can go wrong in an IS/IT project, a customer and a system developer may want to draw a fishbone diagram, it is called a fishbone diagram because it resembles the skeleton of a fish. The main issues that emerged from the discussions fall into two areas that the majority of the interviewees agreed namely - business and technical issues. Both issues related to all retail organisations understudy, this is not a surprise since the notion of interacting issues is fundamental to the argument of the research. From the results of our survey, we can define the following common structure in most of the large corporate Retails which contributes to the failure or the success of a software project using the *cause-and-effect* analysis also known "Ishikawa" or fishbone as shown in Figure 6.11.

6.6.6 Implementing the Fishbone: An Approach in Capturing of Smart Requirements in Organisation A

To figure out major IS/IT failures in the retail sector, the use of fishbone technique was highly effective among business and techie groups. During our interviews, one important characteristic which had been highlighted in many retail organisations by IT departments (system developers) is the role of the Sales department in contributing or speeding the obsolescence of ITS. The sales people are driven by good pay, and high bonuses (rewords) which prepares them to take high risks. While the IT development team working on a particular system (which takes time to develop) the sales team already stuck a deal. The sales team activities in most of led to the cancellation of many ITS project in this (retail) active sector.

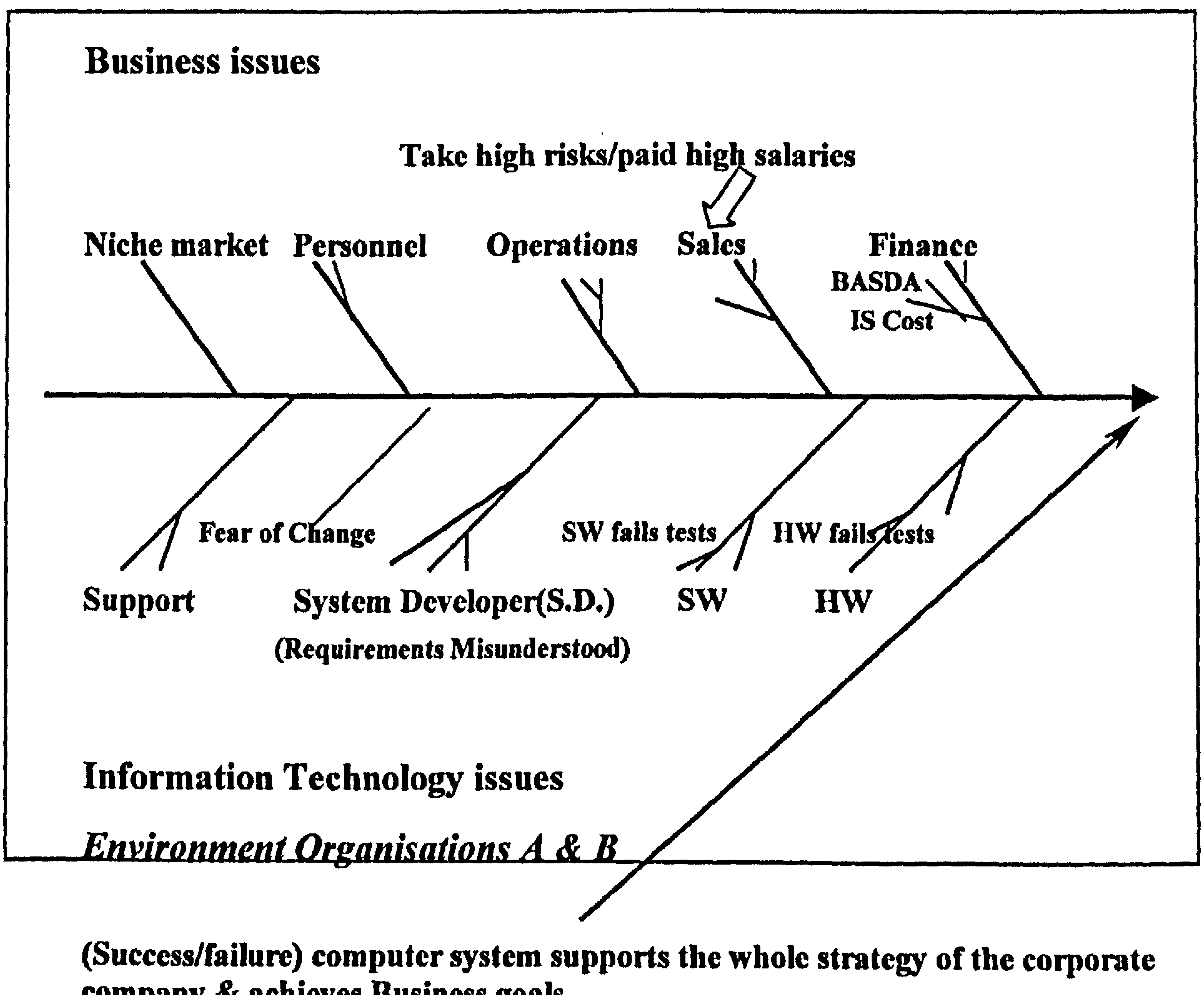


Figure 6.11: Case Study 1: Perceived Use of the Fishbone Technique in the Retail Sector

This fact mentioned on more than one occasion in organisation A and during the conducted questionnaires, interviews and feedback as been illustrated below in the fishbone diagram (Figure 6.11). This fact is a new and important outcome highlighted in the fishbone diagram and as a result of our study in the retail organisations of which people did not come across.

The detailed fishbone diagram shown in Figure 6.12 was the result of analysed data that gathered using the questionnaires data and many discussions with well known retail personnel (IT and non-IT) in London in addition to workshops ran as part of the IT-system development topic in the postgraduate degree courses, namely the MBA and DMS of which many are mangers working for many retails in the city of London.

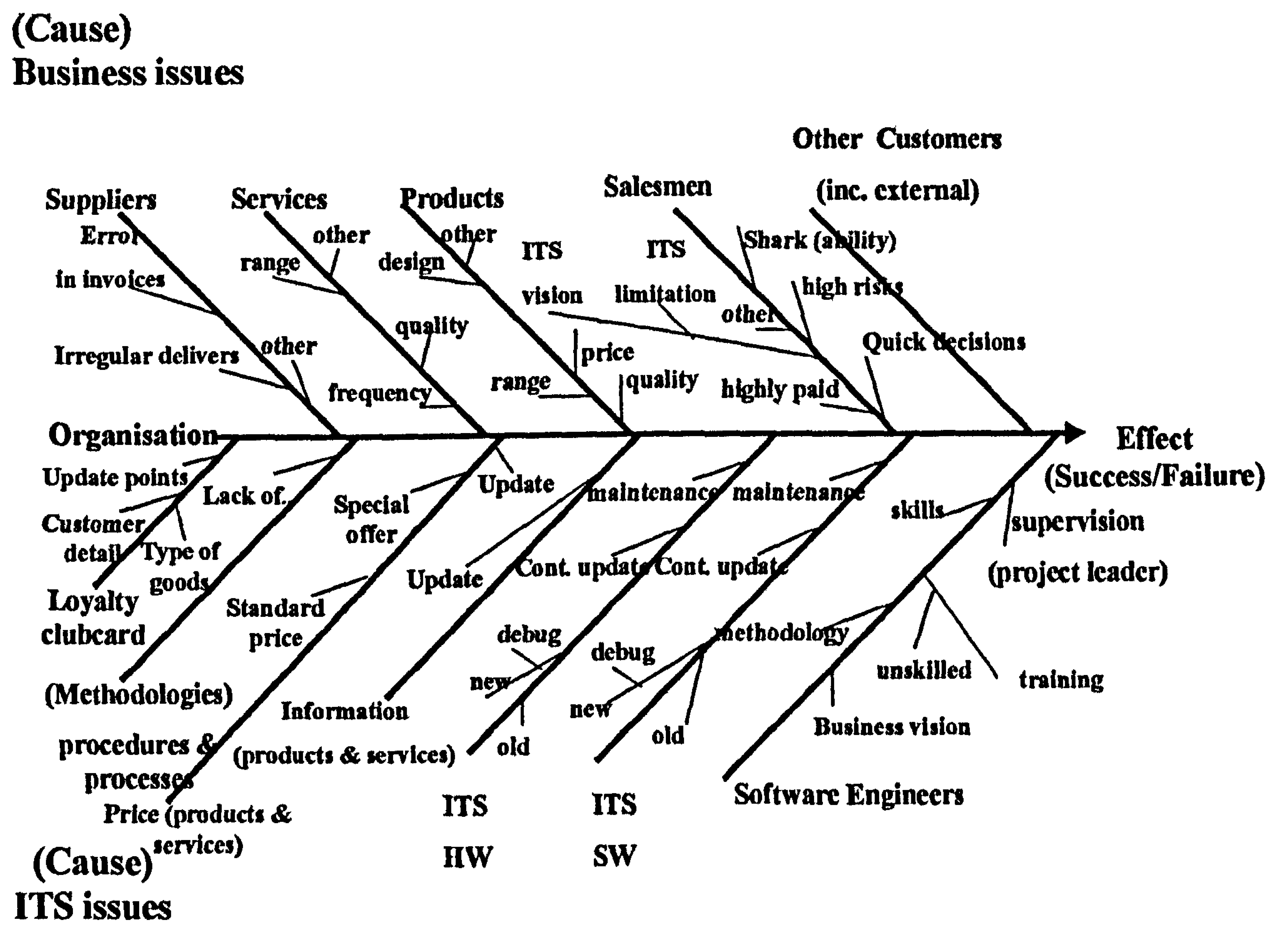


Figure 6.12 Detailed Fishbone Diagram for Retail Organisation A ITS Project

The value of the above two fishbone diagrams is to systematically list all the possible problems (business and technology) that can occur during the requirements stage. In the retail case above, it is useful to organise the fishbone diagram by listing all of the business (top) and technology (bottom) issues on either side of the main-bone

In a similar fashion to the experience used in the fishbone, the rich picture technique has been exposed to the same group of people. The detailed rich picture diagram shown below was the result of many discussions with well known retail personnel (IT and non-IT) in London. Both techniques were welcome by the participants due the ease of use which no prior knowledge required. In addition to the stimulated discussions and partnership contribution of both customers (non-IT) and system developers (IT) personnel. On comment came up is the time it took to reach agreed requirement to the assumed system, but both groups were happy to accept this sacrifice if it means acquiring a usable and efficient system in their retail organisations.

To manage the requirement you need to manage the knowledge each party possesses, e.g. TBK or TTK. To combine the two, you need a knowledge management (KM) system to handle, moderate, enrich ..etc. this combined knowledge. We believe that KRF is the system that handles, moderates, and amalgamates both TBK and TTK. KRF, on one hand will cater for changes in the requirements, but on the other hand will help to stabilise requirements through the use of different tools and techniques, such as brainstorming, interviews, rich picture, fishbone (Ishikawa, 1993), scenarios, joint application design (JAD).

6.7 Adoption, Implementation and Documentation of KRF in Retail

KRF is a key process in the initial requirements stage of the system development process which can be related to the so-called **"Agile"** process revolution for software development. The main principles are daily communication and collaboration between customers (businesspersons) and system developers (techies) throughout the IT/IS project, Chapters 3 and 5. This requires frequent delivery of working and valid requirements and openness to frequent change of customers' requirements. Chapter 6 introduces the tools and techniques implemented on the adaptation of KRF in retail organisation A, financial institute B and most of the workshops ran.

KRF does this by creating a **"requirements profile"**, a compilation of all of all features the IT/IS needs, prioritised by "the customer -business", who represents the interest everyone (stakeholders) with a stake in the project and its results. The highest-priority items are taken for completion in a **"mini-project sprint"**. These normally last a month and end with a demonstration of results to other sub-groups in the project management team, after which another mini-project sprint begins. Every day of the KRF begins with a 15-20 minutes meeting between the customers and the system developers where the facilitator asks the same three questions of the team; what did you do since the last meeting; what are you doing until the next meeting; and what prevented the team from doing more work. This usually starts with **Brain Storming session (s) using flip-charts followed by applying the Data Set methods, Fishbone and Rich Picture** (the latter tested only in the retail organisation A). The process required plenty of discipline to cover *levels 1-3*. Most of the times the facilitator will ask the same questions at the daily meeting and some team members will say *"enough already"* but the facilitator has to do it. The self-management aspects of KRF also oblige team members to learn how to manage their own time.

6.7.1 Pilot Testing and Adoption Process in Both Retail and Financial Organisations

KRF model (Figures 6.13 and 6.14) and its process aims at breaking down the non-functional requirements structure into smaller and manageable parts in order to capture, make requirements functional and manageable in any system development methodology. Requirements engineering specialist group (RESG) of the BCS (see Chapter 2) established a few years ago to highlight the importance of smart requirements in any IT/IS project.

Many organisations including the two Organisations A and B neither heard of the RESG nor KRF but they were happy to adopt KRF. AS mentioned above KRF is a model (framework) for elicit, capture, and manage smart requirements (see Chapters 1, 2 and 4), it is a model that breaks the initial stage of an IT/IS project down into small processes (Figure 6.13 -process 1-8 and section 6.14.2), each of which produces a tangible result, to be carried out by self managing teams. Some of the traditional methodologies and approaches to system development are practically not easy to use and maybe not relevant and especially to software building take too long to produce results, and by the time they are delivered, the customer's needs, priorities and business goals may have changed. Worst still, project management team involved in the process hates coming to work every day in small rooms and to be given tasks and more tasks. KRF is different, it takes project team members out of small rooms and puts them in a room with flip-charts and whiteboards and other tools (see sections on Research Basis of KRF and Motivation for KRF in Practice). In these rooms, the workshop(s) session conducted which becomes *classrooms-business* essential in the real world of capturing smart requirements. The project management teams have to talk and discuss the problem and address it as a customer-system developer team. The level of noise is a good indication that a project team management is using KRF, because members of the team are talking. If the room is dead quiet, they are not using KRF. A similar experience happened when the author ran the workshops among professional postgraduate students at the University of Westminster. In a workshop the group divided into two teams, business (customers) and system developers in accordance with the nature of their jobs at their work place.

The customers like KRF because this kind of system development is easy for them to participate in and a model finally delivers results and in a reasonably short period over 1-2 months and it is easy to learn, apply and relevant to their problems. It is only in the last five years that the debate over methodologies has had much relevance beyond the arcane, and often introverted world of system development. Rather like Linux and the open source software movement. KRF became popular largely with our postgraduate and professional students whom most are managers in business and IT departments, gradually developing a following of admirers in the retail sector. Now KRF is being targeted more systematically at senior levels of large retailers that might benefit from using it. In some organisations, Chief Executives (CIOs and CEOs) are part of the problem. They need to be engaged directly with the customer and system developer as they are not too thrilled about being left out of the action. The KRF initiative coincides with a growing feeling among IT/IS developers that traditional system development methodologies are holding them back. They feel that old methodologies had run their course and were not able to scale for them. Many IT/IS developers used the classic *"waterfall"* method of software development, where small team of people work on separate stages of several projects simultaneously, handing off to the next team in sequence over a period that could typically last 12 months. The Waterfall method assumes that nothing has changed over that time and with lots of people working on different projects, if someone drops, it can affect six or seven other projects. With KRF's dedicated project management teams that issue does not arise. But it must be said that the traditional waterfall approach can be cumbersome but also pretty quick. IT/IS developers are always looking for new ways of doing things. The author expects only about one-third of organisations that try to use KRF will succeed, those organisations that do not succeed with it are often those for whom IT/IS is their lifeblood and if they do not succeed with it, they risk going out of business. Also, KRF approach is a complement to all methodologies and not a replacement.

One of the main challenges for organisations adopting KRF is how to deal with the huge cultural change involved in moving to an approach based on small project management teams, and the cost associated with that. It is not cheap when organisations change and retool the culture, in addition, the training cost should be taken into account. On top of this organisations need a lot of good leadership skills since many of them invested in the old way of doing things, and it becomes more about ego, but they have to drop that if they want to move forward. In addition, it seems that system develops' support, global presence and costs are related with non-IT factors that influence the adoption of technology and hence KRF model. It also appears that costs and support are considered as influential factors for KRF adoption.

6.7.2 Testing Knowledge Requirements Framework (KRF)

The KRF deviced that the requirements should be organised into a list of stakeholders' needs, a set of stakeholder requirements, a system specification, with traces between these (the specification traces to the requirements, which trace to the list of stakeholders). The requirements will certainly need to be prioritised, approved (or rejected), and then have their status tracked through to final acceptance, figures 6.13 & 6.14 illustrate the process.

Requirements is about proper understanding of stakeholder viewpoint, needs, conflict handling, scenarios, traceability and validation The main aim of the Knowledge Requirements Framework (KRF) is to create a compatible environment during the requirement process, with the principal objective of knowing the customer needs (requirements). Preparing for KRF may involve changing in the attitude of both the software engineers and the customers in handling the requirements. The change in attitude should be on the top of the list of anticipated future changes, plus others in the system development process.

KRF represents a powerful paradigm (approach) which combines both management science and software engineering methods and methodologies. Earlier we stressed the important role of knowledge and communication in determining a quality requirement. The KRF architecture (Figure 6.13) accommodates and provides a rigorous, clear, and agreed requirements through its different levels, processes, tools, and methods used especially in the first and second levels of KRF. The potency and strength of the KRF concept lies in its experimental approach to organisational change. The ideas generated by ITS experimenters continue to be robust and challenging. Robust because they are rooted in continuing efforts to refine variables and rearrange experimental designs and challenging. In addition, KRF uses knowledge from various disciplines that bear on the issues of the quality of business sector. KRF represents a powerful paradigm (approach) which combines both management science and software engineering methods and methodologies. Earlier we stressed the important role of knowledge and communication in determining a quality requirement. The KRF architecture (Figures 6.13 & 6.14) accommodates and provides a rigorous, clear, and agreed requirements through its different levels, processes, tools, and methods used especially in the first and second levels of KRF.

KRF (Knowledge Requirements Framework) is proposed as an approach to overcoming the problem of inadequate understanding of requirements. It combines both management science and computer science techniques (Anderson et. al., 1995; Louis 1974) but its overall approach is socio-technical, dealing with the social (human) interactions between customers and developers (Bostrom, 1977a; Mumford, 1985, Pasmore, 1988). Earlier the importance of communications in determining requirements was stressed and KRF, it is argued, provides a means of achieving the necessary level of communication that helps overcomes the problems of the culture gap discussed above. The process of customer requirements elicitation involves human-human communications with the aim of achieving a better understanding within organisations and helping elaborate requirements that lead to better systems that better meet the requirements and expectations of the stakeholders (Mumford, 1995a; Mumford, 1995b). The overall approach is aimed at generating the knowledge and understanding needed in both the customer and the software developers to enable the development of a sound, agreed, and fully effective project requirements definition (Kotonya and Sommerville, 1998). This process is sometimes called customer requirements engineering (CRE) and is the process of determining a complete, correct and clear specification of a future software-intensive system from the incomplete, inconsistent and ambiguous statements of need from stakeholders as diverse as end-users, managers and members of the public. Whereas conventional software engineering (SE) approaches focus on models and languages to express system specifications, there has been a recent shift towards a focus on customer requirements engineering *processes* (CREPs), see Kotonya and Sommerville (1998) and KRF adopts just such a focus.

The key principle that drives the approach is the belief that both sides must work together to generate knowledge and understanding of one another's worlds and that both have a lot of learning to do. We reject the view that the customer already knows fully exactly what they want of the system, and we also reject the view that the software developer knows fully about the customer's business and what is needed of the system. We believe that the only way to get good requirements definition is through partnership and mutual understanding. KRF provides a framework for achieving this and Figure 6.13 illustrates the overall structure of KRF.

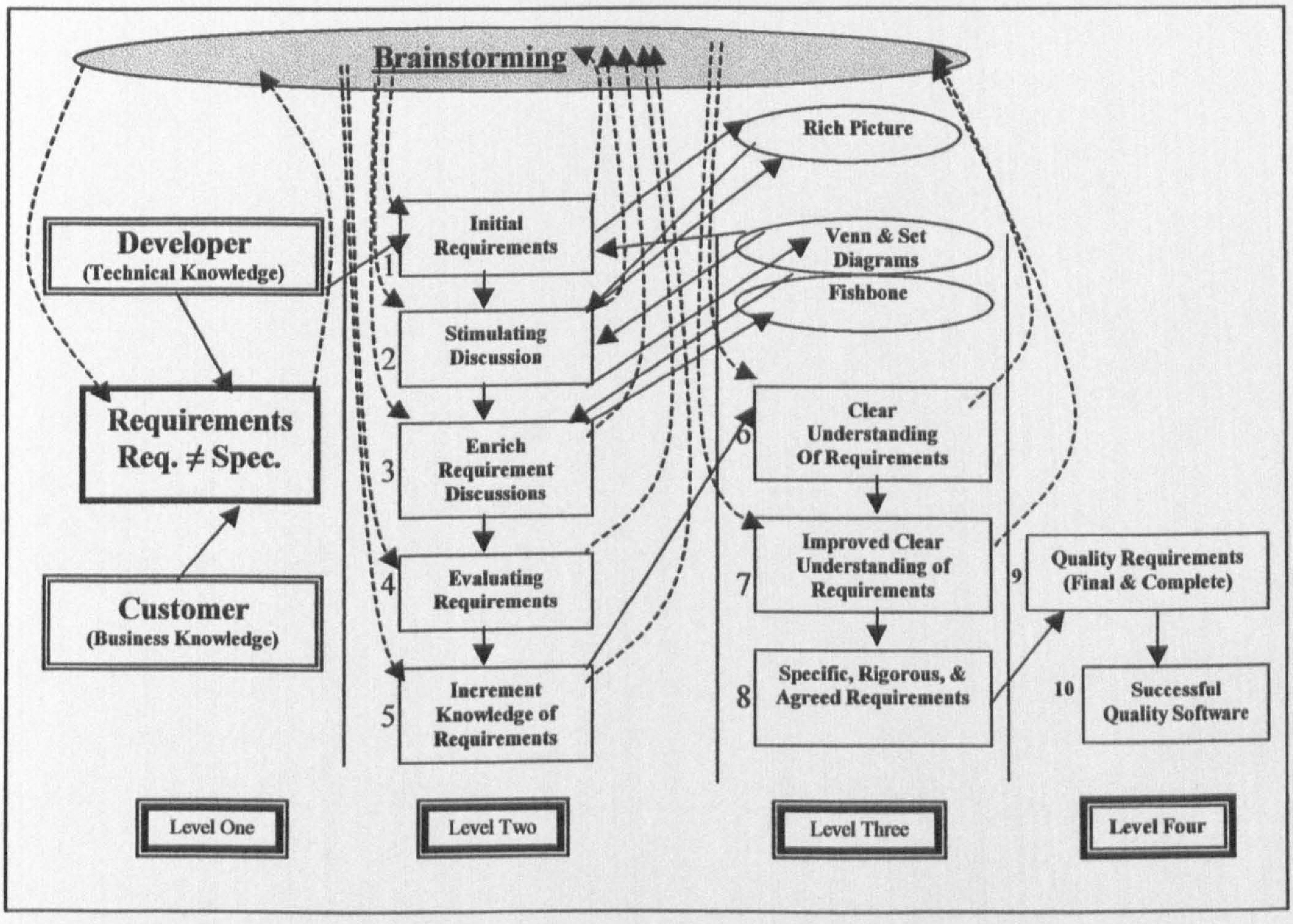


Figure 6.13: Knowledge Requirements Framework (KRF) Architecture

Figure 6.13 illustrates the KRF approach, it consists of four major levels and a total of ten processes within these levels. This chapter deals only with the first two levels and the set diagrams are important techniques within these levels. KRF is a socio-technical approach dealing mainly with social (human) interactions between customers and developers. After all the process of customer requirements elicitation involves human-human communications with the aim of achieving a better understanding within organisations and helping elaborate requirements that lead to better systems that better meet the requirements and expectations of the stakeholders.

Figure 6.14 shows briefly the activities that take place in sub-processes 1-8 to capture and to document requirements. This description deals only with the first three levels and the techniques used within these levels. KRF is largely a sociotechnical approach dealing mainly with social (human) interactions between customers and developers (Mumford, 1985). After all the process of customer requirements elicitation involves human-human communications with the aim of achieving a better understanding within organisations and helping elaborate requirements that lead to better systems that better meet the requirements and expectations of the stakeholders. KRF uses several techniques at present, and we are also exploring the use of further methods (Al-Karaghouli et al., 2000). The purpose of all of these tools is to generate, in the various groups involved in a project, the knowledge and understanding needed to create an effective requirements definition.

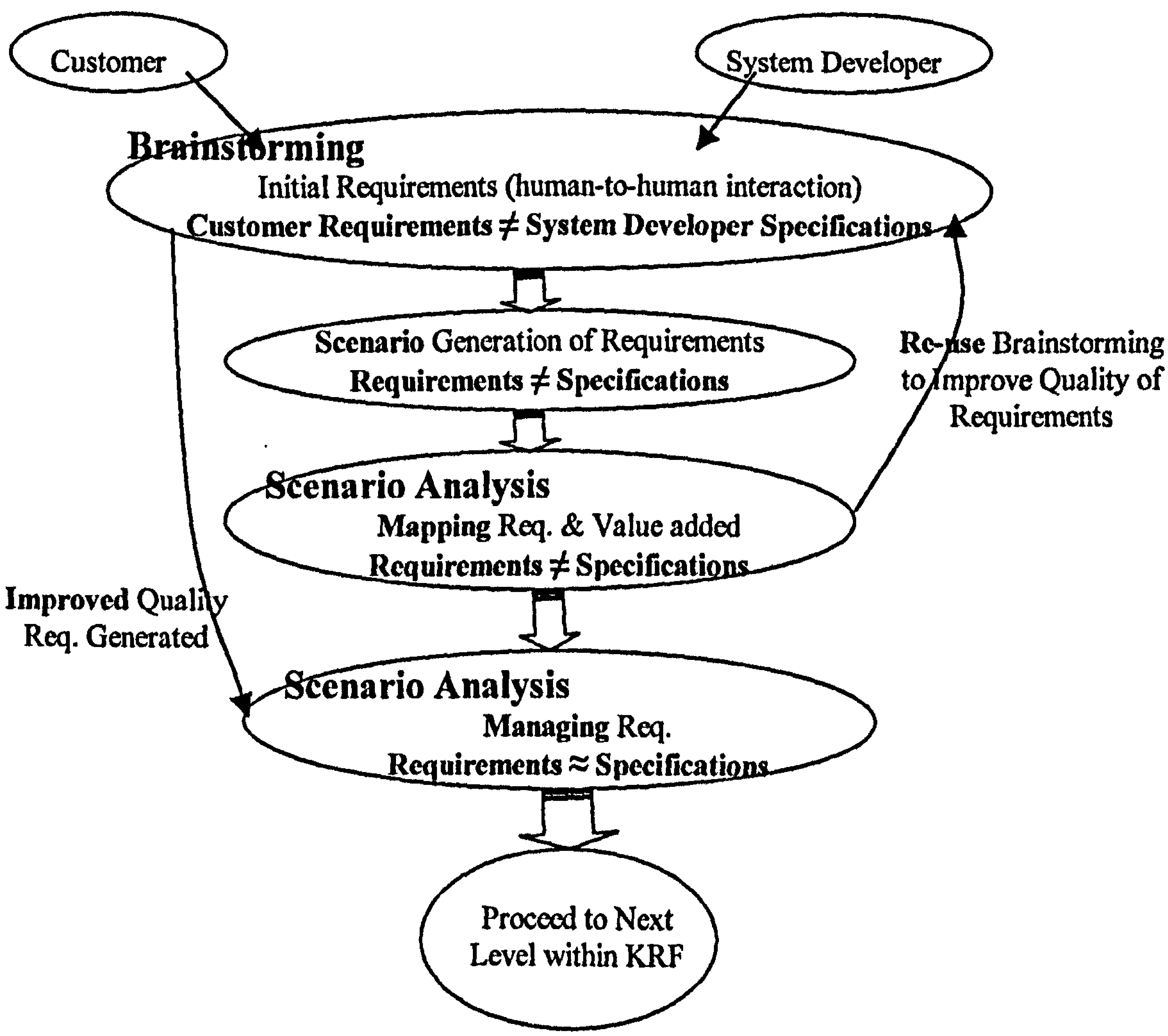


Figure 6.14 Human Activities and Generation of Scenarios Repeated in Every Process within the Three Levels of KRF

KRF consists of four major levels and a total of ten processes within these levels. This chapter deals only with the first three levels. Level 1 is the overview of the relationship between the groups with the objective of developing the requirements and detailed specifications for an IT enabled business system of some kind. This is broken down into the detail of levels 2, 3, and 4, i.e. the ten stages. A key feature being that the requirements determination and specification process is not a single step but a series of increasingly more detailed refinements or evolutions. In the initial stages it is about stimulating discussion and enriching and evaluating the discussion before a more formal specification is even attempted. Typically this changes the initial concepts and thoughts such that a radically different set of requirements may evolve. At each level a series of techniques are used. In level 2 these may include brainstorming, rich pictures, fishbone diagrams, set diagrams, scenarios, Joint Application Design (JAD) workshops, etc. The techniques for level 3 and 4 are more formal and traditional.

The knowledge about the customer, from the system developer engineering viewpoint, is often limited. Sometimes system developers take too narrow a focus in terms of the customer requirements, and have different perceptions of the problem during the first stage of the life cycle (O'Brien, 1993) Figure 6.14 illustrates the activities and interactions between the customer and the systems developer; and what is happening *within the processes 1-10 within the 3 levels* of the KRF. KRF is a knowledge capture and a knowledge management system. KRF is a set of processes that creates the base of knowledge between the two groups (customer and system developer), and it creates the knowledge base for organising and matching requirements. This learning process also contributes to the creation of the learning or knowledge organisation with the two groups interacting and leaning from each other (Weerakkody and Hinton, 1999; Guns and Jossey-Bass, 1996). KRF captures this knowledge and understanding and thus can be regarded as a knowledge management (KM) system (Skyrme, 1998; Collins, 2000).

6.7.3 Detail Testing of KRF: Validation of Requirements and Specifications

As it can be seen from the KRF diagram (Figure 6.13 -levels 2-3), there are a number of checks and enhancements that are worth performing using mixture of techniques and tools from both management sciences and IT namely brainstorming, fishbone, and rich picture. Once a draft has been established to reduce the number of defects (both requirements and specifications) it contains. For example:

• Check that business requirements (BR) match system specifications (SS) in each sub-stage of level 1.

• Check that the change of state for all components (BRSS) has been considered in every sub-stage in levels 1, 2 and 3. It is easy to forget some common requirements-specifications, in which case the meaning of the (BRSS) is that the after state for that component is totally unrelated to the before state and thus may take on any arbitrary value in an implementation. This is rarely what the customer in the real world.

• Check that agreed (successful) and errors (defects) requirements-specifications parts during capturing, elicitation of requirements-specifications are enhancing building, sharing knowledge and deep understanding between both groups. Otherwise there may be incompatibilities or potentially defects or even a false in each level.

• Check that the total procedure of requirements-specifications in each level is compatible, i.e. each requirement-to-specification. If they are not, there are some cases that are not specified and which may be problematic in the implementation.

• Attempt validation to check the requirements-specifications behaves as expected. If provable, these help in confirming the correct understanding and intuition of the requirements-specifications. If they turn out to be defect this may indicate a problem in the elicitation process, applying one of the techniques or tools mentioned above (Brainstorming, Fishbone, Rich picture) or at least in the understanding of it. The mentioned techniques and tools take a significant amount of skill to use effectively.

• Sketch (diagram) the requirements-specification scenarios using either the rich picture or the fishbone or both depending on the problem. This can be useful to check the requirements-specifications acts as expected. Normally requirements-specifications will need some adoption to allow it to be sketched. Nevertheless, this may prove useful exercise in the removal of defects from the original requirements-specifications.

If the rich picture is used, using an alternative approach is to rapid-prototype the requirements-specifications, such as the fishbone. Fishbone is a popular tool in the TQM subject area. Some data and process refinement is feasible to use in the level 3 to harvest and establish smart requirements.

6.7.4 Detail Description of KRF Architecture

The outcome of activity of identifying and managing requirements is a fully detailed smart requirements of the IS/IT Project. The smart requirements should include detail of its overall concept (specifying the form, function and overall purpose of the project and benefits it will provide). To get to this point, the identification of smart requirements must pass through several levels and processes as illustrated in Figures 6.13 and 6.14, detail of these levels and processes is mentioned below. These activities form an approximate sequence, although in practice customers and system developers will often recycle or backtrack through the processes. We will describe them in the order in which they usually occur, as shown in Figure 6.13.

Fully specified requirements, which totally define every part or activity, do not spring fully formed from the customer-system developer's imagination. The process of identifying initial requirements starts as a more general, ill-defined, even vague idea (this depends mainly on the customer understanding and generally on the system developer skills) of what might be an appropriate outcome to a felt need. So, the concept of generating initial requirements stage starts with an idea for the IS/IT project. These ideas need to be explored further to formalise by translating them into a smart requirements through intensive and continuous communication to bridging the knowledge and understanding gaps mentioned in chapter 5. The outcome of these *nine* processes is an agreed and acceptable IS/IT concept of smart requirements. The agreed concept of smart requirements has then to be turned into a primary design of the IS/IT system. The outcome of the four levels and the nine stages is described below.

Level One (Initial level)

- Developer (Technical Knowledge).
- Customer (Business Knowledge).

Level Two (Negotiation level)

- Stage One - Initial Requirements.

• Stage Two - Stimulating Discussion.

• Stage Three - Enrich Requirement Discussions.

• Stage Four - Evaluating Requirements.

• Stage Five - Increment Knowledge of Requirements.

Level Three (Common Understanding & Agreement level)

• Stage Six - Clear Understanding of Requirements.

• Stage Seven- Improved Clear Understanding of Requirements.

• Stage Eight - Specific, Rigorous, and Agreed Requirements.

Many forms of representation have been used or recommended for use in systems development, such as the "Brainstorming", "Venn or Set Diagram" and "Rich Picture" (see Figure 6.10) and the "Fishbone" techniques (see Figures 6.11 & 6.12). These include representations such as:

• Sketches or storyboards - "Brainstorming" sessions applied in during the whole process (levels 1-3).

• Chapter prototypes or mockups - "Brainstorming" sessions (levels 1-3).

• Diagrams using prescribed notations - "Rich Picture" (see Figure 6.9), "Fishbone" sessions applied in level 2 stages 2 and 3.

• Diagrams with dynamically negotiated notation - "Venn diagrams", "Set diagrams" "Fishbone" and "Rich Picture", applied in level 2, stages 2 and 3.

• Text in natural, semi-formal and formal languages - "Brainstorming" applied in level 1 and level 2.

These representational forms may be combined in systems development work, either on a dynamic, ad hoc basis or through a prescribed method. Surveys, case studies and anecdotes all provide illustrations of successes and, too often, failures of these diverse forms of representation in supporting communication amongst users and developers.

Different levels and processes in KRF are used in different organisations and often in different organisations within the retail sector or other industries. However, there is considerable similarity between the levels and processes used and their sequences. Furthermore, they all have the same underlying principle, that over time an original and initial requirements, is refined and made progressively more detailed until it represents what is needed from the perceived system to be turned into an actual and functional system. This has *two important* implications. The **first** is that at each process decisions cut down the number of options of both the customer and the system developer, which will be available further along in the design activity. For example, deciding to make the outside casing of the system more sexy (different colouring as it is the case of Apple computers i-Mac) and the way he IS/IT system is networked. This means that the uncertainty surrounding the IS/IT development reduces as the number of alternative ideas and suggestions being considered decreases. In fact, the identification of smart requirements prior to the development of the IS/IT system can be considered as one of progressively reducing the uncertainty (defect requirements, see Chapter 1, section 1.7- Novel Contribution and Chapter 2, sections 2.1.1 and 2.4) regarding the future IS/IT system. It can be seen that KRF acts a filter, depicting the progressive reduction of defect requirements options from many to one.

The **second consequence** of the progression from initial requirements to detail and smart requirements concerns the cost of changing customer (one's) mind on some detail of the perceive system. In most stages of the system development life cycle for example, the cost of changing a decision is bound to incur some sort or rethinking and recalculation of costs. Early on in the requirements stage, before too many fundamental decisions have been made, the cost of change is relatively low. Relatively quickly, however, as the development progresses, the interrelated and cumulative decisions already made become increasingly expensive to change. KRF adopts the idea that it is best to spend time and effort in the early stages of the development process and improve the understanding and knowledge of both customers and developers in establishing and teasing out the requirements before progressing. KRF addresses only the first stage of the system life cycle, i.e. requirements, not the whole system development life cycle, see Figures 6.12, 6.13 and 6.14. Thus KRF is not a full methodology or approach to systems development and is not intended to replace any existing methodology, on the contrary, KRF is aimed at complementing and enhancing existing approaches. Clearly it would most easily compliment an approach with a similar qualitative, soft or socio-technical philosophy. However, it may actually be most effective in enhancing a hard approach because their need for better requirements analysis is greater but of course the application of KRF may be more difficult to achieve as the developers in a hard approach are not so attuned or sympathetic to a softer approach.

KRF recommends the use of a facilitator to drive the approach because of the notion of two separate 'sides'. A facilitator is an independent person who guides the process and helps overcome the various barriers that are in the way (sometimes deliberately put in the way) and any problems that occur. The facilitator may also arbitrate at times but ideally should get the groups to agree rather than imposing anything. The facilitator is also responsible for the more mundane elements such as getting the right people involved, arranging meetings, setting agendas, etc. The person (or people) needs to be independent so as not to be seen as part of one 'side' or the other and not be tainted by any internal 'politics' or bias. The presence of a facilitator should be borne in mind in the discussion of the use of the two techniques below.

6.7.5 Field Workshops: System Development Process Needs Customer Involvement

There are many system methodologies, approaches, and techniques available today, and many more are being developed even as I write. This may mean more choice, but it makes it very difficult for a business to ensure its hardware and software products work for the user. During this research, we come across a few backlashes that come when system developers ignore the idea that customers may want to actually use something. We have seen customers pull their hair out during the test trials of new system interfaces just prior to lunch. In some systems, the costs of fixing all the problems would be higher than the first actual cost of the system (Appendices A, B, and -Cases of system failure). Isn't it time for the system developer to start involving the users in each stage of the development (design and analysis) process and analysing how they actually use interfaces across products. Communication these days are easy to conduct through internet sites, intranets, mobile devices and its applications. These are just some of the most widely used digital applications across the United Kingdom.

We realised the importance of involving the customers (users) throughout our research work. A target group of customers was interactively involved while the design and test of our KRF model studied. Thanks to the usability of the KRF, which many candidates were impressed by it ease of understanding and use. This is a clear indication of the value of a good usability. We are not suggesting that we standardise methodologies and approaches; and do away with creativity, just that we involve customers in system development process from day one. This can happen in many ways:

• **Conducting behavioural questionnaires (surveys)** and focus groups. Two types of questionnaires have been designed. One for the customers (non-IT departments in the retailing organisation mentioned in Appendix F) and the other for the system developers (IT department within the retailing organisation or the outsourcing companies).

• The questionnaires followed by face-to-face interviews and in some cases telephone interviews to fill any gaps in the returned-questionnaires.

• Using requirements mapping and managing requirements to discover how customers use KRF as an effective interaction technique. Brain storming and Fishbone techniques used extensively during this phase.

• In many of our first attempts of using the KRF, **using paper and focus group** (customers and system developers) during their interaction to assess an early interactive was simple but very helpful technique.

And it doesn't end once the interaction has been launched. At this stage we can fine-tune the requirements by analysing the smart requirements we collect from both the customers and the system developers (requirements mapping). It is worthwhile mentioning here that, there are many software packages such as Webtrends, Commercetrends, or Redeye to capture information about where customers go on the interaction. From this data, we can pinpoint the areas persons mismatch knowledge and understanding and re-evaluate their gaps of knowledge and understanding. New technology devices provide us with opportunities to collect and harness this valuable information and use it to improve both the customer's and the system developer's experiences. KRF will improve the project management process and trying to get everything right before the project becomes problematic.

All techniques used in KRF are based on a workshop-participants scenario (see section-customer and developer "knowledge" gap). Participants will tackle a set of related questions such as:

What features of user-developer communication can or should be supported by such representations?

What properties of a representation contribute to making it an effective communicative aid in system developments?

How are representations transformed in the course of use for communication?

What relations are there between effective representational support for communication within user-developer co-operation and for communication outside those collaborative activities, e.g. in communicating the results of their work to system implementers or others who may not have participated in the creation of the representations?

The workshop discussions between user and developer shall provide initial answers to the above questions. They also reveal gaps in our current understanding of the communicative role of representations in systems development and laying the groundwork for a research agenda to produce further answers to these and other questions which arise through the discussions. The workshop discussions should also lead to recommendations for the selection and use of a range to support user-developer communication in systems development practice. This in turn should lead to proposals for technologies to support communication through representations.

6.7.6 KRF as a Socio-technical Process

In this chapter we concentrate on discussing stage 2 and 3 via the associated techniques of rich pictures and set diagrams. It is hoped that these different techniques will help to illustrate the concepts of KRF at this level and particularly address the mismatch or gap between customer and developer identified above. KRF, particularly the levels described in this chapter, is a socio-technical process due to the role played by the two groups, i.e. the customer and the system developer through human-human communication, which a social characteristic of the human nature. The requirement process is the most important stage in developing the ITS product where the two groups express their knowledge and understanding of the future proposed product. It is conceived as a social constructivist approach (Barnes, 1974; Colins, 1982; Colins 1983) where technological artefacts are open to sociological analysis, not just in their usage but also in their design and technical content. In KRF this implies that the elicitation of requirements emphasises the social interpretation and meaning rather than just the technical elements in the attempt to bind business knowledge and technical knowledge and establish a mutual understanding.

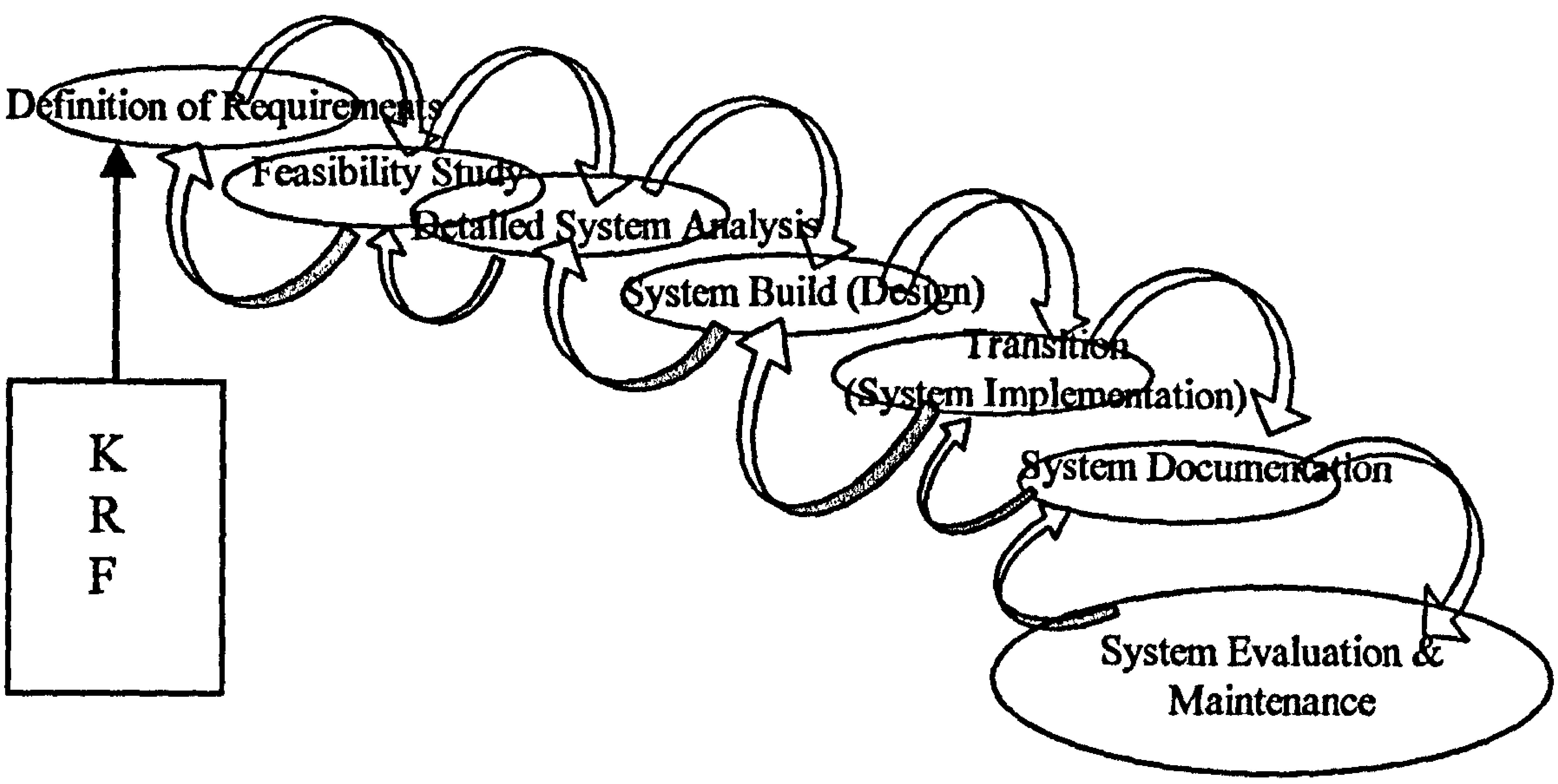


Figure 6.15: KRF Contribution to the System Development Life Cycle Approach

Requirements evolve with time. This necessitates managing requirements evolution and aligning requirements to organisational changes.

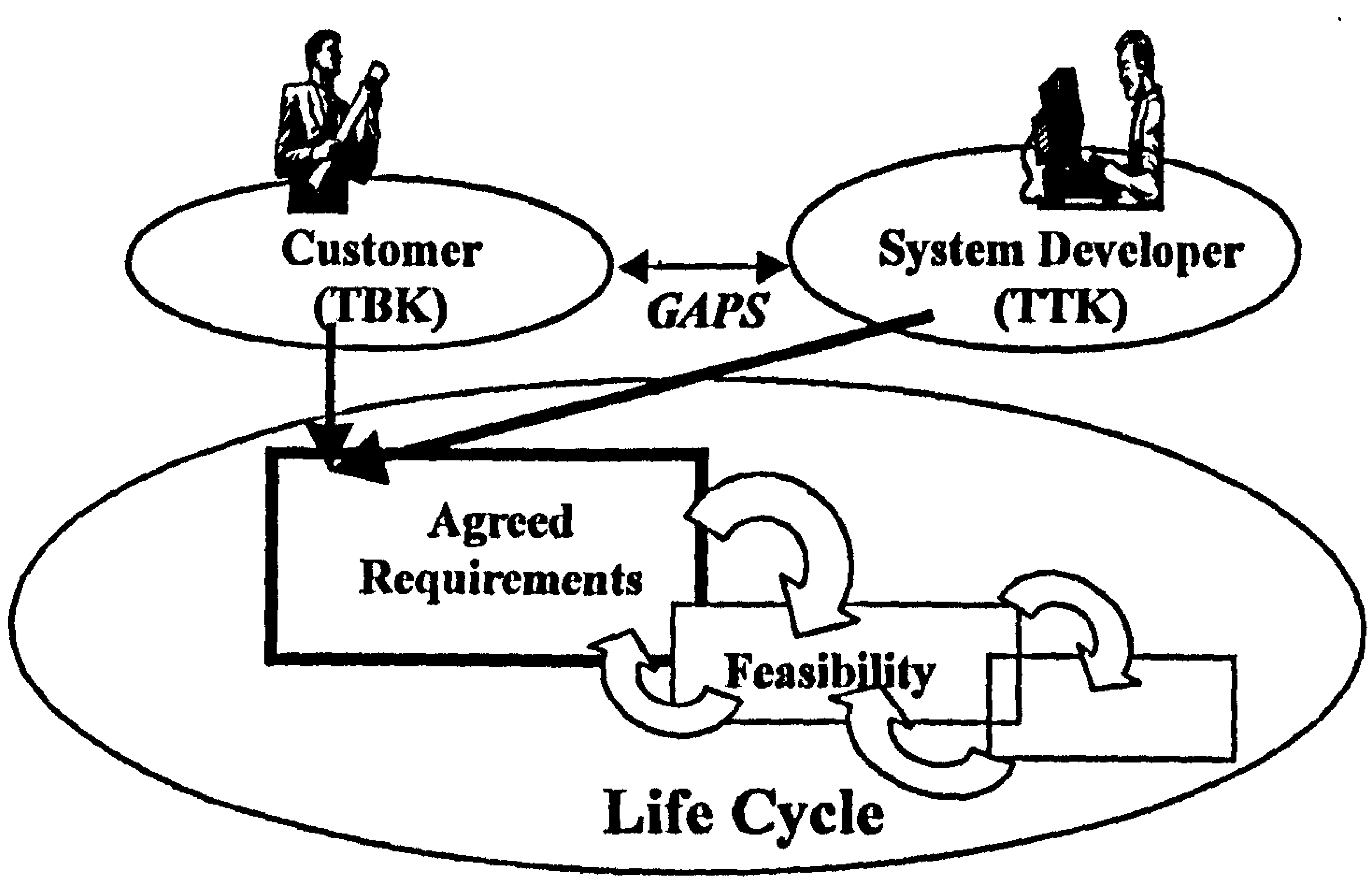


Figure 6.16: Requirements Engineering Framework: Knowledge and Requirements in the System Development Life Cycle

KRF addresses the following issues:

- Best RE practice capitalisation.
- Models for the REP quality assurance and improvement.
- Environments for the RE process enactment and monitoring.
- REP traceability.
- Engineering techniques for the KRF as a REP
- KRF is a co-operative and iterative learning process
- Documenting requirements and the RE process
- Requirement evolution management

6.8 KRF: A Goal of Requirements Engineering Process

The goal of the KRF is to improve our understanding of the RE process. KRF shall provide a forum for the presentation and discussion of:

- Innovative ideas for KRF.
- Best KRF practices.
- Business problem statements.
- Evaluation and comparison of approaches to KRF.

Our overall approach, which we refer to as the KRF approach, illustrated in Figure 6.13, is aimed at generating the knowledge and understanding needed in both the customer and the software developers to enable the development of a sound, agreed, and fully effective project requirements definition (Kotonya, 1998). The key principle that drives our approach is the belief that both sides must work together to generate knowledge and understanding of one another's worlds and that both have a lot of learning to do. We reject the view that the customer already knows fully exactly what they want of the system, and we also reject the view that the software developer knows fully about the customer's business and what is needed of the system. We believe that the only way to get good requirements definition is through partnership and mutual understanding.

6.8.1 KRF Techniques and Tools: Ease of Use and Relevance

The elicitation, capturing and managing business requirements is a vital step in system development. We had to specify the inputs, the outputs and the relation between them. This has been done suing Venn diagrams and set diagrams. Venn diagrams provided a common language for resolving arguments between the customer and the system developer; and the discussions between the author during the validation and the different people in business organisation during the time of conducting the study. This is a significant improvement over classical informal methods like structured analysis (Yourdon, 1989) or object oriented analysis (Booch, 1994). The precise semantics of the matching of each business requirement with the relevant specification and its powerful data like sets (BR) and (SS), and relations allowed us to identify exactly what information (BRSS) the system could convey and the exact behaviour of the operations matching this information. Using Venn diagrams, set diagrams, fishbone and SSM helped dispel ambiguities and misunderstandings in matching the customer requirements with the system developer specifications.

Sometimes readability of a formal notation acts as one of the limitation of our approach. It comprises a large array of symbols, some of them which are not common in ordinary IT literature. Our aim in using a graphical notation like Venn diagram, and set diagrams is for ease of use, build and share knowledge, easy to grasp and deep clear understanding of both groups. It takes more time to get a good mental representation of the information structure in Yourdon (1989) and Booch (1994) for example than with a graphical approach such as E-R model (Weaver et al., 2002) or our KRF framework. We have to stress that despite the ease of use of graphical approaches, some RS could not be graphically expressed, such as the future expectation of the systems. KRF looks at needed not expectation, which are clear different.

In general, requirements engineering literature and professionals have been working with the assumption that an information technology system should be clearly specified before it's develop and implementation can start. Failing to follow a well-defined requirements process (Chung et al., 2000) has in the past caused tremendous cost overruns, delays and many project failures (Macaulay, 1996; Robertson and Robertson, 1999). One of the reasons often cited is that the cost and time required for fixing an error increases as development goes on. These experiences combined with the fact that the most critical decisions are usually made during the early development phases support the assumption that the investment of up-front effort will pay off during the later phases of development, i.e. analysis, design, testing, and implementation. This is also the conclusion of the comprehensive CHAOS report of the Standish Group, first published in 1995. A survey described in this report shows that almost half of cancelled projects failed due to a lack of requirements engineering effort and that a similar percentage ascribes good requirements engineering as the main reason for project success. Nevertheless, there are many business and especially system development organisations that still do not practice good requirements engineering. One of the main reasons given for skipping the requirements engineering phase is lack of time (same applies to lack of testing!). Too often, there is high pressure to deliver something to the customer as soon as possible to keep a customer happy. For this reason, a lot of organisations have recently shown great interest in the newly emerged agile methods, such as Extreme Programming. However, it appears that agile approaches overlook requirements engineering as a development phase and solve any problems caused by this lack of up-front effort in the next increment or iteration.

So far, these two camps do not seem to be connected nor do their proponents collaborate closely. For this reason, this research study wants to bridge and to bring these two groups together. Some of the questions that still remain unanswered include: When should or which approach be used? How can both approaches be combined? Although good answers to these questions are likely to be several years away, this bridge (KRF) is intended to get a step closer to an answer. The use of diagrams and graphical notations allowed us to obtain very quickly a first intuitive overview of the problem, for example the consistency between scenarios and sets diagrams would be expressed by refinement proof obligations. The professional culture gap we highlighted in our research study is not about theory. It is about discovery. This gap exists in both the public and the private IT-sectors. We would argue that the culture gap is a major factor that contributed to the failure of ITS projects of which the rate of failure is getting worse. What the IT industry most needs is a sense of proportion and much greater sense of realism rather than series of myths that need dispelling. Strong monitoring especially in the requirements stage and tougher approach to business-system development are making an impact. The checking, review and testing processes are not tough enough. Also, there is a need to change in attitudes between both the business and the IT groups, this will help to eliminate the fatal lack of direction that ruined so many ITS projects over the years and achieve best-practice.

Our discovery of the professional culture gap will put efficient business-technology above policies, however flawed. But this does not mean that ITS project will not fail, for a wide variety of reasons! Customers (business) need to be more involved at the requirements stage in ITS projects to ensure success of an ITS project. Finally, our research has highlighted one important factor among other factors contributed to the high rate of IT/IS failure which we named as risk factor, i.e. factor (x) which could be for example the human factor, the over/ underestimated factor, or lack of confidence in the software product. The later (lack of confidence) leads to a low profile. The (x) factor has a serious effect on the business and leads to preventing the business from going forward.

6.8.2 Smart Requirements -KRF

6.8.3 Smart Requirements Contribute to the Outcome of System Development Process

The purpose of this research study is to further understanding business and technology cultures that need to be taken into consideration when developing new ITS and understand what causes the success or failure of ITS projects in terms of business and technology cultures (intellectual & professional culture clash).

Part of this research study is to address the need for integral practical theory relating successful ITS development to business requirements and needs. Therefore, this study focuses on developing a practical framework, context-based and explanation of requirements in retail ITS projects in the UK (Brynjolfsson and Smith, 2000; Ehrens and Markus, 2000). In doing so, the research study strive to develop an integrated framework. To describe and explain the process of adopting and achieving smart requirements. We foresee that the availability of such framework (approach) is a modest contribution in improving the success rate of ITS projects and presents available contribution to knowledge that provides principles for retail organisations and others to undertake such initiatives. The theoretical background that forms the construction and the development of this framework is extracted from previous research which validates those constructs in an easy and practical context. Figure 6.17 extends the model (Figure 2.1) put forward earlier in Chapter 2- section 2.1.2, which shows that KRF compliments the hard and soft methodologies in order to make the **non-functional** structure of requirements functional. The research study reports intermediate results as an important contribution to the UK's ITS area in systems engineering methodologies. The requirements - KRF template leads to a common language for expressing requirements. The template provides a guide for identifying functional requirements, non-functional requirements, goals and constraints and linking all these components in a requirements network. The diagram below shows that requirements exist in and across methodologies as the first step towards the development of a system. It is clear from the diagram the important position of KRF. Also, from the diagram below, it evident the important role KRF plays in determining requirements.

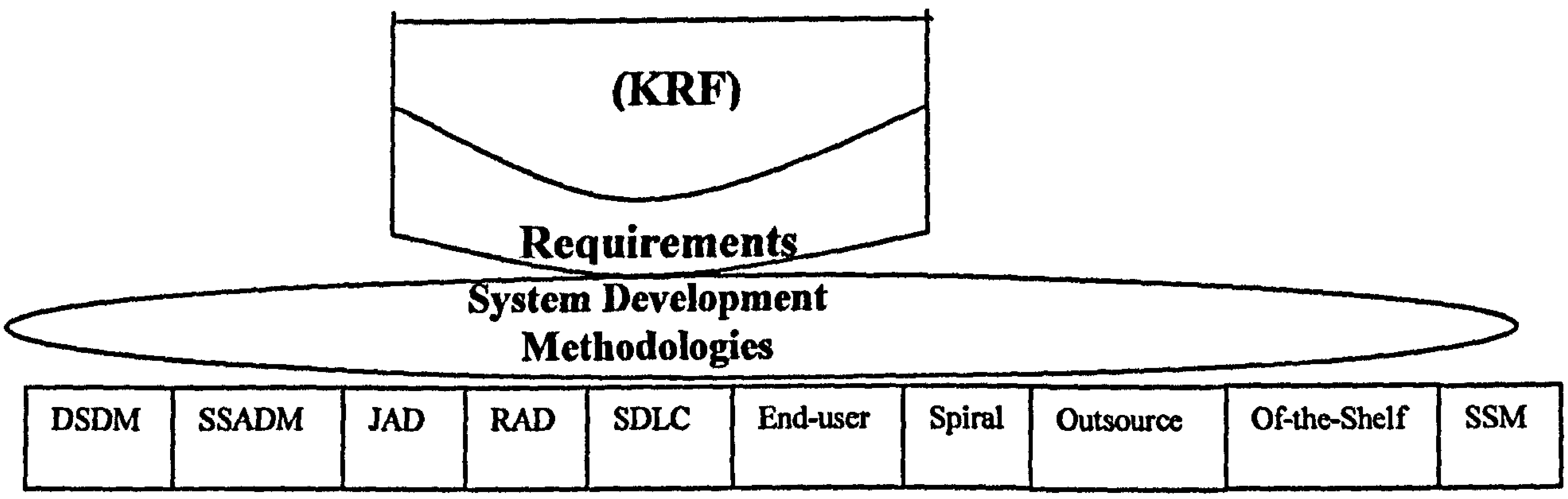


Figure 6.17: KRF Application in Relationship to System Development Methodologies

A requirements shell identifies a number of quantifiable components about individual requirements: unique identification, requirement type, description, purpose, customer value, conflicts and fit criteria. You can use each of these components as input to testing the requirement to determine whether it is or is not a well stated requirement. For example, the fit criterion is an unambiguous specification of how you will know whether any given solution fits, or does not fit, the requirement. The KRF's quality gateway is a process for testing requirements. To pass through the gateway and be included in the requirements specification, a requirement is tested for relevance, coherency, traceability, completeness, consistency, viability, and a number of other qualities that successful requirements must have. These tests are concerned with ensuring that the requirements are as complete and accurate as possible, and that they do not cause unnecessary problems later in the project.

6.9 Set Rules for Change of Requirements Process

The following set of rules is to be followed by participants (senior or non-senior), they act as guidelines for the successful transformation of the requirements process towards the adoption of successful ITS. In several cases, sub-guidelines were identified and included in the rules of which some were devised by authors on the subject including (Miles, 1997; Jaffe and Scott, 1999; Senge et al., 1994 & 1999) by comparing the causes of success and failures in the experience of other organisations during organisational change. Other rules were derived during the research case study, through careful selection of relevant information in the existing literature on organisational change, which includes Anderson et al. (1995), Hammer and Champy (1993). Critics might question whether such rules could be followed. That is, if the usefulness of each rule depends on the organisation and the context, can any set of guidelines be generalised and formed that is true in all acses? While it is true that every situation is unique, all situations concern organisational systems that are comprised of people. Consequently, there are certain basic aspects regarding the nature of systems and human behaviour that can be relied on from one situation to the next, even if the details of the actual implementation are different. These aspects are reflected by the appropriately extracted, combined and applied information that was used in formulating these rules.

6.9.1 Rule 1: Incentive for Change

All requirements transformation efforts require initial incentives that create a sense of urgency about change. Often, the incentive occurs when executive leadership realises some reality about the organisation's competitive situation. For example, financial losses, benchmarking studies, analyses of industry trends, or a diagnosis of the enterprise's strengths and weaknesses could motivate change (Miles, 1997). Whatever the incentive, it must be sufficiently convincing for managers and employees to consider change and be able to sustain interest in the change throughout the hard work that will be required. Senior executives IT and non-IT must also be functional and support the change in order to generate motivation for change. Senior executives must be leaders ready to "walk the talk" and role model, also, they should actively drive the change process, grant permission for people engage in new behaviours, and encourage others to make the necessary changes (Galliers et al., 2001).

6.9.2 Rule 2: Focus on the Customer

Most organisational change practitioners appear to agree that customer's satisfaction must be the key motivation for change (Hammer and Champy, 1993). Transformation efforts that focus on cost control or profitability improvement are likely to alienate customers and ultimately reduce profits. In fact, Hammer and Champy (1993) claimed that focus on cost control instead of the customer is one of the key causes of failure of reengineering efforts.

6.9.3 Rule 3: Executive Commitment

Commitment by senior executive to change process is generally considered essential. For the most part, any significant change will require considerable resources, and the senior executive must be committed to providing those resources in sustained fashion. Alternatively, an executive with considerable influence and power should be designated as the leader of the program.

6.9.4 Rule 4: Comprehensive Change Plan

The successful transformation effort must change the organisational system from a current state to a desired state. This requires a co-ordinated and aligned alteration of organisational structure in a way that engages a significant group of employees in the process. The implementation requires not only project management skills, but skills for managing complexity, emotional reactions, conflicts, and securing new behaviour. These change management skills may be introduced by experts, but should ultimately be adopted and set in the minds of both IT and non-IT personal. According to Anderson et al. (1995) a comprehensive change plan should address four distinct levels which are change level, education level, team level, and personal level. A way of reducing conflicts, this arena could be formal or informal, through teams (Senge et al., 1994). The change should draw out potential conflicts and offer a safe arena for resolving them. Attention to the process of organisational learning (Senge et al.' 1994) must perceived. The change plan must anticipate revision, experimentation, trial and error, and provide time for reflection. A means of securing the changes in organisational culture should be established. Behavioural changes will not stick in the culture unless they are somehow secured, such as through aligned reward and compensation systems or personal performance objectives (Kotter, 1996). In addition, guidance by a co-ordinated set of theory, methods, and tools should be put in place. The theory should be based on defensible theories of organisational change, without theory, learning can not occur (Senge et al., 1994).

6.9.5 Rule 5: Change Process Infrastructure Teams

Designing and implementation a comprehensive change plan requires experts in transformation and comprehensive change infrastructure. Usually the change process infrastructure is composed of a number of teams, each with different responsibilities and compositions, which serve to co-ordinate transformation through multiple, connected means and on many levels. Anderson et al. (1995), Miles (1997) Jaffe and Scott (1999) all recommended structures of interlocking teams and individuals. These generally consist of some variation on executives steering committee, change council, changing initiative teams, cross-functional team, and advisory teams. The cross-functional teams and advisory teams are two important factors in the requirements development process as the cross-functional teams are teams that draw together individual, perhaps from various areas of practice (IT and non-IT), to help resolve issues, drive changes, and mitigate potential political struggles. While the advisory teams consist of group of individuals drawn from different levels of the organisation who serve to provide regular feedback on the progress of the change process.

6.9.6 Rule 6: Commitment of Sufficient Research

Finally, retail organisation interviews conducted and used in formulating conclusions about organisational change in a real-life situation. The research will show that the hardest aspects to change in system development process is due to the human complexity in establishing initial requirements rather than the actual implementation of new ITS.

6.10 Think Outside the Box: Customer Interaction with Experts

There is ample evidence that finding requirements early saves time money and anguish later on in a project. To be able to find the requirements you need to make them functional to all the different stakeholders by quantifying them in a consistent and understandable way. The KRF requirements template leads to a common language for expressing requirements. KRF provides a guide for identifying functional requirements, non-functional requirements, goals and constraints and linking all these components in a requirements network, through the stages 1 to 10 and between the different levels. A requirements shell identifies a number of quantifiable components about requirements: unique identification, requirement type, description, purpose, customer value, conflicts and fit criteria. You can use each of these components as input to testing the requirement to determine whether it is or is not a well stated requirement. For example, the fit criterion is an unambiguous specification of how you will know whether any given solution fits, or does not fit, the requirement.

KRF is a Quality process for testing requirements and filtering unwanted requirements. To pass through the KRF approach and be included in the requirements specification, a requirement is tested for relevance, coherency, traceability, completeness, consistency, viability, and a number of other qualities that successful requirements must have. These tests are concerned with ensuring that the requirements are as complete and accurate as possible, and that they do not cause unnecessary problems later in the project.

This study describes research which used a combination of I.T. and management techniques and tools for the investigation of requirements in large computer systems used in retail organisations. The evidence shows that system development process can elucidate many aspects of such human activity systems which are not disclosed by conventional systems analytic methods. In particular, tacit behaviours, social protocols and shared historical models are shown to be key elements of effective engineering design teams. What is more, it is also evident that lack of attention to such elements and their importance can have deleterious consequences in the design of the computer system, organisational structures and work systems by managerially or technically determined methods.

6.11 KRF is not a Sliver Bullet

This chapter has addressed some of the issues that we consider vital to the improvement of IT/IS development and building process, through smart requirements of the initial system development. At a time when many IT/IS projects are failing. System developers are seriously trying to improve this aspect of system developments. So what we can do to raise the standard of ITS and software building practice in a global context. Skilled and Stronger project management coupled with clear management metrics that enable senior business and ITS managers to make balance and informed decisions would be a good starting point. The module of KRF enables the modularization of crosscutting concerns within software developments. KRF techniques and tools, applied at the initial stage- requirements at all system development methodologies, are changing the way the software is developed in various application domains, ranging from enterprise to embedded systems.

Of course we would not start satisfying the customers (stakeholders) until we adopt processes that positively mandate iterative and incremental development through KRF so that we build in the vital customer feedback loops that acknowledge that even the best customers find it hard to specify what they need. Given that KRF is destined to tackle larger and larger projects (take for example recent government projects) then at least a development process such as this will provide a more objective measure of progress so often craved and build in the flexibility to respond to changing business needs. Perhaps even more fundamental is education of both business customers and system developers process and practice especially at the requirements stage. By and large it is just not done. Many business organisations that are truly strategically dependant upon ITS identify people as a key asset in their respective messages. The reason this is such a critical problem is that there have been many genuine advances in ITS practice over the last 15 years and many UK based ITS and software organisations have not capitalised on these largely due to a lack of investment in education. This will give UK government a significant competitive advantage to compete with the awakening economies of the world rather than dependent solely on off-shore provided as it happens in recent years.

It is a high stake to claim that there is an absolute solution to this complicated problem. It is complicated because of the complex nature of humans (Zeithaml et al., 1987; Woodman, 1987). His/her interaction, the behaviour within the life cycle on one side and in designing new software on the other hand, i.e. in the requirement stage of the life cycle. We would like to stress that many factors contribute to unused (shelved) software and failed ITS projects, and no one can doubt this fact (Myers, 1979). We believe that mistakes cost less if they are corrected in the early stage of the design process of and software, i.e. the requirement stage in the Life Cycle. KRF creates constancy of purpose to improve communications, by adopting methods and techniques with customer and system developer learning what their responsibilities are. KRF breaks down barriers between different groups and encourage the customer and the system developer to work together to foresee difficulties and to clear misunderstanding in deciding on system requirement and system use. KRF helps the customer and the system developer to work together to accomplish the transformation in the business environment.

6.12 Mission Critical: TQM and Requirements

In the retail organisations, IT directors should concentrate on using ITS to reduce costs rather than pretending that IT can increase profitability.

In the 1970s, continuous reviews and inspections were being recognised as important to improve productivity and product quality (Crosby, 1989; Crosby, 1984b; Dale, 2003), and thus were adopted by development projects (Linger and Hausler, 1992; Gitlow et al., 1989; Ishikawa, 1985; Juran, and Gryna, 1988; Kan, 2002). As a result, defect removal within the development of the ITS process strengthened. According to Crosby (1989, 1985, and1979b) "It is always cheaper to do it right first time". Get the right requirements right first time will contribute to cost and time saving in developing an ITS. Thus the purpose of our research study was to find cost-effective ways to avoid requirement defects in the ITS. Getting the business requirements (smart requirements) right first time, which will lead to reduction in time testing and implementation, this in turns will enable the system developer to meet budget and avoid time overrun. We could see two basically different approaches to this:

- Compare the existing system development processes against the KRF model of the requirements stage and identify weaknesses. Then improve the weak processes (see Sutcliffe et al., 1999 and Oakland, 1989). Our view in the different chapters of this thesis is one. That is, the focus on both the internal customers (different departments within the organisations) and the external customers in developing product and also in developing a computer system of a retail organisation. This view is also highlighted in our KRF model which is based on the TQM approach to achieve quality product through the prevention rather than correction process as the latter cost too much in the ITS industry.

- Analyse the non-conformable requirements in present systems, identify techniques that could prevent them, and try the best of them in new ITS projects. The eliminating defects approach is widely used in the TQM area, but we could see no guarantee that the improved processes are cost- effective. Finding the most cost-effective processes within the KRF nine processes was even more elusive. The KRF model/approach tends to measure its success as conformance to the whole system development process, and as improvement on the bottom line. Also, the other methodologies used in system development models have few specific guidelines for better requirement processes. So we decided to try the defect-driven approach. However, there are few reports on such experiments in industrial settings. Shingo, 1986; Sutcliffe et al., 1999 have investigated an ITS project where they first identified requirement-related defects, weaknesses in the written requirements, and weaknesses in the requirement processes. Next they suggested many improvements to the requirement processes, pointing out that they most likely would have avoided the problems. We see this as a hybrid between the KRF approach and the defect-driven approach. In our research study we wanted to narrow down the necessary new processes within KRF, estimate their benefits and costs, and try them out in practice.

According to Card (1998) a straight defect-driven approach is Defect Causal Analysis (DCA) which is developed by IBM and used there and at several other places. The principle of DCA is to collect defect reports find frequent types of defects, discuss them with local developers, and let them suggest improved procedures. KRF on the other hand does not collect defects reports but eliminate defective requirements from the start through focus groups between the customer and the system developer using different techniques and tools which have been described in the chapter related to KRF. Then the new procedures are deployed. Improvements are measured as changes in mapping smart requirements. We wanted to do something similar, but had to face several differences. DCA looks primarily at implementation defects, where developers have good expertise. We wanted to look at requirement defects, where customers and system developers have less expertise in each other tacit knowledge (Little et al., 2001; Nonaka and Teece, 2001). In addition, typical system developers know rather few requirement techniques. Further, system developers often reject techniques they know, due to the risk involved in any new technique or approach. For this reason we wanted process expert and researcher advice on improvements. Since our advice came from outside the development team, we reasoned that it was important to motivate both customers and system developers to use the techniques, and planned to involve them when promising techniques had been that successful. An important motivational factor was the expected cost and benefit to their project, project finish on time and within budget. We wanted to estimate this before the new techniques were deployed. DCA is used in large companies (e.g., IBM) and could rely on statistical data to identify benefits over a period of several years. We worked in smaller organisations with an average of 700 employees, 30 of whom were system developers.

6.13 Summary of Requirements

The research study sought to address the issue of the professional culture gap on the premise that the destructive effects stemmed from negative attitudes and preconception developed and perfected over time between the customer and the system developer. According to

Sommerville and Sawyer (1997), *"there are misunderstandings between customers, those developing the system requirements and software engineering developing or maintaining the system"*. The research study borrowed perspectives from *literature on IT and management science*, in an effort to develop a richer understanding of the issue. By viewing ITS in retail organisations based on two metaphors - business requirements and system developer. The relevance of these two metaphors to the study of ITS failures has been emerging as a consistent them in the literature (for example, Lucas, 1975; Ginzberg, 1981; Willcocks and Mason, 1987; Galliers et al., 1992). The recent downward trend in global economies has increased the focus on many approaches and techniques to get the best of customer data and information. Customer Relationship Management (CRM) and Knowledge Management (KM) applications can be used in mining smart requirements in the same way where customer and consumer data is mined for every last byte of value

Throughout the thesis, which deals with requirements engineering, we prefer the shorter term of referring to requirement stage over the domain lifecycle development model. Use cases and models, however, are based on different modelling techniques and aim at different levels of outcome, such that serious consistency and completeness problems are induced.

The difference between requirement-related defects and complete, adequate, and agreed (smart requirements) in the system development process is often debated. In this thesis we will use this distinction. Requirement defects (non-conformed) can be defined as a requirement defect if the information technology system works as intended by the system developer, but does not match the business requirements. One example is that customer and the user are not satisfied with it. They may find it not easy to use, unable to support certain customer tasks, etc. Another example is that the system developers does not co-operate properly with existing ITS. Unstated customer business needs (tacit requirements), and expectations, misunderstood requirements and misunderstood existing ITS especially software are typical causes of requirement defects. The requirement defects can relate to functional as well as non-functional requirements. Non-conformed requirement may creep in at any stage of development. That is why, it is important to get the requirements right first time (Deming, 1986 & 1993). Many of the incomplete (defects) creep in at the analysis/ elicitation stage, others are caused by system developers making wrong assumptions during design or coding, and some may even be revealed by testing.

Non-conformed requirements may be detected at various stages of system development process. The earlier they are detected, the easier they are to repair, i.e. zero defects (Oakland, 1999; Crosby, 1989). Ideally, they should be prevented from creeping in. However, detection as well as prevention requires some effort in addition to usual development. The question is whether it pays to spend this additional effort. In this chapter we discuss only non-conformed requirements. Compared to implementation defects they are more costly to repair. And due to their nature, we need KRF and other techniques namely brainstorming, and fishbone to prevent or detect them than we need for implementation defects. System developers can, for instance, end implementation defects through testing or inspection of each other's software, but they can rarely end requirement defects that way. Usually the businesses people (customers and users) and current software in usage (to prevent legacy problem) must be involved to end these non-conformable requirements.

6.13.1 Requirements Management

Inadequate requirements cause many problems in software products. This paper reports on an experiment to reduce the number of requirement defects. We analysed the present defects in a real-life product and estimated the likely effect of 44 prevention techniques.

We had hoped a novel combination of techniques would come up, but the best approach was quite well known, although new to the company: study the user tasks better, make early prototypes of the user interface, and test them for usability. This approach was tried out in a new development project in the same company. Due to the new approach, there was no doubt about requirements during programming, and as a result it became the first project in the company that was completed on time and without stress. Usability was drastically improved, and as a result the product sold twice as many units as similar products, and at twice the unit prices. Over the last ten years, RE has moved from an immature software engineering phase to a well-recognised practice and research area spanning the whole system lifecycle. RE requires a variety and richness of skills, processes, methods, techniques and tools. In addition, diversity arises from different application domains ranging from business information systems to real-time process control systems, from traditional to web-based systems as well as from the perspective being system families or not.

6.13.2 The Sociotechnical Aspect of Requirements

This research work explores the problems of and solutions for managing changing requirements. In particular, we will distinguished and explore the relationships and interplay between changing requirements and systems architecture (specifications).

Conceptual modelling is in the broad view of information systems engineering requirements. Engineering Requirements (ER) explores the objectives of different stakeholders and their activities to meet these objectives in order to derive system requirements and therefore lead to better (Gans, et al., 2003) systems i.e. systems that meet the requirements of their users. Thus ER product models use user concepts for modelling instead of concepts like data, process, events etc. used in conceptual models. Since the former is more stable than the latter, ER manages change better. This chapter will give the rationale for extending traditional conceptual models and introduce some ER product models. Also, in contrast to conceptual modelling, ER lays great stress on the engineering process employed.

6.13.3 Bridging the Gap between Past and Future Requirements: A Scenario Based Approach

The aim of this research is to generate a discussion about effective ways of using Scenarios to express requirements, including:

• Describing the structure of requirements as problems faced by stakeholders.

• Organising customer and system requirements.

• Validating requirements, specifications, and designs from the start of the project.

Clearly identifying and understanding Requirements is a critical first step in the software development process, involves the generation of a description of the goals of the envisioned system, leading to a description of the artifacts that must be built to achieve such goals. Given that requirements engineering is a critical determinant of the quality of the final system, and given the size and complexity of the current generation of software development projects, the area has attracted increasing research attention. The aspects of requirements engineering, including:

• Theories and models of RE, with special emphasis on how these might lead to the development of better RE tools.

• Requirements elicitation and evolution techniques.

• The interaction between system requirements and business processes and its impact on business process reengineering.

• Conceptual modelling and requirements definition techniques and their role in analysis and validation.

• Non-functional requirements and design rationale.

• The impact of software architecture on RE.

• Cultural, political and organisational issues that impact requirements engineering practice.

• Insights into requirements engineering practice drawn from industrial-scale case studies.

6.13.4 Social Analysis in the Requirements Engineering Process

Our research has concentrated on system development and in particular requirements identification, specifically understanding requirements and user interface development. The choice of terminology to characterise this important domain is not an issue. The common purpose is to treat organisations and their ITS applications within a unified and scientific framework, with particular reference to the huge range of issues that elude the institutionally established disciplines. Computer science does not concern itself with the human issues. The social study of ITS impacts does not address the fine details of information requirements within and between organisations. The analysis and design of information systems develops methods for solving the practical problems preceding software engineering but offers no scientific foundation for them. Those disciplines are not appropriate for addressing many of the problems caused by the rapid growth of global communications with its effects on business, government, the economy and politics. A semiotic perspective can accommodate the individual and the social, the human and the technical, intra-firm and inter-firm interactions, at a level of detail that opens up the prospect for scientific theory building. Can a semiotics of organised behaviour provide the necessary insight?

The aim of this chapter is to achieve the following objectives:

• Bring together those interested in the theme to facilitate their future collaboration.

• Discuss future activities and possible institutional arrangements.

• Assemble materials to support the development of the subject.

6.13.5 IS Project Management and Leadership in Retail

The failure of any project is due to more than one factor. In many studies including our own, the risks we identify falls in three categories:

• Project risks - managing project's stages and team members.

• Technical risks - overstated or understated technology.

• Business risks - system developer and customer relationship.

In the retail sector, the technical risks dominate both the project and the business risks. This due to frequent job change of a "project manager" from one retail organisation to another due to high salary of such a position. When a project manager leaves his project team, no one is prepared to take over due to the risk of being sacked if he does not prove himself.

Project leaders and managers should put their fundamental project management skills in their proper organisational context and master the vital communications and people skills that is critical to every project's success. Project mangers should be able to apply a methodological approach to managing projects, which is a key to becoming a successful project manager. Any project carries a certain degree of risk. To reduce this risk, effective project leadership and a proactive approach to risk management require both strong project management techniques as well as strong people skills-knowledge, which are built on a combination of experience and training.

6.14 Conclusions

It is clear that many ITS projects suffer from significant waste and luck focus on customer requirements. Traditional ITS projects can be improved by streamlining the process, improving information flow, being clear about business requirements and business-IT alignment. Yet the project management team still remain to be convinced that open mind and open thinking will transform project management process in the way that it has manufacturing.

In this chapter, we have illustrated that the requirements process is a sociotechnical process that relates to human-human relationship. To establish and manage smart requirements, you need to manage the different knowledge (TBK and TTK) and understanding which plays an important factor in the outcome of building an ITS. This note thus extended this literature by characterising equilibrium (participation) customer and developer decision making in the presence of this knowledge and understanding gap. The framework presented here is common to other papers, but the analysis is different in that the customer must be explicitly incorporated into the equilibrium of the requirements stage and throughout the development process. One result of this additional complexity is that due to the nature complex of the human being, the multiple equilibrium are likely to exist. Rather than assume that a particular equilibrium in certain stage will exist, this note derives results that are true for all equilibrium. This of course leaves open the question of which equilibrium one should anticipate. According to a study by Ryan and Harrison (2000) in which they indicate that our current approaches for estimating ITS value leave room for improvement. Ryan and Harrison discovered that traditional quantitative methods are used in approximately 31% of IT investments. The most popular were return of investment (ROI), internal rate of return (IRR), and net present value (NPV). These techniques were found to be useful for estimating tangible benefits, but much less so for individual productivity improvements; and better decision making process, but typically without the benefit of a rigorous, formalised process. According to the authors, the greatest shortcoming is the demonstrated failure to identify "hidden" or seldom (considered costs and benefits) which they termed the "social subsystem costs and benefits" that stem from employees' expertise, judgements, decisions, and task interdependencies. Further, they speculate that this failure explains the fact that over 50% of ITS projects cost more than twice their original estimates (Webb, 1997).

Adding to the difficulties mentioned above is the complication that this assessment must be done by both groups, namely system developer (techie) and the customer (business). Typically, the customer assumes responsibility for delineating the benefits of the ITS project while the system developer assumes responsibility for identifying and assessing the cost delivery. The difficulty arise due to the different orientation and the existing gaps of the system developer (techie) and the customer (business) with respect to knowledge, understanding (which KRF addresses), and performance measures. The latter, Fisher (2000) refers to as the "culture divide", he explained as follows:

"When traditional IT managers consider ROI milestones, they are likely comparing the performance of software and hardware against the budget they have received to buy, make, and implement the solution. When sales and marketing managers contemplate ROI, they are thinking about revenue growth and market share".

Given the cultural divide between the system developer and the customer, it is easy to see how the 'social subsystem costs and benefit' can fall through the cracks. Until the customer gains a full understanding of the technology's potential and until the system developer acquires an appreciation of the business strategy, the full benefit of an IT investment cannot be estimated with any degree of confidence. At equilibrium participation (customer and system developer), the contribution of both the customer and the system developer to the system development process will be more preferable to produce an ITS that support business goals and objectives. And despite the fact that the system building process might take longer, the higher-quality and business satisfaction of the system developed will be more profitable. From the customer's perspective, too few hiccups and glitches make implementation easy and economical under this framework assumptions, so it would likely be interesting to consider how different evaluation-related assumptions might change the equilibrium development behaviour.

Chapter 7 – Conclusion: Way Out and Thinking About

Summary

This concluding chapter begins by summarising the reasons why new IT/IS in the retail sector was chosen as a subject of this thesis and presenting conclusions draw from both the literature and empirical research study reported in he thesis. The chapter reflects on the research covered in this thesis in the areas of IT/IS failure, requirements and KRF. The chapter presenting, summarising the research carried out in this thesis and drawing the conclusions drawn from both from both the literature and the empirical research reported in this dissertation. This follows an overview of the contributions the research makes to knowledge, and the research derives of both academics and practitioners. Thereafter, a critical evaluation of the research process is presented and the limitations of the research are discussed. The research novelty in this dissertation is claimed and summarised. It then assesses the findings in order to consider whether the research study has addressed the specific research questions raised. Areas where further research is thought to be necessary are suggested, and also the extent to which the results of this research study can be generalised to other industries. Finally, the implications of the finding are considered in the context of future success prospects for the traditional retailers, newcomers, and the IT industry. The chapter ends by providing recommendations for further research in the areas of Information system failures and requirements.

7.1 Introduction

The retail sector was considered to be an important example of cases of large system failures to study because of its position as the world's big investor in IT/IS and new technology. The extent of retail's domination of the market for new IT/IS projects means that finding from an industry study also have a wider relevance in the context of technology change in the UK economy as a whole.

This thesis has studied the system failures and the impact of Smart Requirements on the system development process within the retail sector in an attempt to find out why so many IT/IS projects do not reach their full potential, despite the large amount of money invested and the acknowledge commercial imperative. It is becoming increasingly common to read in the national newspapers, professional publications and TV of how IT/IS has the potential to transform retailing practice, but in reality the progress appears to be slow and incremental. New services have tended to be added to a retailer's existing services rather than replace them, and they only become integrated into mainstream retailer practice over a period of many years. As indicated by limited take up of e-shopping to date, this may be due to other factors such as internet security.

It was noted at the beginning of this thesis that conservative approaches to the adoption of IT/IS in retail offered significant opportunity for new markets entrants to challenge the traditional retailer's structure in the UK. The degree of success experienced by new comers such as the supermarkets in a comparatively short period indicates that the retailers are starting to lose market to organisations that are able to offer new forms of finance, e.g. banking, insurance, and personal loan services by utilising IT/IS more effectively. In such operating conditions, the business incentive to improve productivity within traditional retailers is considerable. However, there appeared to be little evidence of this in practice. The relationship and the professional and intellectual culture clash gap between the business and the techie in the UK retail sector warranted further investigation and this issue formed the focus of the research study.

7.2 Research Study Overview and Findings

In drawing findings from the dissertation reported, the dissertation started with an overview of the research problem in Chapter 1. It has been identified in the literature and empirically confirmed that capturing and managing requirements in the initial stage of building an IT/IS and communication have a significant problem for organisations including retailing on the success or failure of IT/IS implementations. The business requirements and the sociotechnical issues attached to the IT/IS were not taking into account when an IT/IS developed in a business-lead IT strategy but have evolved as a result of the latest technological innovations. As a result, many retail organisations with big IT/IS have a set (sometimes patchy) of complex systems with diverse platforms, and various business and IT modules, most of which either experiencing teething problems or failure. A novel module-knowledge requirements framework (KRF) was then proposed.

However, the normative literature indicates that there are mixed results as to how successful business organisations have been implementing IT/IS. Clearly, the challenge of capturing and managing requirements in the initial stage of building an IT/IS and communication, complex data quality and data integration processes involved has been raised as a potentially important issue affecting the successful outcome of an IT/IS projects. In fact, it is reported that more than seventy five per cent IT/IS projects are failing because of **the intellectual and professional culture gap**, complex data quality and data integration issues involved. Chapter 1 then, states the aim of this research, which is to explore requirements vs. specification and communication issues during the initial stage of the system development process that affect the success or failure of IT/IS project's Implementations, resulting in the development of a frame of references that will translate into a model that can be used to guide organisations in supporting their IT/IS projects with Integration tools, techniques and processes. In doing so, resulting in the development of a frame of references which translates into a (KRF) module that can be used to support customers (business and operation departments) and system developers (IT department in retail organisations). Thereafter, Chapter 1 provides a general overview to the dissertation outline.

In an attempt to meet the aim of this dissertation, Chapter 2 (*looking out*) started with an extensive literature review on the motivations to IT/IS project developments, from fundamentals to implementation problems and challenges, with a particular focus on customer-system developer interaction at the initial stage of requirements. Much of these motivations are empirically confirmed and then reflected in Chapters 5 and 6. In investigating further the above requirements and sociotechnical issues involved in IT/IS projects, Chapter 2 reviews the relevant literature and seeks to investigate models and factors that influence IT/IS development, adoption and implementation associated with IT/IS projects, as well as understanding problems, barriers and benefits to IT/IS project developments. The main research issues derived from Chapter 2 are that: (a) there is a near absence of research and theoretical models that describe the *intellectual and professional culture gap* issues involved in IT/IS projects, (b) since a diversity of knowledge and understanding between both the customer and the system develop have been identified and exist in the business-IT in the UK. In doing so, Chapter 2 makes further contribution to the IT/IS literature since it enhances knowledge by proposing classifications for IT/IS development and adoption. In fact, choosing the right combination of tools and techniques that support IT/IS solutions is a daunting task. Business organisations and particularly retailers implementing IT/IS are facing many IT/IS to be integrated as a big system to suit their business needs. The system developers making competing claims, offering a range of technical solutions and promising impressive returns on investment on IT/IS projects.

It has been identified in the literature and empirically confirmed that both customers and the system developers are often unaware of the many ranges of non-traditional (unconventional) methodologies available. In this case, even though the system developers acknowledge the limitation inherent in traditional hard and soft methodologies. Such limitations do beyond the shortcoming of these methodologies to capture business requirements (Figures 2.1 & 6.17). In addition, include customer and managers of business departments concern over the unsuitability of these methodologies when applied to the IT/IS projects for added-value, though creating new knowledge and opportunities. It has also been identified in the literature and supported with empirical data, that the limitation and concerns over the use of such methodologies and approaches in capturing and managing requirements may force business managers into considering an adopting important parameters that influences the evaluation of IT/IS projects have been highlighted. These parameters deal with (i) KRF complements both hard and soft methodologies- it is not a replacement; (ii) KRF is a practical model; (c) KRF integrates business requirements and system developer specification in a smart requirements. The author has argued, identified and empirically verified that these parameters can consist of categories of evaluation criteria for the assessment of integrated business requirements and IT specifications. Even though this may take longer time to establishing clear and regroups requirements at the expense of long-term strategically important IT/IS investment. This kind of procedure may create an incentive for business and techie people form different department in the retail organisation to start with a small IT/IS projects, to avoid disappointment. The empirical data reported has identified a further reason for adopting this approach through the workshop facilitated by the author that aimed at avoiding resistance of both the customer and the system developer in establishing smart requirements.

The need to consider initial and follow-on IT/IS investment levels have also been identified in the research, as being vital when choosing IT/IS projects. The reason for this is that clear and rigorous requirements although it takes longer to establish but it cut cost of correction in later stages of the development of the system, and benefits are more immediate for both customers and system developers as the requirements stage is exists in any hard or soft methodologies as it presented in Figure 6.17. Empirical research reported in the dissertation has identified that during the development process of an IT/IS, there is a need to consider not just system customers (end-users) as a stakeholders but, also the system developer especially if the system was developed in-house. This is in addition to customers in other department of the retail organisation that are dependent on data and information handled by the system. The justification of the use of a cross-functional stakeholders (customer-system developer) team approaches may help to prepare the retail organisation for future business-led It process by intensifying the interaction between different departments. The novel framework has been proposed (see Table 4.1, Figures 3.2 & 3.3) to reduce confusion surrounding the integration area, and to support the choice of appropriate tools and techniques. An evaluation of integrated tools and techniques has then been presented using both proposed framework and literature findings. In doing so, the author demonstrated that such a framework supports system development process. The presented framework consists an influencing factor for determining quality requirements for IT/IS development and adoption. In investigating more sociotechnical factors that affect the development of IT/IS, a novel conceptual model was identified (see Figure 3.2). This meets and satisfies the aim and hypothesises of this dissertation reported in *Chapter1*. The conceptual model was then empirically examined and modified in Chapter 5 and 6 of this dissertation (see Figure 6.13).

To undertake the research that focuses on the issues identified in Chapters 2 and 3, a research methodology was developed and adopted. Justification for the research methods is stated within *Chapter 4* (finding out). The inherent problems within the various research philosophies are stated and the suitability to this research outlined. The research strategies existing within the IS field are also described and discussed within this chapter. The research issues that have been identified in previous chapters of this thesis were investigated through the use of both quantitative and qualitative research methods, this consists of case settings to explore data through questionnaires and interviews with system developers; and with customers. These issues dealt with all the factors that influence the success or failure of IT/IS projects.

Chapter 5 (data analysis: making out:) then presented and analysed empirical evidences and offered an empirical analysis of the two research method strategies used for the different case perspectives of both Customers and system developers. In doing so, it described the technical and organisational perceptions during the realisation process of the requirements wide-data strategy. Empirical evidences derived from case studies interviews with customers and with system developers also confirmed much of the issues identified in Chapters 2 and 3. However, the data analysis findings considered in Chapter 6 (novel contribution) indicated a number of necessary modifications to the conceptual model and the proposed framework for establishing requirements issues involved in IT/IS projects.

The process of developing a revised conceptual model was only made possible after having carried out the empirical research reported in Chapter 5. As a result of following the investigation of research issues identified in Chapter 3, a revised conceptual model is presented Figure 6.13- Chapter 6. The revised conceptual model supports the *six* main factors that influence organisations when taking decisions to support their IT/IS projects with KRF tools and techniques. These factors deal with:

- Technical-specification;
- Technology Enablers;
- Organisational;
- Sociotechnical- requirements;
- External Pressures; and,
- A Framework for Evaluating IT/IS development and adoption.

Each factor was highly correlated with several sub-factors that are derived from the aforementioned findings from the questionnaires/interviews/case studies (with customers) and the analysed results from the questionnaires/interviews (with system developers). Factors and sub-factors are represented in (Chapters 5 & 6).

7.3 Assessment of Findings

The thesis put forward in Chapter 1 was that the difficulty to establishing smart business requirements which leads to improve the rate of IT/IS failure upon the way in which new IT/IS development and implementation is conceptualised and managed within organisations, rather than upon the difficulty of translating IT/IS opportunity into increased productivity areas in different departments. By contrasting the ways in which the retailers and their new competitors approached the acquisition, development and implementation of new IT/IS projects, it was possible to identify a number of factors which were critical to the success of failure of each IT/IS project studies. The findings from a number of projects recently implemented in a variety of traditional UK retail organisations, government departments and IT industries were brought together in order to analyse the requirements and system failures issues in more detail. Two projects were studies in depth, with the background cases described in chapters 5 and 6.

The analysis of the findings set out in Chapter 5 has shown that the way in which new IT/IS projects in the case study retail were managed was indeed pivotal in shaping the requirements and the development processes and eventual outcome achieved. These findings do not mean that all projects studied were badly managed. On the contrary, many instances were noted where effective collaboration between business, IT, and management facilitated and enhance IT/IS project success. Chapter 6 drew these findings especially in retailing together and concluded that the retailers studied were unable to translate the learning taking place within *individual projects especially at the requirements stage* into a systematic process that could utilised in the *development process* for the benefit of the retail organisation as a whole. Consequently, despite the amount of resources the retailers have dedicated to information technology, the improvements made remain fragmented and transitory in nature.

This research study has confirmed the findings of earlier work that has variously identified the impact of requirements, the relationship between the customer and the system developer, communication, gaps of *TBK and TTK; and professional and intellectual culture clash* as a critical issues in the getting the development of new IT/IS projects right first time. It has also built upon these findings because previous research has focused upon different system development methodologies rather than enhance the existing ones, and hence has not paid the same attention to the vital issue of generating positive and continuous communications to disseminating organisational learning especially between the two parties (customer and system developer). It can therefore be contended that the research study has contributed to the theoretical debate about the nature of IT/IS development and reasons for the continued existence of IT/IS failures, as well as provide practical guidance for customer-system developer-project manger on the successful development and implementation of future new IT/IS projects.

7.3.1 Can the Results be Generalised to Other Organisations and Industries?

As discussed in Chapter 5, it is a dangerous ground to assume that the findings of an analysis of two case studies have a wider application in other situations but the KRF model extends the limitations of traditional retail-base model (KRF) has been developed, thus resulting in the testing hypothesis (see H1, section 1.8). Even if a larger number of cases had been studied, the method does not allow "proof" to be established in a statistically significant sense. However, the position of the retail sector as the UK's leading investor in new IT/IS made it a particularly suitable arena in which to study the interlink issues of requirements and ITS failures. This means that lessons learned may have relevance in a wider context that is usually provided by concentration upon one specific sector. It has also been argued in Chapters 2, 3 and 4 that qualitative study of contemporary cases can provide the rich detail necessary to illuminate the social and cultural influences upon IT/IS since the research study argued that requirements is a sociotechnical issue rather than a technical issue.

Care has been taken throughout the analysis process to compare the findings with those of previous research and to build upon existing theories where possible (see Figure 7.1). Additional value can be obtained by drawing upon areas of literature (in this case requirements, system failures, management science and information technology) that are usually studied in isolation. Theories of the nature of cultural, knowledge management and learning, of course, have a very broad currency. It is contended, therefore, that the research study of IT/IS failures in the retailing sector can add to current knowledge of more generic issues of IT/IS developments and the IT/IS projects management in practice of which both include requirements.

Figure 7.1: Phases, Steps and Activities of our Research

Phase 1 Analyse research study requirements and study feasibility
Step 1: Familiarisation with requirements
Activity 1.1.1: Discuss with colleagues
Activity 1.1.2: Discuss with colleagues in other academic institutions.

Step 2: Assess possible tasks
Activity 1.2.1: Look at available material
Activity 1.2.2: Discuss ideas with supervisor/s
Activity 1.2.2: Discuss with supervisor/s potential sources
Activity 1.2.4: Decide on a topic

⇓

Phase 2 Design questionnaire
Step 1: Design and create questionnaire
Activity 2.1.1 Design structure on paper
Activity 2.1.2 Discuss with sources
Activity 2.1.3 Finalise questionnaire
Activity 2.1.4 Send questionnaire

⇓

Phase 3 Interviews and workshops
Step 1: Interviews
Activity 3.1.1 Conduct interviews
Activity 3.1.2 Review responses and answers

Step 2: Workshops
Activity 3.2.1 Run workshops on weekly bases
Activity 3.2.1 Brainstorming session and immediate feedback received.
Activity 3.2.1 Re-run workshops using previous week feedback as an input to stimulate and enrich knowledge and understanding
Activity 3.2.3 Explain possible reasons for these outcomes
Activity 3.3.3 Review results

⇓

Phase 4 Analysis of questionnaire results
Step 1: Assess data collected
Activity 4.1.1 Input all responses (data) received in a package (SphinxSurvey)
Activity 4.1.2 Process data

Step 2: Interpret Processed data
Activity 4.2.1 Analyse outcomes
Activity 4.2.3 Explain possible reasons for these outcomes
Activity 4.3.3 Review results
Activity 4.3.4 Revise model

⇓

Phase 5	**Developing KRF: Analysis of requirements/specifications**	
Step 1: List requirements		
	Activity 5.1.1	Assess front-end requirements
	Activity 5.1.2	Assess requirements of hardware and software needs
	Activity 5.1.3	Assess information sources
Step 2: Mapping and capture smart requirements specifications		
	Activity 5.2.1	Front-end requirements
	Activity 5.2.2	Requirement hardware and software needs
	Activity 5.2.3	Draw up timetable

Phase 6	**Conclusion**	
Step 1: Research study assessment		
	Activity 6.1.1	Review project management
	Activity 6.1.2	Review results
Step 2: Note any areas for improvement		
	Activity 6.2.1	Observe requirements/results

Phase 7	**Deliver**	
Step 1: Present completed thesis		
	Activity 7.1.1	Assemble completed thesis
	Activity 7.1.2	Send summary of result to selected retail organisations

Certainly, there are a number of precedents in other service and industry of the UK's market situation currently experienced by the retailers. Many historical studies of IT/IS failures discussed in Chapter 2 have shown that established retailers and system developers tend not to come up with innovative ideas. Such research demonstrates that the usual response by retailing and IT industry incumbents to a threat from IT industry pioneers is further investment in existing IT/IS, or if new IT/IS employed, traditional business process are imposed upon its use. Retailing and IT industry incumbents are then able to avoid the risks of failure associated with early technology uncertainties by delaying major investment in new IT/IS until technology matures or at a later stage. The drawback of this strategy is that they tend to get left behind rather than being an earlier adopter and consequently struggle to establish a viable market position in comparison with early adopter of the technology who have hence been given time to acquire the necessary skills. The parallels are such that future studies of system failures and system developments in the retail sector may well provide another example to add to this list which currently includes government, air traffic control, engineering and many others.

7.4 A Statement of Research Contribution and Novelty

Our research study highlights the pitfalls of many IT/IS directors being in favour of lower cost of IT/IS project developments or outsourcing without considering fully business requirements and how this will affect the business. This research addresses an endless list of potential barriers such as, how much face-to-face time is needed at the initial requirements stage between the customer and the system developer, how should the business manage ITS remotely and how do skills and knowledge get passed from the developer to the customer and visa versa, and how can the customer devise IT/Is strategy to link it to the organisation's business strategy.

Many of the issues our research study addresses have been confirmed by other gurus. For example, almost one-third of IT/IS directors see project failures rates of between 40-75 per cent paints a disturbing picture for the ITS industry, but with most projects, success or failure can be predicted as early as the 20 per cent completion point. The relationship between the value of the development work accomplished and the actual costs incurred is remarkably stable over the period of most projects. If an IT/IS director have an overrun after 20 per cent of the project is completed, then all signs point to an overrun for the finish job. The actual failure occurs when directors make over-optimistic forecasts without possessing the ability to examine the actual work achieved. Not every new IT/IS project will succeed, but by evaluating projects at an early stage, the decision to cut losses can be made before cost spiral out of controL

In addition to the above many ITS failed due to lack of continuous check. One of the biggest problems is that nobody ever seems to be able to tell a project manager where they are in the project! This is true where the developers asked in many cases during this research study, they would only ever say they were either 20% done or 80% done, even right up to the week before the work was due. Even when they were finished, there was no way of knowing the quality of the product until after it had gone through quality assurance (QA). The Success of an ITS depends continuous feedback (which the key of KRF). Probably the greatest change is in the speed, quantity and most of all, quality of feedback. Feedback is everywhere nowadays and because management has slowly come to realise it's actually a good thing. This is evident during the development, application and implementation of KRF and participation of different parties using the KRF. The popularity of feedback during the different stages of KRF refines the requirements which leads to speedy iterative development, this meant that feedback cycles are becoming shorter and shorter. Some managers admitted that they no longer have to wait twelve months to see if the system will integrate successfully with the rest of business departments. In addition, finding errors even as soon after they occur will incur time to fix it and more cost.

It is worthwhile mentioning here that this study does not concentrate only on system failures. The study treats the issue of system failures as a learning process to achieve success by learning from the history of failures. Without failure people will not learn from mistakes. Recently Nairn (2003) reported on the failures of many supply chain projects due to the failure in delivering the expected business benefits. Acquiring a new or even update an ITS not only bring problems with technical issues but, also problems with people, organisation and management, ITS failure is only part of the big problem. The majorities of ITS projects take longer, cost more and take up more of an organisation time than initially estimated. Many business organisations know very well from bitter experience of either developing or acquisition of an ITS.

7.4.1 A Novel Model for Requirements Efforts

We have established three golden rules for determining smart requirements and software development; only build it once, build it right, build it with the business and customer in mind. The days when system developer rush to get software out the door, and almost use the customer to help test it, are long gone. Relationships between the system developer and the customer get damaged and customers are not prepared to tolerate this practice anymore. Customers should trust the software they acquire or buy. Software failures at home or business make people concerned. If they worry that their online order or other sensitive information is not being handled in a secure and reliable way, it can lead to them not using technology for trading. Customers are not particularly happy when a system developer asks the customer to take it on trust to test the beta version. It is almost as if the customer is doing the testing for the system developer. In some big systems and quite often, when a software failures takes place, it is not so much inherent in the system, it is the way it has been configured.

7.4.2 KRF

Almost every ITS will fall over in the early stage (requirements) of the system building process, but we are trying to understand the impact more clearly to use other ways of communicating with both parties. KRF is a common-sense approach, which recognises that successful ITS is about more than technology, it includes and covers people, process and change management equally. That, in itself, is a big step forward to treat the requirements as a sociotechnical rather than a technology issue.

The implementation of big IT/IS in retail organisations is a difficult process with a significant proportion of the projects suffering overruns in time, manpower and cost. System technical failures constitute only part of the difficulties. The challenge of implementation often lies in the "soft issues" of people (customer and system developer) communicating positively at the early stage of requirements. The KRF model looks into the less understood "soft issues" and is developing requirements capturing tools and techniques to help retail organisations before the IT/IS develops further. This increases the certainty that the IT/IS will bring benefits to the retail organisation in the shortest time. Our research study creates a framework to catalogue, capture, and manage implementation of requirements collated from primary data collection, published literature and case studies. KRF brings improvement by aligning technological specification with business requirements.

7.4.3 Benefit and Implications for the Design of KRF Model

We believe that the work described in this thesis has contributed a number of significant benefits to information technology system developments, namely:

- Prior to the work described in this thesis most of system development approaches/methodologies fail in two categories, namely hard approaches or soft approaches. Our work has a mixture of the two approaches mentioned. In addition our approach has incorporated many management science tools and IT tools (e.g. Venn diagrams, Set theory, Rich picture-see chapters 3 and 4). System developments had no such a mixture approach to the systematic gathering and evaluation of many different parameters for the definition of the requirements stage.

- Our Knowledge Requirements Framework (KRF) both lessens the workload on the system developer and enables many more requirements parameter phases to be systematically investigated and refined through the different levels and sub-levels in the KRF (see Figures 6.13 and 6.14) due to the system developer and the customer continuos participation and communications.

- The current system development methodologies require very labour intensive on the system developer side, hence many systems experienced problems or glitches. KRF requires regular human interaction to produce more refined requirement sets to be evaluated, as a consequence, only a limited number of system might experience problems.

- In our research many requirements sets within the different levels and sub-levels of the KRF can be systematically generated, evaluated, and refined with the different tools used, namely Brainstorming, Venn diagrams, Fishbone. As such many more requirements parameters can be evaluated with the human interaction.

- The capability of the KRF to investigate many different requirement parameter sets in a systematic fashion enables system development to explore and to get things right first time and to reduce testing time, that have previously been unexplored.

- KRF has been tested, the combined effectiveness of new, and more refined requirements of proposed logic in a more systematic fashion than arbitrary. Analysis of the best and more rigorous requirements that fits business and technology needs from a number of workshop sessions has highlighted new logic that offer potential benefit through the use of KRF.

In summary, we believe that our KRF has enhanced and not replace any system development methodology to discover requirement parameter sets which improves system development methodologies as the requirements stage is the heart of any hard or soft approach in the development process of any ITS.

7.5 Added Value of This Research

This research study adds something to the current state of knowledge in the following seven areas of the system development:

- Establish the different knowledge and understanding between the customer and the system development at the initial requirements stage of the system development process.
- Identify the professional and intellectual culture gaps between the customer and the system developer.
- Contribution to knowledge (theoretical and practical), enhance and advance the quality of literature in the area of IT/IS failures in general and specifically in the retail sector of the UK.
- Develop and build a framework (KRF) to share knowledge and deep understanding, capture, handle, and manage business requirements in addition to satisfy the above issues to enhancing constructive communication between different parties in order to improve the rate of success of an IT/IS.
- The ITS projects that KRF approach has been applied for were different as were the working environments (retail and banking).
- Our results were extremely consistent over a year period.
- Different organisations were happy to use the KRF approach including the different tools KRF contains during the organised workshops.

The above contribution areas have been fully addressed in Chapters 3, 4, 5 and 6.

7.6 Future Prospects for the Retailing Sector

Despite IT/IS failures in retailing, there are many success stories (see Appendix C). As consumers become ever more sophisticated in their purchasing requirements and habits, retailers are investing in ever more innovative methods and IT/IS of grabbing attention and promoting brand values. The consumer of the 21st century expects and demands more than just a product alone. Often the IT/IS design of a system with a retail environment can have as much effect upon consumers' perceptions of a brand, promotion or retailer as the quality of the goods themselves. Consequently, retailers and suppliers alike are always looking for inventive ways in which to distinguish their offering. This research study attempts to provide a framework (KRF) of how to develop a quality IS in a retail organisation. The key objectives are to critically investigate the high rate of IS failure process, to identify the drivers for the use of quality IS in the UK retail sector, to studying application examples of IS failures in order to determine the possibilities of using approaches, methods and tools in the establishment of feasible framework (KRF), to investigate the implementation of successful IS in the UK retail sector, especially on the sociotechnical issues in system developments.

To conclude the research study, this section reflects on what the results can tell us about the future make-up of the retail sector. At this stage it is still difficult to predict the likely extent of change in the retailing structure. It is clear that the benefits to the consumer in terms of increased choice and efficiency are likely to be considerable. The historical review of the retailers in Chapters 2 and 3 showed how new products and services tended to evolve and integrate with existing ones over a period of many years due to the sophistication of new IT/IS. It is important to bear in mind the cautionary note described in Chapter 1 (section 1.1) against the frequent belief to exaggerate the potential of new technologies. Claims that IT/IS advances will prove the demise of traditional retailers may be well premature despite the takeoff of many e-retailers in the last five years.

It was argued in earlier chapters that **professional and intellectual cultural clash gap** still exists in the retail sector which encompasses the dealing that they have with both the customer and the system developer. As a result, attempts to introduce radical change in attitude especially in the initial stage of requirements of system development based upon new communication devices and technologies have so far been both belated and half-hearted. The business departments, especially the sale and accounts departments (Chapter 6, Figures 6.9, 6.11 and 6.12) tend to mistrust radical change of IT/IS, as trails of the Euro has shown. Evidence has been put forward in earlier chapters which shows that the retail sector remains strong, but that the pressure from newcomers is forcing them to become more technology oriented. Steps have been taken by the retailers to address some of the business and technological issues (TBK, TTK, knowledge and understanding gaps) described in earlier chapters that have compromised IT/IS projects. It is clear from the empirical research study that these changes have had limited impact to date because collaboration between different departments in a wider organisational context is not yet evident. Earlier research has also shown that technology change tends to be incremental in nature, is initially based upon existing practice, and the sociotechnical changes associated with new IT/IS acquisition and implementation take a considerable amount of time to filter through the IT/IS system.

7.7 Directions for Future Work

Information technology system failures have received much attention from academic and practitioners in the last fifteen years, with professional cultural clash emerging as one of the most dominant topic. A well-know view is that if management is more concern with the organisation's survival than with the profitability (Gavirneni et al., 1999), it is efficient to use mixed tools and techniques from the management science and the IT subject areas to explore such a clash which leads to many ITS failures. Our research study extended this idea to a setting where customers and system developers behave opportunistically when they control the decision.

In the existing literature, different IT models are typically judged by comparing the likelihoods of certain factors which might lead to ITS failures. We instead investigate the initial stage (requirements) of the development of an ITS explicitly for the purpose of evaluation of gap existed between the customer and the developer. We compare a number of models using the families of requirements in Fortune and Peters (1995); Kotonya and Sommerville (1998); Macaulay (1996); Sommerville (2004); and Sommerville and Sawyer (1997). We find that a comparison of the customer and the system developer (knowledge and understanding) favours the most richly parameterised model, as does a traditional likelihood-based comparison that uses only a limited tools and techniques.

7.7.1 Suggested Areas of Future Research

This particular research study has concentrated upon UK retailing, future research that builds upon these findings, and focuses upon comparing the implementation of retail strategies for IT/IS in a number of different countries may be of considerable importance. In Chapter 6 it was noted that research in other sectors has also a commonly reported on failures to maximise the benefits of new IT/IS. The scarcity of success stories in this area indicates that a comparative study of IT/IS project management in a variety of service and industry organisations may provide valuable insights into the problem.

It has also been shown in this research study that the limited opportunities the retailers have taken to facilitate IT/IS change have had some success at the individual project level, but have not yet instigated a longer term commitment to change throughout the organisation. This lack of learning and interaction between the different business departments and the IT department from past experience is not regarded as a problem with the retailers because the market position of the retail sector remains strong. Whether this position is sustainable over time is a question that remains to be answered and would make an interesting longitudinal study. Obviously, the very nature of this research study is constantly changing and therefore a very similar research to this one carried out in one year's time could yield very different results. In order to get a clearer picture and better understanding of developing an IT/IS project, similar research with a professional primary research can be conducted. The information about the customer's requirement regarding present and future ITS projects, can be collected by either of the two methods namely Time Series and Neural Networks. Time Series look at past data to forecast and predict linear and non-linear (BPP, 1995; Bierman, 1991; Newbold, 1991). On the other hand Neural Networks mimic the human brain and deal with non-linear models (Awad, 1996). The advantage of Neural Network over the Time Series is that Neural can be trained to map past & future information of a Time Series. Neural Networks take the form of image, voice, and are good for pattern recognition.

Rigorous prediction of the customer's requirement and evaluation represent a major professional achievement in reducing the time that a software engineering project takes which leads to a huge reduction and saving in the cost of a particular project.

The rigorous prediction is the future direction of BSE and its applications which can be achieved by either the classic technique (Time Series) or the latest Neural Network or both as it has been mentioned above. In our opinion Neural network can achieve a better prediction.

Other areas of research, outside the scope of this study, that warrant research could be an investigation into the implementation of the framework (KRF) developed in this research in other industry sector of the UK. Such research would be extremely benefit many industries and would help them to get a clear picture of how IT/IS development projects can be managed. Moreover, the factors necessary for success and failure of IT/IS implementation could also be investigated.

7.8 About the Thesis

This study was a hands-on research in the area of ITS in retail in the UK where Participants applied requirements engineering techniques to an example system related to their professional working environment. The workshops began with an outline of the problem to be solved, i.e. a tutorial on requirements, then questionnaires and exercises where the participants take an informal system specification and extract specific functional and non-functional requirements to create a requirements specification.

The main part of the study looks at the phase of requirements within the System Life Cycle approach to requirements capture. The principles of use cases are explained in further chapters, and the participants had the opportunity to use case model (KRF).

This chapter provides an insight for researchers and practitioners to discuss engineering requirements, as a branch of system development concerned with methods, techniques, and tools for eliciting, specifying, and analysing system requirements. The chapter features a substantial component to augment its traditionally strong technical program. Our work involved many discussions and workshops in providing practical approach to the problem of clearly understanding, managing, and engineering business requirements.

Requirements traceability, and the relationship between a requirements and specification a use case model (fishbone) is also discussed in chapter 6. Smart requirements is the outcome (common knowledge CM) of shared business (TBK) and technical (TTK) knowledge (see Chapter 6). This research traces the evolution of the concepts behind both TBK and TTK, contrasts this with real practice and highlights the ethical problems of IS developments. Both TBK and TTK are tacit knowledge that needed elicitation, exchange, shared, and managed between the two parties. The research study regards the common knowledge (CK) as the way enterprise can leverage the know of its business and IT employees for the benefit of the IS's enterprise. Further, it is argued, the customer (TBK) and the system developer (TTK) with it the sharing of knowledge, not only enhances the enterprises IS ability to compete by increasing the competence of its customers and system developers also enriches the welfare of all those who are able to engage in the IS development process.

The advocates fall into two parties, those who focus on business knowledge who place a great emphasis on business and human elements, and those who focus on technology. In is important to note that through the research both parties (the customer and the system developer) appear to share the assumption that common knowledge is beneficial, and that in some senses the CK which is managed and shared is equivalent to the success of an IS. There is an asymmetry in most of the participant in the workshops who involved in the discussions. CK and requirements are primarily discussed from the point of view of the customer requirements. KRF aims at the motivation of both the customer (TBK) and the systems developer (TTK) in order to utilise exchange and shared knowledge to enhancing IS capabilities and effectiveness (Kermally, 2004). In the real world, it is often the dominant influence and knowledge sharing is prime importance in the system development process. For many years, many organisations achieved competitive success through the systematic management of TBK and TTK.

7.9 Research Study Limitations

The main limitation that the researcher has experience is a limited amount of information. Information about system failures (since no one would like to admit failure!), information about IS usage by the retail sector of the UK is quite limited and inaccessible. There is more competition between retail organisations in acquiring information which includes information on IIT/IS strategies, IT/IS acquired, brand information and customer habits. Hence, part of the information is a trade secret and is confidential. Furthermore, the researcher also experiences time constraint and family problems. In developing the KRF model for the adoption and evaluation of requirements that can be used as a frame for system development, there was a need for robust research methodology. Such a methodology could be used as a framework for developing other application specific models for the adoption of IT/IS.

Chapter 4 describes the use of quantitative and qualitative data gathering methods were justified for gather the necessary data. The reason for this is that such methods allow generalisation of soft and rich data, which is associated with sociotechnical issues. Despite its strengths, qualitative research methods do have inherent weaknesses, with a number being encountered during the reported research process. In conducting this research, the collection and analysis of qualitative data has proved time consuming and demanding despite the use of the software package *SphinxSurvey Plus2* (Scolari, 2000). Nonetheless, the relative difficulty of analysing this data did not invalidate and conclusions drawn, since multiple sources of data were applied to data obtained and multiple tools from the management science and IT areas were used.

Moreover, the author has acknowledged a number of additional issues regarding the use of quantitative and qualitative research methods. Firstly, the inability of the researcher to interpret events from the subject point of view, is questioned, without some degree of bias.

However, to try and address this, the author uses a multi-method approach (data triangulation) to data gathering. Although, the author does consider that there will always be elements of bias inherent in qualitative data analysis, due to its subjective nature. Secondly, the relationship between theory and research might be considered weak and unstructured, as qualitative approaches may be criticised for not instilling theoretical elements. However, in the case of this research study, the author sought to partially address this concern through developing a conceptual model (see Chapter 3) proposing factors that influence requirements adoption, and building a framework for evaluation system development process.

7.10 Conclusions

This thesis bridges the literatures of IT and management science to investigate and support for collaborative the specification of user-oriented system requirements through a mixture of formal and informal approaches and documentation support tools on order to improve the process of developing ITS.

We first investigate the relation between the customer and the system developer at the requirements stage. Although, in some cases the relationship is working, but we find strong evidence of a strain, mismatch of knowledge and unclear understanding of what each party wants from the other. Using different tools and techniques to provide a forum within which to identify durable best practice that are applicable across the full spectrum of UK Retail and IT/IS sectors. By bringing together the many strands of knowledge and expertise applied across a wide variety of niche arenas, the study aims to provide insights into how they can be applied generically across the whole range of business processes and IT/IS environments.

There is ample evidence that finding requirements early saves time money and anguish later on in a project. To be able to find the requirements you need to make them functional to all the different stakeholders by quantifying them in a consistent and understandable way. Current assertion practices in developing ITS mostly lead to the system developers nostrum "the quick fix". We believe that it is time for change in system development process and treat the development process as an organic development (live system) that accommodates to changes in the business environment. The main assertions of KRF are that customers and system developers need to face up to the complexity of the requirements process that both parties should deal with and to develop formal and adequately simple but powerful approaches, and to learn to use them together. To achieve this, a wholly new conception working together has to be developed.

The aim of this chapter was to explore the development of KRF and to further the debate of requirements in the ITS sector. A project involving major retailers in the UK was selected with which this aim could be achieved. In preparation, detailed discussion of requirement contribution to system failures arose from literature reviews. Fieldwork which included sending questionnaires, personal interviews, telephone interviews, and running workshops undertaken and summarised. Many general lessons were recorded, traced, with only major points being noted. This revealed much strength, such as the benefit of exchanging knowledge, ideas, and contributing together in building the proposed system. One weakness has being highlighted was the time taken to reach agreed requirements but people were prepare to sacrifice time against wasting financial resources in unusable systems. However, we can not dispose of people (customers or system developers) who are responsible for creating the bad news and causing headaches for them selves and disruptions to their business activities through stubbornness.

In our judgement the system developers need the business experience and vision that the customer has. The system developers can overcome this problem by taking in-house business experience, to fully understanding and integrating their IT knowledge and experience with business requirements and goals. To allow him to adapt to today's rapidly changing markets and helping the customer to confront the business problems, supporting changes to keep the customer's business on time, and on budget.

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APPENDIX D: QUESTIONNAIRES

This appendix provides methods and a list of questions that were used to guide the researcher during the interviewing processes. The two questionnaires (customer and system developer) and the interview process which followed some of the returned questionnaires have been conducted with senior personnel with responsibility of their departments.

Two questionnaires have been designed. One to have a feedback of customers/users feel of the system they use. The other, sent to the Head of IT department or the system developer working at a retail organisation. The questions used in the interview are based on an earlier version of a questionnaire of which its results did not included in this study. Both questionnaires focused on the area of research, requirements and system failures. The questions were aligned with research objectives. In order to obtain a complete and a full picture of their perceptions, different questions were generated from an earlier version of the questionnaires and through different stages of the interview processes in order to keep track and to remind the researcher of the information need to be collected. This list of questions was sent to all interviewees, with an explanation of the research area, which was followed by phone calls. Appendix D (D1 and D2) contains the two questionnaires and the list of questions.

Two types of questionnaires which are used to collect primary data to support the research case study of information technology system failures in the Retail Organisations.

Dear Sir/Madam,

We are conducting a survey on the effect of requirements in the development of information systems. The information we collect on this survey is used to help both customers (end-users) and software builders (system developers) in developing future information technology system that meets business needs.

This is where we would like your help. You have been randomly selected to take part in this survey and we would be grateful if would complete the attached questionnaire. The questionnaires are to be returned in the pre-stamped enveloped. Please be assured that the data provided will be treated as strictly confidential and used for research purposes only.

The questionnaire should take no more than 6 minutes to complete. A summary of the result will be made available to you by ticking the relevant box at the end of the questionnaire.

We would like to thank you in advance for taking the time to complete this questionnaire.

CONFIDENTIAL REQUIREMENTS QUESTIONNAIRE

(for research use not commercial)

I am a senior lecturer at the University of Westminster - Westminster Business School, we are conducting a study on the way/s to improve the <u>quality of software specified requirements</u> (as <u>we believe initial requirements is the crucial stage in delivering successful software projects</u>) to benefit both the Software Engineer and the End-user environment. I would be extremely grateful if you could complete this questionnaire and return it in the envelope provided as soon as possible.

D1. A SOFTWARE BUILDER QUESTIONNAIRE

Please tick the relevant boxes (ignore irrelevant questions):

S1. Are you: working for a company ☐ freelance consultant ☐

S2. Job title:

IT Executive ☐ System Architect ☐

Project Manager ☐ Analyst/Programmer ☐

System Development Manager ☐ Software Engineer ☐

Other ☐ Please specify ....

S3. Do you play a role in software development? Yes ☐ No ☐

S4. What platforms do you use to run your software on?

Unix ☐ Windows ☐ Window NT ☐ Other ....

S5. How many different software development methods do you use (e.g. SSADM, OO, ...etc.)?
Please specify ______________________________________

S6. Is your software development method working? Yes ☐ No ☐

S7. How many development staff do you have at your site? ______

S8. How many software engineers in your team? ______

S9. Do you spend too much time monitoring existing systems? Yes ☐ No ☐
If yes specify % time ....%.

S10. Would you prefer easy and flexible unconventional development methods (e.g. SSM) during the initial requirement stage? Yes ☐ No ☐

S11. How many projects do you personally develop per year? ______

S12. On average how long a project takes to be completed?

0-3 months ☐ 4-6 months ☐ 6-12 months ☐ 12+ months ☐

S13. What is the percentage of successful projects per year? ——%–

Which factors influence successful completion? ______________________

S14. What is the percentage of failed projects per year? ——%–

Which factors influence failure? ______________________

S15. On average, what budget is allocated to a project? £.................

S16. Is communication breakdown a problem? Yes ☐ No ☐
with whom (e.g. with colleague, with customer)? ______________________

S17. Do you involve the end-user at:
The beginning ☐ Early stage ☐ The implementation stage ☐

S18. Do you have a clear understanding of the user's business goals?
Yes ☐ No ☐ Sometimes ☐

S19. Do end-users change their requirements faster than you can deliver?

Yes ☐ No ☐ Sometimes ☐

Tick here if you would like a copy of the summary of our results ☐
(please write your address below; anonymity will be prevailed)

Thank you for your co-operation in completing this questionnaire.

Please return to: *Your Address:*

Wafi Al-Karaghouli
Senior Lecturer
University of Westminster
Westminster Business School
35 Marylebone Road
London NW1 5LS

CONFIDENTIAL REQUIREMENTS QUESTIONNAIRE

(for research use not commercial)

I am a senior lecturer at the University of Westminster - Westminster Business School, we are conducting a study on the way/s to improve the quality of software specified requirements (as we believe initial requirements is the crucial stage in delivering successful software projects) to benefit both the Software Engineer and the End-user environment. I would be extremely grateful if you could complete this questionnaire and return it in the envelope provided as soon as possible.

D2. AN END-USER QUESTIONNAIRE

Please tick the relevant boxes (ignore irrelevant questions:

C1. Are you: working for a company ☐ self employed ☐

C2. If you are working for a company, how many employees? ....

C3. What is the nature of your business?
Finance ☐ Retail ☐ Public sector ☐ Manufacturing ☐ Other ....

C4. What platforms do you use to run your software on?

Unix ☐ Windows ☐ Window NT ☐ Other..................

C5. Are you happy with your computer system (inc. software design)?
Yes ☐ No ☐

C6. Did the produced software (final product) meet your business requirements?
Yes ☐ No ☐
If no why?
....

C7. On average, what budget allocated to the software project? £.................

C8. How did you hear about the software developer you are currently using:

From past experience ☐ Word of mouth ☐
Advertisement ☐ Other ....

C9. Do you think a close user involvement in the initial stages of the project is important?
Yes ☐ No ☐
If yes why? ....

If no why? ....

C10. Would you prefer easy and flexible unconventional development methods during the *initial* requirement stage? Yes ☐ No ☐

C11. Rank in terms of importance for choosing software: *Very important =1 Important = 2 Not important = 3*

Goodwill of software house	☐	Brand of software	☐	User friendly	☐
Software performance	☐	Reliability	☐	Efficiency	☐
Business related	☐	Help (inc. on-line help)	☐	Documentation	☐

C12. How many successful software projects were on time on budget? ....

C13. How many business software projects <u>did not complete on time and on budget</u> over the last 10 years? ....

C14. Did you abandon a software project? Yes ☐ No ☐
If yes why? ....

C15. Have you been aware of I.T. limitations during the initial requirement stage?
Yes ☐ No ☐

C16. In your opinion, is continuous communication between the user and the software engineer important? ☐ Yes ☐ No
Why? ________________________________

C17. Were you involved in the project at:
The beginning ☐ Early stage ☐ The implementation stage ☐

C18. Do you think that the software engineer concentrates more on I.T. aspects rather than the business goals? Yes ☐ No ☐

C19. Do you sometimes consider outsourcing in your software development?
Yes ☐ No ☐

Tick here if you would like a copy of the summary of our results ☐
(please write your address below; anonymity will be prevailed)

Thank you for your co-operation in completing this questionnaire.

Please return to: *Your Address:*

Wafi Al-Karaghouli
Senior Lecturer
University of Westminster
Westminster Business School
35 Marylebone Road
London NW1 5LS

APPENDIX E: SELECTED LIST OF RETAIL ORGANISATIONS THAT TOOK PART IN OUR STUDY AND CONTACT DETAILS

Retail Organisation	Name of Contact	Established	No of Employees	Branches	Turnover(£)
Abbey National	MD:Andrew Pople (Retail)	1849	25,000	687	1,000.0bn +
Aberness Foods Ltd	RD: Bruce Nicol	1857	450	17	N.A.
Joseph Alexander Ltd	FD: Dennis Alexander	1923	N.A.	19	N.A.
Alexandra Workwear	SMD: M Fletcher	N.A.	33	N.A.	N.A.
Alexon Inter Ltd	Mer D:Terry Kirton	N.A.	3,000	92	N.A.
Alfred Marks	Mar D: S. Lilly-white	1919	N.A.	100	N.A.
Malcom Allan & Sons	Mar D: G. Allan	1954	100	15	N.A.
Alldays Stores Ltd	HoM: Peter Skinner	N.A.	6,000	450	N.A.
Allders Dept. Stores	Mer D:George Foster; IT D:Malcolm Singer	1862	3,000	12	8m
Aubrey Allen Ltd	FC: Jon Holiday	1947	50	3	4.5m
Allied Domecq Leisure	FD: David Stevenson	N.A.	N.A.	1120	N.A.

Allied Irish Banks	Mar D: N Gallagher	1824	N.A.	36	N.A.
Allsports	SaD: Ron Rome	N.A.	1,200	150	N.A.
Althams Travel Serv. Ltd	OM: P Mackie	1874	250	30	54
Andy's Records Ltd	MarD: B Gray	1977	240	31	N.A.
Anglia Regional Co-operative Society Ltd	OM: C. H. Whitelock	1877	2400	46	N.A.
Apple Pan Ltd	OGM: Beatrice Thalmann	1987	100	4	N.A.
Argos Plc	CE: Dr Mike Smith	1973	12,250	367	1.44bn
ASDA Group Plc	Tr D: Tony Campbell	1965	75,000	206	N.A.
Ashley (Laura)	CE: A. Iverson	1963	500	177	336m
Audio Excellence Ltd	SaD: N Hawkins	1981	20	6	N.A.
Ethel Austin Ltd	ROM:R.J.Carroll	1934	1,000	130	70m
Austin Reed Ltd	FD:Geoff Gibson	1920	N.A.	48	N.A.
Avis Rent A Car Ltd	FD: I. Wardle	1975	500	180	N.A.
B & Q Plc	D: Martin Toogood	1969	17,601	279	1.2bn
Badger Inns Ltd	MD: R.Mackenzie	1777	1,000	79	N.A.

Stanley Ball Ltd	MD: J.L.Mansfield	1932	50	6	N.A.
Bally Group (UK) Ltd	RCD: Kishor Tharani	1892	1,000	59	N.A.
Barclays Bank Plc	C:Andrew Buxton	N.A.	N.A.	2,030	N.A.
BASS Leisure	CSM:Warren Page	N.A.	1,000	300	N.A.
Bay Trading Co	MD: Charles Bal	1986	1,000	95	50m
J.E. Beale Plc	CE:Michael Mitchell	1881	201	6	46.3m
James Beattie Plc	FD: M.F. Smart	1877	900	9	90.3m
Belfast Co-operative Society Ltd	MOM: D. Anderson	1889	1,155	27	80m
Bensons Shoes	JtMD: Brian French	1917	500	140	40m
Bentalls Plc	FPD: J. B. Ryan	1867	1,000	6	84.3m
BHS Plc	CE: Keith Edelman	1928	N.A.	136	N.A.
Frank Bird Ltd	MD: Malcolm Bird	1939	25	4	1.5m
Blockbuster UK Group Ltd	FD: R, Prime	1990	10,000	800	N.A.
Bodum (UK) Ltd	FD: P. Simonson	1983	30	2	N.A.
Body Shop (UK) Retail Co Ltd	C: Gordon Roddick	1976	N.A.	252	219.7m

Bon Marche Ltd	RD: K. Black ITM: K. Leason	1974	1,300	115	50m
Bond Laundaire (Bolton) Ltd	MD: D. H. Bond	1950	27	7	250m
E H Booth & Co Ltd	MD: H. M. Booth ITDe: M. Price	1847	1,600	23	84m
Boots the Chemists Ltd	MD: Steven Russell MarD: D. Kneale	N.A.	53,577	1226	3,107bn
Bristol & West Building Society	FD: J. Warren RSM: L. Machin	1870	2,300	159	N.A.
Britannia Building Society	MD: J. Heaps	1856	3,000	200	N.A.
British Heart Foundation	OD: Mandy Ford	1961	600	27	24m
British Shoe Corporation	MD: Rebecca Cotterill	1960	25,000	1000-2000	N.A.
Budgens Foodstores Ltd	FD: Graham Rigby	1872	N.A.	103	N.A.
Burger King Ltd	CE: Bob Lowes	1972	270,000	360	5bn
Burton Group Plc	RDDD: J. Robson ISD: Nigel Hall	N.A.	N.A.	1,530+	1,878bn
Cantors Plc	FD: Ian Hanson	1920	850	300	62m
Carpetright Plc	FD: Ian Sneyd	1988	1,000	246	185.3m

Chelmsford Star Co-operative Society Ltd	MM: V. Howard	1894	300	17	23m
Chelsea Building Society	FD: Peter Walsh	1875	600	39	N.A.
Cheltenham & Gloucester Building Society	FD: David Bennett	1850	3,000	235	N.A.
Cheshire Building Society	CE: J.D.P. Hughes	1870	550	59	N.A.
Clinton Cards Plc	MD: Clinton Lewin	N.A.	4,000	486	N.A.
Cobra Sports Ltd	FD: N. Connor	1979	700	74	30m
Courts Furnishers (UK) Ltd	MerD: N. Blake	1850	1,000	85	297.5m
M & S Cohen Ltd	D: Keith Oates	1884	65,498	285	5858bn
Comet Group	PMD: L. Martin	1933	4,914	223	585m
Connors Chemists Ltd	OD: Donal McCaughey	1988	150	18	6.5m
Cookstown Furniture Centre (Group)	RCD: R. Chesney ITD: D. Steadman	1975	30	3	3m
The Cooperative Bank Plc	MD: T.J. Thomas	N.A.	4,000	130	N.A.

Country Casuals Ltd	RCD: A. McLoud Smith	1973	N.A.	170	N.A.
Coventry&East Mercia Co-operative Society Ltd	DCE: M. Holden	1845	1,100	44	30m
Debenhams Plc	MD: P. Kaursland	1777	N.A.	88	931.5m
Dixon	FD: R. Shrager	1953	10,000	N.A.	N.A.
Etam	MD: N. Hollingsworth	1923	5,400	288	N.A.
French Connect	CE: S. Marks	1972	1,100	21	70m
Halifax Building Society	M.D. R.F. Boyes	1987	27,000	1100	N.A.
Harrods Ltd	MerD: M.Zipp	N.A.	1,000	1	N.A.
Iceland Frozen Food	FD: A. Pritchard	1970	17,000	752	1.3m
John Lewis	CE: D.E. Young	1864	21,100	23	1431bn
McDonalds's Restaurants Ltd	CE: D. Richards	1974	38,000	680	720m
Nationwide Building Society	MSD: T. Melville-Ross	1990	N.A.	700+	N.A.
Safeway	MarD: R. Partington	N.A.	N.A.	370	N.A.

J. Sainsbury's	RD: D. Clapham	N.A.	36,082	363	10,148bn
Selfridges	MerD: C. Reuben	N.A.	N.A.	1	242m
Tesco	MD: D. Malpas	N.A.	N.A.	545	12,094bn
The Gap	M.D: J. Griffiths	1986	N.A.	58	N.A.
TSB Bank Plc	MD: R. Ellwood	1986	26,007	1,100	N.A.
Woolworths Plc	MerD: G. Adams	N.A.	16,259	780	1,43bn

Sources: The Financial Times, 1997: Shopping Centre and Retail Directory, 1996 & 1997: Conspectus, 1999.

Where:

C = Chairman, CE = Chief Executive, CSM = Commercial Services Manager, D = Director, DCE = Deputy Chief Executive, FC = Financial Controller, FD = Financial Director, FPD = Financial/Property Director, HoM = Head of Marketing, ISD = Information Systems Director, ITD = IT Director, ITDe = IT Development, ITM = IT Manager, JtMD = Jt Managing Director, MD = Managing Director, MM = Marketing Manager, MOM = Marketing Operations Manager, MarD = Marketing Director, MerD = Merchandise Director, OD = Operations Director, OM = Operations Manager, OGM = Operational General Manager, P = Partner, PMD = Product Marketing Director, RCD = Retail/Commercial Director, RD = Retail Director, RDDD = Retail Dsign/Development Director, ROM = Retail Operations Manager, RSM = Retail Support Manager, SaD = Sales Director, SMD = Sales & Marketing Director, TrD = Trading Director,

APPENDIX F: SAMPLE OF AN OFFICIAL CORRESPONDENCE

Mr Hesselgrave

London NW1

Date: 3rd July 1997

Customer Requirements

The objective of our research is to look at the high rate of software project failure. We believe that the problem of high failure can be addressed and reduced by looking at the end user's initial requirement and try to get as much as possible an accurate requirement. This can be done by looking at different methods and techniques. Several reasons exist for such failures, for example cost and overruns due to poor initial specification, inadequate requirements analysis and problem definition, and obsolescence due to rapidly changing work environment. The focus for our research is, however, the first stage in any project which is the establishment and agreement of customer requirements (Juran, 1988).

Many of the Software Engineering (SE) projects/products did not see the light, not because they were badly designed or they did not finish on time, but the end user keeps changing his/her mind even in some cases at the final stage.

End users fantasy (not need) sometimes override his/her need. They like the product to do this and that, just because they like the product to do that, not they need it for their work. A big percentage of quality products suffered from **"The like" symptoms.**

Our research looks at the current market of Information Technology (I.T.) and in particular the Software Engineering Development (SED). The software engineering market is extremely large with areas such design, implementation, support. This study is, therefore, limited to examining the software engineering using the first stage of the Life Cycle i.e. End-user requirement stage.

The software engineering market has many different methods of design including life cycle, prototyping, and recently object-orientation (OO). Many companies jumped on the bandwagon and are still experimenting with the later.

The study also researches the software engineering process (SEP). This includes looking at the established theories and testing hypotheses. Our study looks at both education and industry, but concentrates on industry.

Quality software is essential today if a company wants to maintain its competitive advantage, it is crucial to stay a head in technology by using easy and reliable software.

In certain cases, quality software on its own is not good enough if it is not backed-up by training. Training is essential today if a company wants to maintain its competitive advantage. Therefore, it is imperative to make use of this technology to train end-users to gain the optimum value.

The playing role of software engineering in information systems is rather big. It is not difficult to find examples of this. In some ways the situation is not surprising as sheer volume of information available to the software engineer makes it difficult to find relevant details. The transfer of the best practice from one project to another is a difficult and frequently neglected activity, but it is a key part of maintaining competitive advantage.

The research will also explore the quality and reliability of software issues, as well as the software development, user interface with the software developed and under development.

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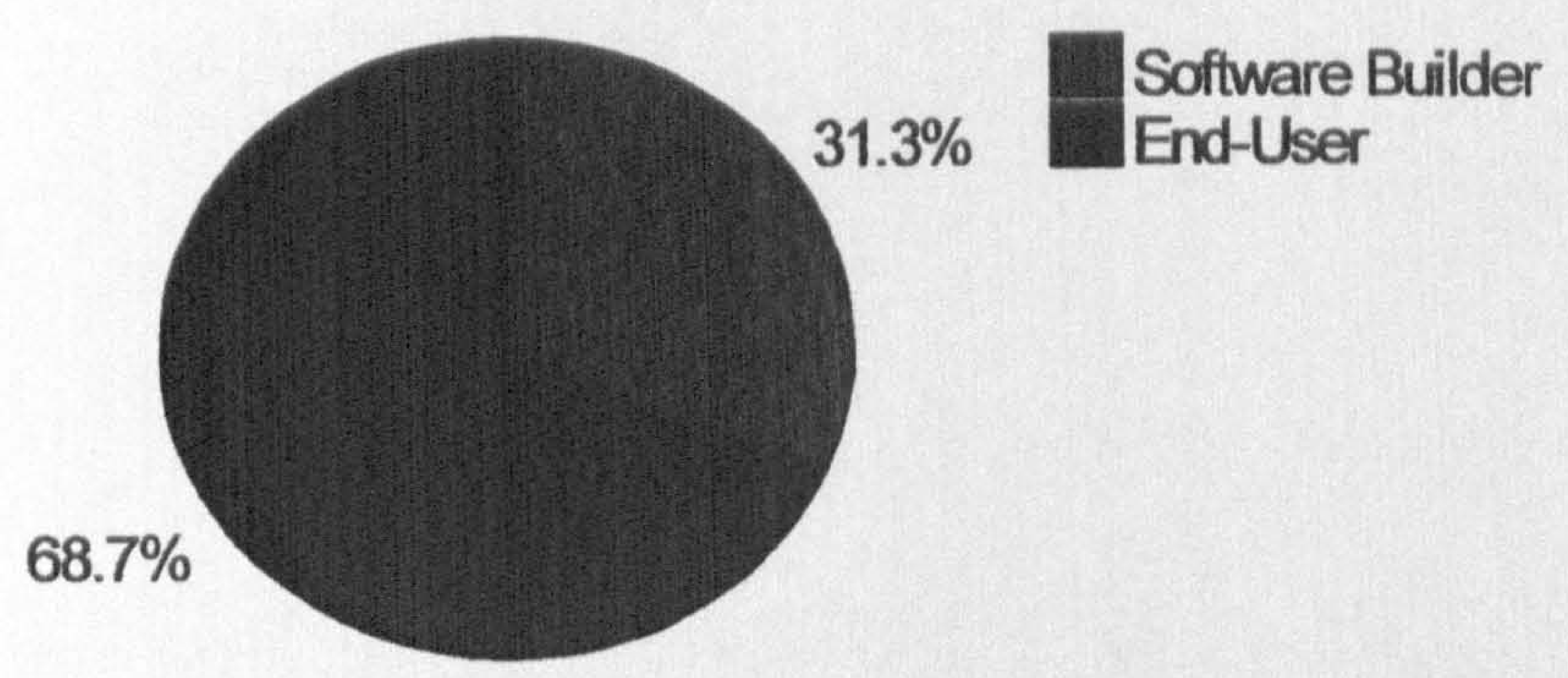
Some images distorted

APPENDIX G: TABLES DESCRIPTIVE STATISTICS FOR 230 RETAILERS AND IT/IS ORGANISATIONS IN THE UK INCLUDING SAMPLE OF QUESTIONNAIRES AND INTERVIEW TRANSCRIPTS IN SPHINX FORMAT

Question 2: Questionnair type, which questionnaire is this?

Pie-chart representation of 'Questionnaire Type'



S4 & C4: What platform do you use to run your software on?

Platforms	N°. ans.	Percent.
Non -response	158	68.7%
Unix	43	18.7%
Windows	51	22.2%
Window NT	55	23.9%
Other (Please state)	22	9.6%
TOTAL OBS.	**230**	

S10 & C10: Would you prefer easy and flexible unconventional development methods during the initial requirement stage?

Unconventional Meth	N°. ans.	Percent.
Non -response	158	68.7%
Yes	59	25.7%
No	13	5.7%
TOTAL OBS.	**230**	**100%**

S12: On average, how long does a project take to be completed ?

Completion time	N°. ans.	Percent.
Non -response	158	68.7%
0 - 3 months	21	9.1%
3 - 6 months	24	10.4%
6 - 12 months	21	9.1%
12 and more	6	2.6%
TOTAL OBS.	**230**	**100%**

S13: FactorsWhich factors influence successful completion?

Code of Respondent	Factor	Frequency (Requirements)
4	Architecture and design.	
7	Availability of testers.	
8	Good IT skills.	
9	nil	
11	Good user requirement definition.	15
13	Limitation of resources.	
14	Understanding user requirements.	
15	Payment by customer.	
16	Programmer intelligence.	
17	Resources availability, Budget, user availability.	
18	Knowing what the customer wants, proper planning.	
19	Good planning.	
20	User involvement & attitude.	
21	Close customer contact.	
22	Time to market.	
23	Good planning + req. specs.	
24	Good planning & reqs.	
25	Level of resource, accuracy of spec.	
26	Time constraints	
27	Sucsess or failure depends upon who youo ask!!	
28	'Buy-in' from project sponsors & senior management, Good business analysis, A solid technical platform.	
32	Market demand.	
36	Clients requirements and changing their minds.	
37	Protoype Methodology	
40	Time + budget.	

41	Reduce Planning and do something.	
42	IS09000 Certification.	
43	Management Project, Management Expectations.	
44	Clear requirements and strong management.	
45	What is success! profitable to business. Agreeing customer requirements at start and setting measures.	
46	Project management, configration control.	
47	Customer input.	
48	Preparation & understanding client's business.	
50	Detailed planning & effective estimating.	
52	Development tools, skills, methods.	
53	Attention to detail.	
54	Good analysis/design + milestone planning to measure progress.	
55	Design & understanding.	
56	Budgets corporate strategy.	
57	Planning.	
59	No risk to Business.	
60	Small/simple.	
61	Planning.	
62	Initial specification and consultancy.	
63	Good tight spec + planning & project control.	
78	Archtecture Design	
79	Communication, feedback between developers and business users through entire process	
199	Preffer use of method, and culture.	
200	Mange change and sound requirements/specifications.	
201	Proactive evaluation and requirements.	
Total	50	

S14:Failure, Which factors influence failure?

Code of Respondent	Factor	Frequency (Requirements)
7	Change user requirements	10
8	nil	
10	Platform	
11	Timeliness/Technology	
12	User changes requirements	
14	Lack of above	
15	Refusal to pay by the customer	
17	Lack of user availability	
18	Not knowing what the customer wants	
19	Time.	
20	Bad planning.	
22	Time to market.	
23	Marketplace changing, accurate response.	
24	Available too late	
28	Absence of any of the above ('Buy-in' from project sponsors & senior management, and Good business analysis, A solid technical platform and good developeer	
36	Changing requirements.	
38	Poor specs.	2
41	Dev. time, too many chiefs talking.	
43	Management Project, Management Expectations.	
44	Customer changes their minds.	
45	Not getting agreed success criteria at start of project.	
47	Lack of communication.	
57	Bad planning.	
59	Poor management, poor testing, deployment.	
60	Poor specification.	
61	Lack of Planning	
62	N/A.	
63	scope croup.	
79	Disconnect between business users, developers and testing	
201	Many implementation, technical limitation.	
Total	28	

S17: Do you involve the end-user at :

End User	N°. ans.	Percent.
Non -response	158	68.7%
The beginning	51	22.2%
Early stage	37	16.1%
The implementation stage	24	10.4%
TOTAL OBS.	230	

S18: Do you have a clear understanding of the users' business goals ?

Users' Goals	N°. ans.	Percent.
Non -response	158	68.7%
Yes	61	26.5%
No	9	3.9%
Sometimes	2	0.9%
TOTAL OBS.	230	100%

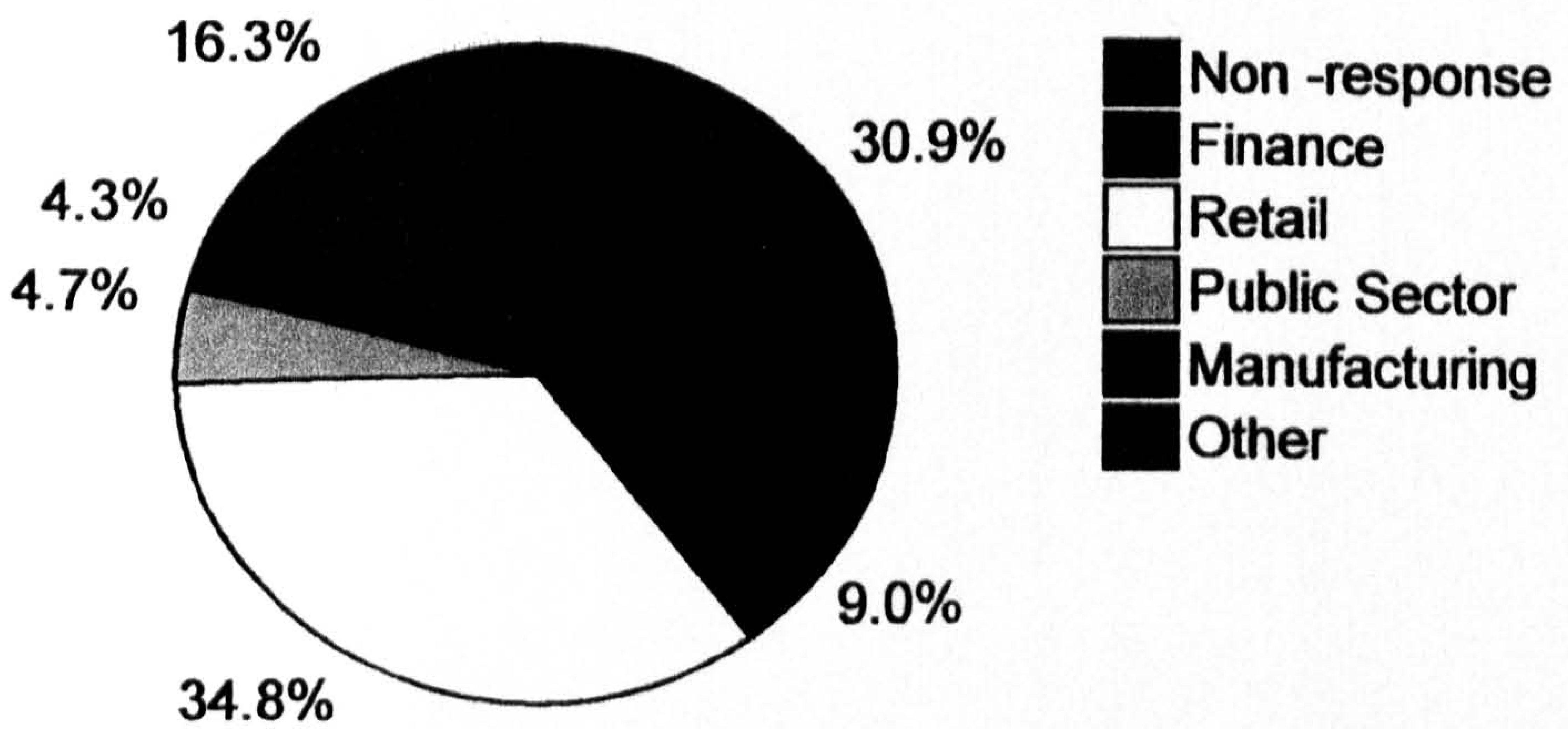
C1: End-user, are :

End-User	N°. ans.	Percent.
Non -response	73	31.7%
Working for a company	141	61.3%
self-employed	16	7.0%
TOTAL OBS.	230	100%

C3: What is the nature of your business?

Business	N°. ans.	Percent.
Non -response	72	31.3%
Finance	21	9.1%
Retail	81	35.2%
Public Sector	11	4.8%
Manufacturing	10	4.3%
Other	38	16.5%
TOTAL OBS.	230	

Pie-chart representation of 'Business'



C4 & S4: What platform do you use to run your software on ?

Software Platform	N°. ans.	Percent.
Non -response	72	31.3%
Unix	38	16.5%
Windows	105	45.7%
Window NT	74	32.2%
Other	27	11.7%
TOTAL OBS.	230	

C6: Did the produced software (final product) meet your business requirements?

Business Requiremen	N°. ans.	Percent.
Non -response	72	31.3%
Yes	116	50.4%
No	42	18.3%
TOTAL OBS.	**230**	**100%**

C6: Did the produced software (final product) meet your business requirements?If *'No'*, why?

Code of Respondent	With Whom	Frequency
5	nil	
6	nil	
68	The designed software does not match business needs.	10
70	People at MIS used to do this	
71	It does not do what we want it to do	
73	Business needs were not satisfied	
76	Lots of different systems	
87	Because it is so rigid	
90	Not all software was present	
122	It does allow duplication of data	
124	Still undergoing developments to meet user needs	
133	Windows uses American language dictionary, no company standard templates, e.g. labels.	
146	Reliability problems + differnt needs.	
148	Software vendors lied about capabilities of product. We have needed to spend huge sums on custumisation.	
167	Don't know	
173	It is now out of date.	
178	Not user friendly.	
196	Some systems not as feasible as I would like	
203	We need specifically designed software for Jewellery trade.	
Total	17	

C9: Do you (end-user) a close user involvement in the initial stages of the project is important?If *'Yes'*, why?

Code of Respondent	Reason for A Close User Involvement (Yes)
2	The user has an interest in the project's success.
5	The users can outline-give valuable opinions on product
6	Understand use/purpose.
64	So as to tailor the system to meet your requirements
65	IT projects most have business ownership
66	Avoids time consuming Alterations later.
67	To ensure accurate specification of applications.
68	To know if the software fits business needs
69	The project is important to the business
70	To know the system in depth
71	To follow the development
72	So to allow user input
75	They are the people who use what is to be developed. There input is important
76	Get the design correct
77	Ensure accurate business requirements are captured
80	The requirements of the problem is more disctinct with the user.
81	Because it helps, give chance for the users to get use to it
82	So as to ensure users satisfaction
83	Good to identify individual user need
84	Enable the user to ask questions
85	To be involved in the design of the system
87	Because software is suppose to meet our needs
88	It enables the project to match customers' requirements
90	So you know what the user requires
92	To clear or to understand properly
96	Overcome information requirement gaps
97	To get the perfect struture and cycle of project
101	To tes the system for errors
103	Make project more effective
104	Better understand the project
111	For user inputs and preference
112	Because they are the ones to use the system
113	Tailor the software to the need of user, to get user commitment
114	It's easier to find out what we require
115	Because the system should be relevant to them and workable
116	To ensure all requirements are identified
118	To deal with problems as and when they arise
119	To ensure a satisfactory end-product
120	To meet requirements

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175	It helps define the exact requirements of the project.
176	As it is important to define the criteria from the beginning.
177	End results are more useful, relevant means reliability.
178	As user is the one that has to use system
179	To save time to match system design to needs.
180	Able to clarify needs of your system.
182	To build up trust with users
184	Helps understand what it's about+ waht it is for.
186	To help define business requirements.
187	So that the final software meets the specific requirements of the customer.
188	So that all user needs can be met.
189	Better satisfaction, easier to use.
190	To get system to meet business requirements.
191	Getting the software right.
192	Success
193	Critical for identifying specific requirements
194	To fulfil requirements.
195	To have a clear understanding of user goals.
196	To meet our requirements.
198	Helps to identify requirements
204	Put you on the right track
205	Correct scoping +fot to process/ with flow
206	Final software meets requirements closely
207	To detail exactly waht the company needs
208	Users must buy into and own the project
209	Clear understanding of the system.
212	Fit purpose.
214	To sort problems.
Total	

C9: Do you (end-user) a close user involvement in the initial stages of the project is important?If *'No'*, why?

Code of Respondent	A Close User Involvement (No)	Frequency
73	satisfy business needs	
86	He/she may become disappointed too early	2
108	Get bogged down in retail	
171	So that if modifications are need to be made, they are well designed.	
Total	4	

C11: Business related : Rank in terms of importance for choosing software : very important = 1, important = 2, not important = 3.

Business Related	N°. ans.	Percent.
Non -response	72	31.3%
Very important	110	47.8%
Important	41	17.8%
Not important	7	3.0%
TOTAL OBS.	**230**	**100%**

C13: How many business software projects were *on time on budget*?

On-time - On budget	N°. ans.	Percent.
Non -response	73	31.7%
less than 13	143	62.2%
from 13 to 27	9	3.9%
from 27 to 40	2	0.9%
from 40 to 53	2	0.9%
from 53 to 67	0	0.0%
67 and above	1	0.4%
TOTAL OBS.	**230**	**100%**

Minimum = 0, maximum = 80
Sum = 1028
Mean = 6.55 Standard deviation = 9.61

C13: How many business software *projects did not complete on time and on budget* over the last 10 years?

Not on-time - on bu	N°. ans.	Percent.
Non -response	74	32.2%
less than 17	154	67.0%
from 17 to 33	0	0.0%
from 33 to 50	0	0.0%
from 50 to 67	1	0.4%
from 67 to 83	0	0.0%
83 and above	1	0.4%
TOTAL OBS.	**230**	**100%**

Minimum = 0, maximum = 100
Sum = 481
Mean = 3.08 Standard deviation = 9.25

C14: Did you (End-user) abandon a software project?

Abandon project	N°. ans.	Percent.
Non -response	72	31.3%
Yes	46	20.0%
No	112	48.7%
TOTAL OBS.	**230**	**100%**

C14: Did you (End-user) abandon a software project? If *'Yes'*, why?

Code of Respondent	Reason for Abandon a Software Project (Yes)
5	nil
6	nil
65	Business redirection.
76	Software did not work, we may restart
129	Lack of confidence in software house in understanding of our business requirements
146	Did not fit requirements
149	User specifications changed. Development not done to spec/spec mis-interpreted.
151	Did not progress to spec at all.
154	It did not integrate with bank software.

155	Too complex
178	Changed to a new system-corporate standard
179	User needs change.
187	HR technology upgrade.
189	Failed to deliver.
191	Need changes.
193	Too wide a slope.
209	Does not fit business requirements.
212	Did not satisfy business needs.
220	Did not fit business needs.
221	Complex and friendly

C17: Were you involved in the project at, the beginning, early stage, the implementation stage?

Project Involvement	N°. ans.	Percent.
Non -response	73	31.7%
The beginning	57	24.8%
Early stage	47	20.4%
The implementation stage	77	33.5%
TOTAL OBS.	**230**	

C18: Do you think that the software engineer concentrates more on IT aspects rather than the business goals?

Software Engineer	N°. ans.	Percent.
Non -response	74	32.2%
Yes	119	51.7%
No	37	16.1%
TOTAL OBS.	**230**	**100%**

C19 & S19:Do you want a copy of the summary of statistics?

Summary Statistics	N°. ans.	Percent.
Non -response	124	53.9%
Yes	83	36.1%
No	23	10.0%
TOTAL OBS.	**230**	**100%**

APPENDIX H: CODED QUESTIONNAIRES IN SPHINX FORMAT

BEST COPY

AVAILABLE

Some text bound close to the spine.

Software Engineering

...ware Builder and End-User Questionnaires - Combined

...tudy Number

...response must be between 1 and 999.

Which questionnaire is this?

Software Builder ○ End-User*

...o question 27.End-User for value labels marked with a ''*

...oftware Builder - Are you -

○ Working for a company ○ freelance consultant

What is your job title?

○ IT Executive ○ Project Manager
○ System Development Manager ○ System Architect
○ Analyst/Programmer ○ Software engineer
○ Other (Please state)

Do you play a role in software engineering?

○ Yes ○ No

Which platforms do you use to run your software on?

☐ Unix ☐ Windows ☐ Window NT ☐ Other (Please state)

...dicate the response by selecting one or more value labels

How many different software development methods do you use?

...he response must be between 0 and 10.

Please specify the software development methods you use -

...Is your software development programme working?

○ Yes ○ No

...How many development staff do you have at your site?

...he response must be between 0 and 999.

...How many software engineers in your team?

...he response must be between 0 and 99.

...Do you spend too much time monitoring existing systems?

○ Yes ○ No

...If 'Yes', specify percentage of time -

...he response must be between 0 and 100.

...Would you prefer easy and flexible, unconventional development methods, e.g. SSM, during the initial requirement stage?

○ Yes ○ No

...How many projects do you personally develop per year?

...he response must be between 0 and 99.

...On average, how long does a project take to be completed?

○ 0-3 months ○ 3-6 months ○ 6-12 months ○ 12 and more

17. What is the percentage of successful projects per year?

...he response must be between 0 and 100.

18. Which factors influence successful completion?

19. What is the percentage of failed projects per year?

...he response must be between 0 and 100.

20. Which factors influence failure?

21. On average, what budget is allocated to a project?

The response must be between 0 and 10000000.

22. Is communication breakdown a problem?

○ Yes ○ No

23. With whom?

24. Do you involve the end user at -

☐ The beginning ☐ Early stage ☐ The implementation stage

Indicate the response by selecting one or more value labels

25. Do you have a clear understanding of the users' business goals?

○ Yes ○ No ○ Sometimes

26. Do end-users change their requirements?

○ Yes ○ No ○ Sometimes

Go to question 59.Summary Statistics for value labels marked with a '' or the non-responses*
Go to question 59.Summary Statistics for value labels marked with a ''*
Go to question 59.Summary Statistics for value labels marked with a ''*

27. End-User - Are you -

○ Working for a company ○ self-employed

28. If you re working for a company, how many employees does it have?

The response must be between 1 and 99999.

29. What is the nature of your buiness?

☐ Finance ☐ Retail ☐ Public Sector ☐ Manufacturing ☐ Other

Indicate the response by selecting one or more value labels

30. What platform do you use to run your software on?

☐ Unix ☐ Windows ☐ Window NT ☐ Other

Indicate the response by selecting one or more value labels

31. Are you happy with your computer system?

○ Yes ○ No

32. Did the produced software meet your business requirements?

○ Yes ○ No

33. If 'No', why?

34. On average, what budget was/is allocated to software project?

The response must be between 0 and 99999999.

How did you hear about the software developer you are currently using?

☐ From past experience ☐ Advertisement ☐ Word-of-mouth ☐ Other

Indicate the response by selecting one or more value labels

Do you think a close user involvement in the initial stages of the project is important?

○ Yes ○ No

If 'Yes', why?

If 'No', why?

Would you prefer easy and flexible unconventional development methods during the initial requirement stage?

○ Yes ○ No

Rank in terms of importance for choosing software - Goodwill of software house

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - Software performance

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - Business Related

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - Brand of Software

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - Reliability

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - Help (incl. on-line help)

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - User Friendly

○ Very important ○ Important ○ Not important

47. Rank in terms of importance for choosing software - Efficiency

○ Very important ○ Important ○ Not important

Rank in terms of importance for choosing software - Documentation

○ Very important ○ Important ○ Not important

49. How many successful software projects were 'on-time' and 'on budget'?

The response must be between 0 and 99.

How many business software projects did not complete on time and on budget over the last 10 years?

The response must be between 0 and 999.

51. Did you abandon a software project?

○ Yes ○ No

If 'Yes', why?

Have you been aware of IT limitations during the initial requirement stage?

○ Yes ○ No

In your opinion, is continuous communication between the user and the software engineer important?

○ Yes ○ No

55. Why?

56. Were you involved in the project at -

☐ The beginning ☐ Early stage ☐ The implementation stage

Indicate the response by selecting one or more value labels

57. Do you think that the software engineer concentrates more on IT aspects rather than the business goals?

○ Yes ○ No

58. Do you sometimes consider out-sourcing in your software development?

○ Yes ○ No

59. Do you want a copy of the summary statistics?

○ Yes ○ No

60. Your name -

61. Phone Number -

62. Address -

APPENDIX I: IMPORTANT, REALTED RESEARCH ISSUES AND TOPICS TO CHAPTERS

Chapter 1

• Justifications of The Research Study

Our research work will look at theories and models of ER, with special emphasis on how these might lead to the development of better ER tools; requirements elicitation and evolution techniques; the interaction between system requirements and business processes and its impact on business process reengineering; conceptual modelling and requirements definition techniques and their role in analysis and validation; non-functional requirements and design rationale; the impact of system architecture on RE; cultural, political and organisational issues that impact requirements engineering practice; insights into requirements engineering practice drawn from practical industrial-scale ER cases. Our study takes a conceptual, applied, and practical focus. Case studies and reports on lessons learned in practice especially in the retail organisations in the United Kingdom. In addition, other European contacts in countries across Europe and from the rest of the world contributed their lessons and shared their knowledge to reach the next higher level of software management professionalism.

The rapid changes in business trends are driving both small and medium-sized enterprises, and even larger enterprise IT users, to find a better approach (KRF). For those companies focusing on their core business competency, the chance to outsource their new generation of IT applications to a professional provider is proving extremely attractive. The KRF approach differs from the traditional earlier wave of IT, in which, typically custom build applications, host/legacy platforms were transferred to outsourcers like EDS, and IBM for example on long-term contracts. Large information system development and recent "dotcoms" initiatives continue to fail at an alarming rate (Computing, 2000a & 2000b; Glass, 2001; Mohamed, 2001).

• Research Study Aims and Objectives

In their editorial essay, Daft and Lewin (1993) urged the researchers to pursue new avenues in search for theories and practice for the new organisation forms. They believe that the new research should be directed towards understanding the wide variety of different factors associate with business/IT change from an emergent perspective, hence the development of theories and best practice to understand the underlying relationships of business and technology to sustain organisational change. In addition, we see all requirements specifications to be inherently political due to the need to establish stable human communication networks involving both social and technical elements through successful engineering (if the network is not stable the system fails!).

- **Background**

Information technology systems (ITS) have brought about many changes in organisations (especially in retail organisations) and quality of life that affects us directly as individual or indirectly as members of the Society. The need to have fast and efficient information on products and services is crucial to our socially conscious and technology dependent society.

Tesco and Sainsbury have an extensive customer base and strong brand image (Finch, 2004; Neill et al., 2004). Tesco, Sainsbury, Abbey National, Nationwide, Barclays and Natwest are not tied by the costs of maintaining outdated computer systems and extensive structure of networks due to their high annual turnover (Cameron, 2002). In response to these ongoing changes, the retail sector is undergoing significant structure adoption. Recent mergers and acquisitions include Wal-Mart and previously Lloyds of TSB and Cheltenham & Gloucester building society. In doing so, the research study strive to develop an integrated framework. To describe and explain the process of adopting and achieving smart requirements.

- **The Research Methodology**

Since a major chapter of this thesis is to identify the efficiency of future ITS such as establishing "smart requirements", it was necessary to find sources that were recently updated, which it was difficult to find at the beginning since no one would like to admit failure. The search through the World Wide Web (WWW) has lead to the finding of many interesting information which was writing about various perspectives of ITS including problems covered a wide range of subjects such as critical success factors (CSF) and market forecast.

- **Reasons and Motivation for Selection of This Particular Research**

In many cases the blind adoption of technology, combined with technical confusion and lack of IT business related planning, has led information system decision makers to acquire and buy unneeded and unsuitable information technology systems. Which could cost organisations dearly. There is a great gulf between the appropriate and the actual in the business application deployments of mainstream enterprises. For example, the overspending of the dotcom area, such as the concentration was on technology issues (Mohamed, 2001). ITS should be business-led and business-focused applications. Business organisations should invest in a vastly more flexible, multi-layered ITS applications, which will allow them to deploy simple and powerful business applications as projects demand.

Many of the hard and soft ITS methodologies are by far the most widely deployed in the retail sector, see Chapters 2 and 3. Therefore, it is pertinent to understand how the Knowledge Requirements Framework (KRF) works, how to improve on what is known in the IT/IS literature, and what steps to take in order to maximise the success of a system. Much successful information technology systems have been launched and produced in the United State of America (Gupta, 1996; Laudon, 1996) and in the United Kingdom every month (Watson, 2003b; Nash, 2003b, Watson, 2005), every year and since the computer age, but the rate of failure is still staggeringly high (PASE', 96; Brun-Rovet, 2002; Computing Staff, 2003; Burns and Adams, 2005; Tait, 2005; Morris, 2005). According to a report submitted to the House of Commons Public accounts Committee, an overspend of £60 million was the cost of project overruns (National Audit Office, 2000a and 2000b). Un-revealed, higher figures (an estimate of hundred of millions pounds yearly by the independent IT body is a modest) occur due to failed software projects including abandoned projects due to their huge costs and passed deadlines. Over the past ten years, more and more information technology system (ITS) projects in the UK (Gubbins, 2002) and worldwide have either suffered from glitches (teething problems) or failed (see Appendices A, B and C). Several approaches and methodologies (hard and soft) have been used in the building and the implementation process of these systems. We consider the requirements stage as a major factor in system development process, many IT systems are successful in delivering what they intend to deliver but others are not. A different approach to capturing business requirements is needed to enhance the current available approaches and methodologies. The knowledge requirements framework (KRF) is an approach which will be referred to throughout this thesis, the term KRF will be consistently used to serve the concepts of filtering, mapping, and capturing agreed requirements and recognise the need for radical (in terms of getting the requirements right first time) incremental and continuous improvements through the initial stage (requirements) of the system lifecycle process. This view has been applied in the total quality management (TQM) area (Abraham et al., 1999; Mumford, 1999; Peled, 2000; Schonberger, 1994). Crosby (1981, 1984b), Deming (1986, 1993), Juran (1982, 1989); and Juran & Gryna (1988) are the most popular and well-cited authors on quality scene. Other authors that are likely to be quoted throughout this thesis are Ishikawa (1983, 1985a, 1985b) and Taguchi (1986a, 1986b).

The research undertaken will show that a combination of various aspects of organisational structure, professional culture differences, diversity of knowledge (tacit business knowledge and tacit technical knowledge), and mismatch of understanding can lead to sabotage change to potential new technologies in the major retailing sector (Rigby, 2004b). The specific nature of the factors contributing to the success of new ITS projects in the retail organisations studied, and the relationship between each of these factors, was not apparent at the beginning of this study, but became clearer as the research developed and progressed. Analysis of the empirical material collected suggests that diversity of knowledge, and a lack of understanding between the two parties, i.e. the customer and the system developer are major contributing factors to the high rate of ITS failures, budget, and time overrun (Boar, 1994; Computing, 2003).

- **Novel Contributions**

The most important finding highlight from our research was the establishing of many gaps between non-IT business and IT in the retailing sector (Rigby, 2004b). These gaps include, different knowledge, different understanding of what is needed of the new ITS, different expected requirements. Our focus on bridging these gaps as the key in avoiding ITS project failure. System developers have neglected the Business requirements as the main source and the key to ITS success because if they did not accommodate in the design of a system it would be a failure no matter how technically brilliant (Shillingford, 2004). They concentrate on budgets and deadlines. Also, requirements is an abstract concept difficult to define for specific projects. The task of clearly identifying business requirement is not an easy one. Business requirement process is a sociotechnical problem. Many ITS were seen to be failing due to not recognising the fact that requirements are not techie issues. The sociotechnical side of the requirements was not addressed by traditional hard systems analysis approaches, which concentrates on functionality. Soft system analysis on the other hand attempted to address these problems by means of new techniques such as stakeholder analysis, root definition and rich picture.

This research is to improve the way government and private handles IT projects (Cross, 2002; Gubbins, 2002). The problem of glitches, failures, time and budget overrun affecting information technology system (ITS) projects has engaged the interest of researchers and practitioners over the last 50 years (Gubbins, 2001; Felsted, 2003; Nairn, 2003). However, most work has focused on developing new methodologies rather than looking at the heart of the problem (Avison and Taylor, 1997; Avison and Fitzgerald, 2000; Gelenbe, 2000), i.e. requirements stage (Arnott, 2003c). We believe that there is not an easy answer or a silver bullet to the above questions. But we can say that there is a need for the professional people who work to bridge and translate between business needs and IT; and who understand business, users and IT. The road we followed to find the answer to the above was not easy, as we expected! The above finding were proceeded by many questions, such as:

• How does IT ensure that it really delivers tangible benefits for the business in retail?

• How can it and the business develop a stronger relationship?

• How do IT and business support narrowing these gaps?

• How we can provide a business case for bridging the gaps?

This research study reports on an experiment in the development of the information systems in the retail sector to reduce the number of requirement defects (unclear and incomplete). We analysed the present defects in a real-life situation and estimated the likely effect of prevention techniques and approaches such as Venn diagrams (Sommerville and Sawyer, 1997; Burke, 1999), set diagrams, "rich picture" (soft system methodology), and fishbone and Fishbone. This approach was tried out in a new development project in the two organisations (one is a large retail organisation and the other is one of the big banks) in addition to, many workshops during which managers (professional students) tried them out in their organisations. Although new to the retail organisations, KRF is a novel combination of techniques that studies the customer (end-user) requirements better, make early prototypes of the user interface using the three techniques mentioned above, and test them for usability. Due to the new approach, there was no doubt about achieving smart requirements, and as a result, the project in an organisation completed on time and without stress. Complete, adequate, and agreed requirements have improved drastically the requirements process, and as a result the information technology system met customer requirements on budget and on time.

Our research covers the following areas:

• Information technology system failures.

• Requirements engineering (RE).

• The knowledge gap (KG)- Tacit business knowledge (TBK) and Tacit technical knowledge (TTK).

• The understanding gap (UG).

• Building knowledge sharing process- explicit agreed business-techie knowledge.

We believe that the areas our research contributes to, are as follows:

• Improving the understanding of the information system development process.

• Information technology system failures.

• Knowledge sharing (not transferring of knowledge).

The various explanations for the KRF approach that have been introduced in this research study will be assessed in the context of experience of new ITS projects in the case study retail and banks (Fifield, 2004; Glick, 2004c; Watson, 2004). It is evident that there is a need to consider a more theory building mode using the process theory approach recommended by Markus and Robey (1988). A process theory approach is chosen because it has a longitudinal perspective. Yet, developing an ITS is a process that takes a long time and depends on the size and complexity of a project from its initiation to its testing/implementation. Moreover, process theories are stated in amore flexible form that is less restrictive and more aware to the complex relations in the business context. Thus, a process theory is a more useful and applicable type of theory for understanding the effect of ITS on organisations.

• Point of View -System Glitches and Failures

For the past few years many case of glitches and failures of the public sector have been reported in the press but not many private sectors glitches (Poston, 1998; Nielsen, 2001) and failures mentioned. This is due to the fact that the public sector touches the entire nation while cases of the private sector kept quite as not many of them would like to admit failures (Fielding, 2003). Government IT projects have too often missed delivery dates, run over budget or failed to fulfil requirements (computing, 2003). According to Arnott (2003), the amount of money wasted since 1997 on cancelled and overrun projects is £1.5bn. The Government passionately believes the information society should benefit everybody as John Battle (Harvey, 1997) the Minister of State for Industry, Energy, Science and Technology (DTI) at the time stated that:

"We want to see the new technologies being used as a tool for building social cohesion, at a local, national and international level."

There is a continuous debate on the effectiveness of different ITS methodologies due to the reported rate of system failures (Appendices A, B and C), almost two third (Hammer and Champy, 1993) associated with such initiatives. Many authors including practitioners provide conflicting guidelines, which sometimes based on single or fragmented case studies, on the success of certain methodology. This means that system development practice remains problematic and lacks the unavailability of tested integral theory and this should make the case for a need for such type of KRF approach.

- **Point of View -Requirements**

Capturing, understanding and managing complex business customer requirements is an essential processes in information technology (ITS) development projects. Managing evolving requirements is very important to the progress of building an ITS. Requirements is a complex issue. It includes the following or related activities:

- Capturing and validating user requirements.
- Bridging the communication gap between users and system developers.
- Management of an evolving system specification as a result of changing requirements

- **KRF: Support for User-Developer Communication**

KRF is a flexible management and IT framework which neither need to create a new system development methodology nor replace an existing methodology. KRF fill a gap in the way requirements has been dealt with. It is a simple idea that many system developers and software engineer did not take the time to deeply think about it. This research brings together researchers and practitioners with interests in processes of communication between users and developers in information technology systems development and diagrammatic representations which may be used to support this communication. The research work will address topics about which users and developers may wish to communicate include:

• the user tasks.

• requirements for systems to support the users work.

• envisioned system designs.

• usability and acceptance evaluations.

User-developer communication often relies upon external representations of the above topics (Osman, 2004). In addition to supporting communication about these foci of the systems development activities, the representations must (often simultaneously) support the development activities themselves, aiding communication amongst the participants about the ongoing activities. In fulfilling these roles, multiple representations are often used in combination and in series, demanding frequent transformations between representations.

KRF technique based on a workshop-participants, participants will tackle a set of related questions such as:

• What features of user-developer communication can or should be supported by such representations?

• What properties of a representation contribute to making it an effective communicative aid?

• Which forms of representation exhibit these properties and in which contexts?

• How are representations transformed in the course of use for communication?

• What relations are there between effective representational support for communication within user-developer Cupertino and for communication outside those collaborative activities, e.g. in communicating the results of their work to system implementers or others who may not have participated in the creation of the representations?

The workshop discussions between user-developer shall provide initial answers to the above questions, identifying gaps in our current understanding of the communicative role of representations in systems development and laying the groundwork for a research agenda to produce further answers to these and other questions which arise through the discussions. The workshop discussions should also lead to recommendations for the selection and use of a range to support user-developer communication in systems development practice. This in turn should lead to proposals for technologies to support communication through representations.

The prevalent view is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. This Current research work includes stakeholders' rights and responsibilities, the specification and reuse of requirements and techniques for assessing requirements specifications. The product of this research is a complete requirements process for assessing requirements quality, and for specifying business requirements.

- **KRF: Support for User-Developer Communication**

Engineering and managing requirements is the process of determining a complete, correct and clear specification of a future software-intensive system from the incomplete, inconsistent and ambiguous statements of need from stakeholders as diverse as end-users, managers and members of the public, including people who are eliciting, writing, supplying, managing or testing requirements: project managers, requirements engineers, systems analysts, business analysts, software customers, quality managers. Whereas conventional/formal approaches (methodologies) focus on models and languages to express system specifications, there has been a recent shift towards a focus on engineering requirement processes (ERPs).

- **The Thesis Focus and Research Areas**

The retail sector occupies an important position in the UK economy, and lessons can be learned from the case studied which might have relevance in a wider context than is usually provided by concentration upon one specific sector.

- **Focal Theories of This Thesis**

This chapter has described many theoretical research that have been taken on the natures of information technology system (ITS) failures and technological change (Smith, 2000; Barnes and Hunt, 2000). This research study stems from theories and approaches of different subject areas including information technology (IT), requirements engineering, soft system methodology (SSM), sociotechnical, management science, total quality management (TQM), knowledge management (KM), political, and human studies. This thesis argues that the failures of many ITS attribute not only to the poor performance of an IT Department, the unclear role, and improper use of ITS but mainly to communication breakdown between the IT Department and non-IT Departments (business Departments) in identifying new ITS requirements.

The scope for human influence was also highlighted in the discussion our framework (KRF) as a process, whereby opportunities for intervention and negotiation by management to influence outcomes exist at a number of distinct stages over time. Again, this concept will be drawn upon throughout the research study. The human influences and involvement in the development of ITS are difficult to measure in the conventional sense of productivity improvements, but the issues can be illuminated by both quantitative and qualitative study of detailed cases that interpret productivity in a broader sense than is conventionally found. The focus of this research study is upon analysis of empirical data from the retail and the financial sector, with the objective of identifying particular ITS features which either inhibit or facilitate ITS projects success (Coopers, 1996; Renkema, 1999). It is hoped that the analysis of these cases can inform the wider theoretical debate about the reasons for the existence of the ITS productivity, and that practical lessons can be drawn upon customers and system developers to successfully guide the initiation of future new ITS's requirements.

• **The Concept of Originality**

According to Phillips and Pugh (2001), that there are different definitions of originality that are acceptable, see chapter 3 -section 3.13. This PhD thesis might fall in the four definitions mentioned by Phillips and Pugh, these are:

1- Having many original ideas, methods and interpretations all performed by others under the direction of the postgraduate.

2- Being cross-disciplinary and using different methodologies.

3- Looking at areas that people in the discipline haven't looked at before.

4- Adding to knowledge in a way that hasn't been done before.

Clearly, the acceptance of any definition and role for ITS which acknowledges organisational constraints on the development of new ITS implies that the chance of success can be enhanced by appropriate and effective communications between customers and developers rather than adherence to a particular methodology or model.

- **Conclusions**

The following chapters present and discuss practical results from improvement projects in industry, focussing on the benefits gained and the criteria for success. By investigating the reasons why ITS projects in the retail sector have run their budget and time. According to Bennett (2001), a recent research by Benchmark Research, organisations are losing over £6bn a year due to ignorance of ITS costs. Some of them are even failed to meet business needs (McCue, 2002c) and expectations, this research study will address the issue of whether UK retail are equipped to sustain their roles in the new global market through the use of technology. We are educating customers and system developers to use tools that enable these groups to interact.

Freeman (1989) mentioned that technological development processes were passive enough to participate to "techno-economic paradigm", once enough time was allowed for necessary and in certain cases major social changes to catch up with technological advancements. Information technology systems had the potential to accelerate knowledge and skills of co-workers too. By this, significant improvements could be made to business, provided the ITS were designed with the input and participation of all the customers/users (IT and no-IT managers, and non-mangers) involved.

Chapter 2

- **Introduction**

The current market of Information Technology (I.T.) and in particular the System Development (S.D.) is extremely large with areas such design, implementation and support. Many different approaches of ITS development exist in the market such as the lifecycle, Rapid Application Protocol (RAD), prototyping, and recently object-orientation (OO). Many organisations jumped on the bandwagon and are still experimenting with the later.

CRM suffered from failures too, organisations in the early days went for complex CRM, the industry hits by a massive succession of failure and disappointments. In a survey by IBM consulting Group of 373 senior managers worldwide, fewer than 15 per cent consider their

CRM initiatives as a success, 20 to 30 per cent believes they have limited success and the rest are struggling. Despite this depressing result of the above survey (Everett, 2004), according to Ed Thompson, a CRM analyst at Gartner Europe, "there is much optimism; people are putting the nightmare of the past behind them and are becoming more realistic in their expectations". Jim Beagle, chief executive of consultancy Extraprise's international Business, also believes that things are improving steadily, because "organisations are adopting more considerable approach to projects, people are no longer doing unnecessary mega projects that do not drive values, instead they are focus to drive benefits into specific areas and handle specific business requirements". Harnessing the power of IT is not always easy. The recent downward trend in global economies has increased the focus on many approaches and techniques to get the best of customer data and information. Customer Relationship Management (CRM) and Knowledge Management (KM) applications can be used in mining smart requirements in the same way where customer and consumer data is mined for every last byte of value. The tasks involved are very complex and fraught with risk. Private and government have already successfully implemented a range of complex projects (Ranger, 2002e). However, we still need to improve performance and avoid the mistakes of the past.

Systems upgrades counted to one-third of ITS implementation failures in the last two years (Fielding, 2004). Only 11 per cent of the financial organisation and the public sector in the UK test ITSs at the upgrade stage, leaving themselves vulnerable. The IT services LogicaCMG who conducted the research study indicated that IT Directors blame time and budget limitations for forcing them to cut corners during the implementation process. Also, senior IT mangers lack of understanding of the implementations of not testing is stalling investment. Many system developers let the customers do the testing, which we believe is not acceptable. This research aims to produce that improvement. It sets out a package of measures to help us deliver effective modernisation through IT. Putting them into practice will require commitment across Government, as well as from our private sector partners, and I am confident we can succeed in improving the system development process.

- **Problem Definition: ITS and Requirements**

It is a matter of great satisfaction to us that the applied ITS area has been enriched both in theory and in practice by the contributions of those in the fields of hard and soft system methodologies, and by experiments to improve the quality of designed systems (Oakland, 2003; Oakland, 2002; Oakland, 2001). We quote Lewin's dictum that "the most practical thing in the world is a good theory" which has been practiced in its fullest sense by sociotechnical system innovations. Our research is a witness to the fact that the applied ITS, e.g. soft system methodology has made significant progress in contributing to organisational change strategies and that experiences in soft systems have provided a particularly viable agenda for the future of organisational change. The soft system methodology (see the Ambulance case study in Checkland, 1998) is so full of success stories that continues to generate enthusiasm among both academics and business practitioners. However, in the case of ITS in retail's strategy for information one really needs to look at the stated goals. These are very introverted. At no point does Information for retail consider that its strategy should be supporting or facilitating the provision of better retailing policies to all groups of British society and the stated critical success factors do not give any indication that they are connected to the provision of service to customers. Indeed one could assume that information itself was the cure. However, the problem is not as great as in the public sector (see Appendices A & B -cases of failures; and Parker, 2002) where the success rate of ITS projects is some of the worst in both sectors. With regard to the public sector, the government task forces have suggested that better project management might help address some of the problems and have recommended better training in this area (Parker, 2000).

- **Focus Upon Automation within Existing Structures**

Research carried out by Fincham et al. (1994) in the retail and banking sector found that organisations had concentrated their ITS strategies upon the automation of existing processes to reduce costs, and also in copying the models set by their major competitors, rather than focus upon innovation and business transformation process. As a result, the traditional structures, functions and priorities within the above organisations still remained largely unchanged. The authors concluded that technological change was (evolutionary) rather than (revolutionary) in nature. For example, home banking, e-banking and e-shopping using a computer link have been hailed as the delivery mechanism of the future since the early 1990s, but both banks and retailers have been slow to develop there potential. To date e-banking and e-retailing remain very much a niche market in the UK, effecting only 0.3% of retail customers (Graham, 1997). In fairness to these organisations, he noted how progress has also been restricted by external concerns such as security issues, and by a luck of IT skills amongst older segments of the customer base. Hackett (1994) explains that tendency to replicate existing processes when introducing new ITS reflects a general antipathy towards change and a preference for the security of familiar and established routines. Similar findings were reported by Pennings and Harianto (1992).

The degree of interest in forging connections between studies of work practices and the design of technology to support work was highlighted by the level of interest shown in a recent events held by the British Computer Society (BCS) special group namely "The Requirements Specialist Group (RESG). This includes, 1) theories and models of work, moving from work studies to system requirements, 2) artefacts and the distribution and co-ordination of work-moving from work studies to system requirements, 3) representations of work and representations at work, and 4) engaging users in moving from work practice to design.

- **The Role of Knowledge in a Retailing Organisation**

Access to customer information will be a significant factor in the competitiveness of a retail organisation over the coming years. Empowering employees with the right information for daily tasks, in a user-friendly way will radically improve their effectiveness and productivity.

Knowledge will probably have the most far reaching and profound effect on how retail organisations work in an era where the access to information plays a significant part in the competitiveness of an organisation. Delivering knowledge to employees will enable them to perform their business tasks and provide a huge opportunity for the retail organisation they work in to improve customer service and productivity. In any company, information is held that in various formats, some in databases, but most in electronic files, emails and other unstructured sources. Using a standard desktop screen, ITS is able to deliver information from all these sources to empower employees in retail for decision-making. It is important to understand the types of information within the retail organisations which includes: business data - discrete facts from external data and core business, information - semi structured content such as emails, documents, voicemail and multimedia, knowledge - experiences, ideas, insights and values of individuals. Managing these knowledge assets create a dynamic, innovative and agile organisation. Without managing them, information is lost, lessons are not learnt, work takes longer and trends go unnoticed. Implementing a knowledge management strategy needs an in depth knowledge of both the business needs of an organisation, and the underlying technologies.

In brief how to implement a knowledge management strategy, the business issues, and how to use the technology to improve competitiveness.

- **Other IT Applications**

The application of the electronic-point-of-sale (EPoS) systems are something that all retailers very proud of, because the logistics of such a system is incredible, as it is not easy to manage their stock and customer needs with out such a system. Other ITS applications which many of the large retailers implemented are, in store supply chain systems, enterprise data warehouse, "chip & pin" point-of-sale, retail labour management, self-checkout systems, online store innovation, replace IT systems with package based on standard architecture. The aim of such systems is to reduce systems operations cost and create fundamentally more effective partnership between the business and IT developers.

Most retailers do not have to get information technology systems in on time and to business requirements and technology specification, they also have to make sure that all the other enabling change happens as well. This is not an ITS project, it is a business transformation programme, and that is such an important distinction.

To summarise the argument presented so far, the implications of developments in ITS have been considered to be so pervasive that the retail organisations eventually think that technology could facilitate a new wave of economic growth in the UK, with attendant rewards for its protagonists. . In the process, claim supporters, traditional and established business (bricks-and-mortar) organisations are likely to be rendered obsolete. For example, Forester (1985) described how developments in technology have acquired a "revolutionary tag", thereby representing the most significant change since the early days of the Industrial Revolution (IR). The current Technology Revolution (TR) that we are going through has led to the ambitious idea of the potential applications of technology unleashing a tidal wave of technological innovation in traditional an "e" environment with the implementation of wire and wireless communication, and have economic growth. Porter and Miller (1985) suggested that the impact of technological change could alter the structure of an industry, and in so doing introduce new rules of competition which clearly can be seen in today's retail sector. Many other authors can be mentioned who have put forward similar claims for the "revolution" impact of technology. Ranger (2002c) considered that the impact of technology on profitability, structure and activities would be a key driving force behind the transformation of the retail organisation if it was to meet the challenges of the 21st century especially the tidal wave of American retailers such as Wal-Mart and Selfridges (Thomas, 2003).

A number of significant developments could be cited in support of the argument that technology is "transforming" retail organisations. Graham (1997) and Rao (2000) presented evidence which suggests that these services are evolving alongside traditional business rather than replacing it which the recent events of the "burst .com bubble" have supported their opinions. ITS provides an opportunity to use the latest technology to help improve business and provides an appropriate structure to a business-wide communication infrastructure (Al-Mashari and Zairi, 2000). ITS can be used to enable global business opportunities and improve organisational effectiveness and efficiency by reducing time, eliminating bottle neck, providing better access to information, and improving knowledge of workers through sharing knowledge. There are several technological advances that could have strong impact on retail organisations. These include: telecommunications, bar scanning including optical scanning. Electronic Data Interchange (EDI), Tesco Information exchange (Tie)-(Nairn, 2000), e-mail, wireless communication, laptop computers, networks, expert system, datawarehousing, and PDAs. For example, EDI and Internet-based commerce provides a more efficient way of paying where funds previously took long time to transfer. On the other hand, unlike EDI. Tie appears to achieve more sophisticated two-way collaboration in Tesco's supply chain.

Later chapters of this research study will address the ITS failure and productivity issues within the context of the UK retail organisation, by considering which of the various explanations described above resonate with the examples of the case study retailers. The framework of analysis described in Chapter 5-6 has been derived from ground theoretical analysis of the technological projects studied in these retail organisations. Full methodological details are discussed in Chapter 4. Before testing the issue of the value and success of new technology projects empirically, it is first necessary to conceptualise the problem by considering in more a range of theoretical positions that have been taken in respect of the nature of technology, the failure of ITS paradigm, knowledge paradigm, and requirements paradigm which effects the development of ITS.

- **The Role of Information Technology in Business Organisations**

Before 1980s, information technology systems (ITS) and information systems (IS) had focused on computerising or automating existing process in business organisations to gain incremental improvement in speed and accuracy. In the mid 1980s, ITS and IS change its focus from a supportive to a leading role and started to gain a status as a strategic asset in business organisations. At the end of the 1980s, ITS and IS played a significant role in Europe, as organisations started to consider ITS and IS as "a strategic weapon critical to the survival and success" of a business organisation (Tomlin, 1991). Since then, it is widely accepted that ITS and IS have evolved from traditional administrative, back-office support orientation to a more strategic central role within the business organisations (Atre, 1995; Venkatraman, 1994; Venkatraman et al., 1993). However, to succeed in the implementation of ITS, a business organisation has to provide the appropriate cultural environment where IT staff are skilled and customers (users) are trained. For example, according to Tomlin (1991), in 1988 British Airways (BA) succeeded "from being one of the least popular airlines, with a year-end losses of £100 million to one of the busiest airlines in the world with a profit of £320 million". This was due to the success of the implementation of ITS in the right cultural environment where ITS and IS played a crucial role by empowering staff and users in the lower level of the organisation to make decisions using the correct information.

In early 1990s, several new system development methodologies developed to enable ITS industry and business organisations to make better use of ITS and to match business needs. Most of these methodologies are based on theories of, industrial engineering and information management (Zuboff, 1988; Tapscott and Caston, 1993). Then new approaches hard (Object-Orientation) and soft (Soft System Methodology) that borrows from previous methodologies to improve the system development procedures and in order to increase business organisational productivity, wherein ITS plays an important role, is used in building ITS, but the system failure phenomenon continues (Knights, 2005d).

Currently, there is a general understanding of importance of ITS infrastructure and system development to business organisation. Therefore many business organisations are forced to adopt extensive ITS and global ITS networks especially in retail and e-commerce ventures (Chaffey, 2004; Kaplan, 1996; Kidd, 2001; Turban, et al. 2004). Examples of such business organisations that used ITS to reinforce business organisational change including Ford Motor Company (Bradley, 1993), United's APOLLO and American Airliners SABRE (Miller et al., 1993; Copland and McKenney, 1988) and Taco Bell (Hammer and Champy, 1993). ITS can be used to enable global business transactions and improve organisation effectiveness and efficiency by reducing delays, redundant certain tasks, and providing better access to information. There are several technological advances that could have strong impact on business organisation function. These include; telecommunications, wireless communications, optical scanning, Electronic Data Interchange (EDI), e-mail, internet, intranet, and extranet (Chaffey, 2003). For example, EDI and internet (e-commerce and e-business) provide a more efficient way of paying where financial funds previously took long time to transfer (Oz, 2002; Laudon and Laudon, 2002). Interactive video-link (videoconferencing) replaces expensive and time-consuming face-to-face interaction.

In the literature of ITS, there is a lot of disagreement about the role of ITS, its importance and success in business organisations (Avgerou, 2000). The strategic potential of ITS in business organisations cannot be undermined, where ad-hoc ITS maybe an inhibitor of business organisations. Many recognise ITS as a fundamental enabler of business organisations initiatives (see for example, Katz and Townsend, 2000; Davenport and Short, 1990). They believe that ITS is an active agent of change and living body, without the right implementation and use of ITS it would result in failure. Therefore, despite the hiccups of many system development methodologies, business organisations consider ITS as one of its major contributors to success. For example, Katz and Townsend (2000) argue that ITS is no longer regarded as a mechanism for automation of a business organisation, they view "state of art IT as part of any reengineering effort". They stress that "a company that cannot change the way it thinks about IT cannot reengineer". Guha et al., (1993) considers ITS as an "essential enabler" and calls it a "catalyst", he believes that ITS has been a crucial component for many successful business organisations. However, the relationships and not the role of ITS in business organisations has not been investigated enough which is one of the issue this research study will consider. Clemons et al. (1995) and Davenport (1993) also consider that ITS impacts the preparation, and the implementation of ITS as well, they identified set areas where ITS can play an important role for major changes in the business organisations.

Chapter 3

- **Scale and Scope: Analysing the UK Retail Sector**

Using the UK information technology systems in retails as its backdrop, this chapter addresses the persistence of retail sector intraindustry heterogeneity. The chapter looks at the UK retail sector and the complexity of IS used in retail. This can be further considered by reference to international comparisons. The 'rip-off' Britain campaign demonstrated a clear misunderstanding of the relationship between price and costs and showed how headline figures could be misleading. Current considerations of international comparative productivity may well be making similar errors. It is far from clear that like for like comparisons are being made or that all the activities required are included. Extreme care needs to be taken in examining such claims and in drawing sector wide conclusions from them. British retailing needs to be understood first and foremost in terms of the economic and social needs of this country.

- **The Importance of Information Technology Systems to the Retailers**

Many retailers emphasised how ITS has developed into a strategic issues because it is used to increase efficiency, cut cost, deliver business objectives and goals, link diverse locations, streamline business processes and enhance customer services.

- **Issues of Evaluation**

Our research has concentrated on system development, specifically understanding user interface design on Software Engineering areas of study, but the choice of terminology to characterise this important domain is not an issue. The common purpose is to treat organisations and their IT applications within a unified and scientific framework, with particular reference to the huge range of issues that elude the institutionally established disciplines. This study brings together ideas and innovations, particularly with respect to the questionnaire questions of how work study methods can be used to inform interactive systems. Design. For example, moving from work studies to system requirements, artefacts and the distribution and co-ordination of work, engaging users in moving from work practice to design.

- **The Role of Knowledge in a Business Organisation**

One of the challenges for most retail and financial organisations that there is plenty of data, but no way to use all of them or to put them to use to produce meaningful information. Access to customer information will be a significant factor in the competitiveness of a retail organisation over the coming years. Empowering employees with the right information for daily tasks, in a user-friendly way will radically improve their effectiveness and productivity. Knowledge will probably have the most far reaching and profound effect on how retail organisations work in an era where the access to information plays a significant part in the competitiveness of an organisation. Delivering knowledge to employees will enable them to perform their business tasks and provide a huge opportunity for the retail organisation they work in to improve customer service and productivity. In any company, information is held that in various formats, some in databases, but most in electronic files, emails and other unstructured sources. Using a standard desktop screen, ITS is able to deliver information from all these sources to empower employees in retail for decision-making.

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- **The Role of Information Technology in Business Organisations**

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The implementation and use of ITS is often inadequate in some business organisations, due to its limitations which might result in unexpected outcomes (Knights, 2005d). Sometimes the potential of ITS is neglected during the requirements, the design, or the redesign stages especially when building ITS depends on limited financial resources without fully exploiting the business issue and the capabilities of existing ITS infrastructure. Therefore, to effectively us ITS in business organisation, its capabilities, constraints and contribution to the business need to be exhaustively understood.

- **Current Information Technology in the UK Retailing Sector**

This section will very briefly examine the main development of ITS and will the summarise the implications and benefits of adopting ITS in retail. The use of ITS especially PCs at individual store level has become viable as they have become smaller, faster, more reliable and cheaper. Closely allied to this progress has been the development of "barcode" which are standardised between suppliers, distributors and retailers. Piercy (1983) had earlier identified the main requirements of information system (IS), he also illustrated how the possession of superior information can further increase the power of retailers. EPoS systems are by no means limited to larger stores. Marks and Spencer acquired around 2,500 stand-alone EPoS, which need neither power nor communications cables, for its smaller high street stores (Retail, 1988; OXIRM, 1999). In addition to IT capabilities, successful retail organisations develop superior capabilities in managing core business processes and pricing policy (Buckley, 1994; Murphy, 1994). In turn, mastering core business processes gives these organisations a competitive advantage. One of Marks and Spencer's great strengths is its superiority in handling the inventory management and order flow process (Voyle, 2003c). It is worthwhile mentioning that Marks and Spencer, also imposes rigorous quality control on its suppliers to maintain its own quality reputation in food retailing. As individual Marks and Spencer stores sell their goods, sale information flows not only to Marks and Spencer's headquarter but to their suppliers, who send replacement goods to Marks and Spencer stores almost as fast as they move off-the-shelf (Blackwell, 1994; Field, 1997). Despite shutting down its continental operations as the UK sales surge bucked a slowdown across the channel, Marks and Spencer remains Europe's number one clothing retailer (Voyle, 2002b) and Tesco is Europe's second biggest retailer overall. Within the UK retail-supermarket chain, there were 873 stores with full-scale scanning devices at the start of 1989 (IGD News, 1989). Over 200 of these were Sainsbury supermarkets, among the non-food retailers, Boots had 180 scanning Chemists (Retail Review, 1989). According to Euromonitor (1989), the UK ranked third in Europe in terms of the number of stores that uses scanning, behind France and Germany. Recently, a number of interesting retail-supermarkets including Sainsbury are trying a self-scanning where customers used a portable scanning devises to scan items and add "rewards points" as they placed in the shopping trolley. It is worth mentioning that Tesco was the first superstore of the major UK food-stores (Asda, Safeway, Sainsbury, and Tesco) to develop and implement a loyalty card scheme in February 1995, following a one-year trial at fourteen stores. Seven months later J. Sainsbury was toppled from its long-standing number one place by February 1997. At the time, Tesco had 9 million card holders, equivalent to a 71% penetration level, Tesco have over a million more card holders than its nearest rival and sales growth rates of 8.1% in real terms (Rao, 2000; Wolf, 1997). Recently, according to Smith (2004), the Body Shop is to start trails of its loyalty which is called "love your body membership". The new card is aimed at attracting more customers as the sales drop by 16 per cent in late 2003.

In order to achieve the full benefits of inter-organisation data flows, there have been parallel developments in communication networks to allow suppliers and retailers to co-operate such electronic data interchange (EDI) an in recent years the internet and intranet play a major part in marketing on a global scale. One by-product of such advanced ITS is that it can be a major profit generator for the organisation. Internally the advantage cannot be quantified but externally the market for carefully cross-referenced data is huge. It is foreseeable that there could be a consumer backlash if retailers are not careful about how this information is treated. According to Voyle (2002a), the high street retail chain Boots will invest £130m into technology development through an outsourcing deal with IBM. Boots signed a £710m 10-year contract with IBM who will managed and deliver Boots's information systems which will save boots more than £130m over the life of the contract. Boots believes that good technology systems are a big part of retail these days as it has been stated by its chief executive Steve Russell that Boots needs to continue to invest in leading edge IT and to do so at pace, his vision built on the success of the introduction of state-of-the-art IT systems early 1980s and 1990s.

- **Recent Applications of Information System in Retailing**

This section provides an overview of certain ITS applications in retail and an insight to the complexity of ITS in retailing. Despite the economic downturn and high competition, the recent advances in the usage and implementation of Information Technology Systems (ITS) in the retail sector have contributed positively to their growth. For example, according to Buckley and Sanchanta (2002), the total sales of Wal-Mart the world's largest retailer grew 14.4% to $54.96bn (£37.64bn) with same - store sales - from stores open at least year - up 8.1% overall, including an 8.6% increase from the core superstore chain. Net income rose from $1.38bn (£0.95bn) to $1.65 (£1.13bn), Wal-Mart superstores increased total sales 15.2%, with operating profits up 16.1% to $2.55bn (£1.75bn). Wal-Mart international operating profit leapt from $215m (£147.26m) to $381m (£261), operating profits increased 43%. Losses were down substantially. According to Buckley (2002) Wal-Mart had worldwide sales of $219bn (150bn) in 2001, this year the world's biggest retailer plans to open120-130 new stores in existing markets outside the US, including Mexico, the UK, Canada and Germany. A recent survey published in Fortune (Revell, 2004), put Wal-Mart on the Fortune top ten with revenue in 2003 of $258,681bn (£172,454bn). The fall in profit of major retailers and the fears of falling stock market have intensified competition which leads to more investment in ITS and in search for global market (Kynge, 2002; Merchant, 2002; Bocij at el., 2003a & b). On contrast, Safeway's growth of £168m profit in 2003 (Thapar, 2003) was less than Wal-Mart, Tesco, and J. Sainsbury in April 2002 due to refitting of 30 stores in March 2002 which caused disruption, leading to depressed sales (Urry, 2002).

Teething problems on the ITS retail front have not been the only hiccup, poor management, a lack of consumer focus led for example to the loss of Sainsbury's number one to Tesco in 1990s as the leading supermarket chain. It is worthwhile mentioning that at the time the distribution centres and supply chain systems at Tesco were on average nine years old where Sainsbury's systems were averaging 21 years old. Hoping for a quick fix, Sainsbury opted for the PkMS WMS package solution from Atlanat-based Manhattan Associates in late 1999, but many of the radio-based (RF) systems were still in experimental stage. Retailers including

Sainsbury know that replatforming the business is a massive task. Sainsbury is using the latest web-based version of Manhattan's PkMS suite which is being integrated with forecasting, planning and order management. The web-based PkMS system is now being installed at the original Rotherham test site, which has also been piloting a satellite-based fleet management system from UK-based Isotrak. This monitors vehicle movements in real-time and improves communications between managers and drivers using in-cab computers. This system will be extended throughout the distribution network. According to computing (Ranger, 2002c), within five years, consumers will face a technology revolution when smart tags replace barcodes. Marks & Spencer and Tesco are the leader that adopts such technology (smart tags -RFID) which will be attached to products. The scanner will read information stored on the smart tags, eliminating the need for checkout staff to read each item's barcode. Due to the amount of information stored on these tags such as place of manufacture, raw materials used in production and information on the product, it will be easier to track products through the supply chain. ITS are also being streamlined by adoption of bar coded advanced shipment notices (ASNs) of which information about consignment content is stored in the code so, on arrival at the fulfilment factory, the cases can be automatically scanned and information routed through to both warehousing and central systems. The input information then guides invoice matching and automated payments. Ultimately these bar codes could be replaced by radio frequency identification (RFID) tags once their cost falls (Watson and Thomas, 2004; Thomas, 2004b). In June 2000 a three-year reinvestment project called "Project Phoenix" totalling £900m in distribution systems and stores was announced. Central to Project Phoenix is the plan to build a series of huge new distribution centres called "fulfilment factories" to replace the ageing regional distribution centres by 2003. The facilities in these new mega-centres are state-of-the-art with 2.25 miles of belt conveyor, automatic sorting systems and 20 automated storage supplied by Siemens. Over the next five years the distribution network of 19 regional distribution centres will be replaced by nine fulfilment factories, five of them new, four upgrades at existing location with two national distribution centres for slow moving lines and two for frozen goods. Recently, Sainsbury shows rapid growth, the supply chain investment would certainly appear to be reaping early rewards. Traditionally, retailers have focused upon their internal processes, operations and systems in order to improve performance. Accordingly they have failed to respond to global changes and customer requirements (Murphy and Jones, 2002). If retailers want to be successful, their focus must be shift to suppliers, outsourcing partners, facing to changes in the financial markets, competitors and customers in the external business environment (Divanna, 2002; Meyers and Gerstman, 2001). We can not emphases enough the need of reliable and efficient computer systems to manage the different information in the retail sector. From our exploration of the retail sector, we noticed how contemporary retail organisations continued to apply information technology systems in the same fashion as their medieval counterparts and fail to leverage information technology into new ways of doing business (Ody, 2002). The new technologies challenge the individuals and organisation on using the internet to develop new value propositions with customers in the e-marketplace (Murphy and Jones, 2002).

Within Retail organisations there is clear evidence of the commercial successful of applications of information technology (Knights, 2005a), (see Appendix C; Nash, 2003a, 2003b, 2003c, 2003d). Through the use of artificial intelligence in insurance companies can assess risks and quote for business very effectively. Simulation modelling assists with logistics, manufacturing and military applications. The new mobility of communications and computers; the use of e-mail and the Internet; and the ever increasing IT literacy of the population have contributed to the development of new businesses including e-business and new ways of carrying out old businesses. The retail organisations need to 'cherry pick' some of the success stories and try them out in small scales (Nash, 2002).

- **ITS Strategic Benefits in Retailing**

Increasingly rapid unpredictable change is part of the business climate today. What customers want and how they purchase are changing rapidly, especially in information technology related segments, driving volatility in retail organisations and markets. Strategy formulation in this environment is enhanced by understanding recent market trends, in order to predict market directions and plan products and sales channels appropriately. Information technology system in retail organisations are regarded as systems for business transaction management that can span entire enterprises functionally and geographically, offer the promise of rapid access to business intelligence derived from transactional customer's data, which could provide early visibility of marketplace changes. Such visibility would offer management in ITS-ready organisations a competitive advantage in decision making and strategy formulation. It is difficult to dispute that decision-making process in retail can be only as good as the information upon which decision is made. The rapid progress that is being made in the ITS and applications of IT for retailers is therefore highly pertinent to the development of retailing. According to Ody (1987) that:

"At the highest levels, retail executives have realised the need for help in these areas for some time-but they are only beginning to appreciate that computer-literate marketing staff manipulating sophisticated database can provide them with the answers."

From the retail viewpoint, the most relevant area of development has been the growth in electronic point-of-sale (EPoS) technology. For example, a retailer with full EPoS data capture system can process all information overnight to provide its branches in the morning with a completely up-to-date picture of sales trends by item and by store. Not only does this enable immediate adjustments to be made to reorder levels, it also provides a formidable weapon in negotiating with suppliers. It would be quite wrong, however, to assume that this type of information, however comperhensive and rapidly available, is a complete substitute for liaison between customers and retail stores. Furthermore, customers usually have extensive information about existing items, much of which is internally generated through advertising and therefore more likely to be trusted than information supplied in relation to new products (Dennis et al., 2002).

- **Costs and Value of the IT Function in the Retailing Organisations**

To begin to understand the requirements for any information system (IS) it is essential to understand how organisational factors influence the processes of an organisation. The retail sector is no exception to this and before looking at any aspects of information systems it is desirable to look at it as an organisation and to be aware of particular aspects which contribute to the complexity of any ITS project undertaken by it or on its behalf. The organisation of the retailing sector can be looked at using the six dimensions of context as described by Sauer (1993). The cognitive, technical, environmental, structural, political and historical factors relevant to the retail organisations help one to appreciate how elements of these dimensions of context could contribute to the difficulty of introducing successful information systems. Without taking this into further detail it is useful to bear in mind the complexities and lack of any parallels that are found in the retail sector and to be aware of the problems created by politics and power at every level of the retail organisation. The following outline some of the key differentiating issues.

- The decision making process is obfuscated by a structure of hierarchies superimposed upon other hierarchies. It is further complicated by the involvement of multiple decision-makers.

• Communication and understanding between stakeholders has not been improved by a strategy that does not even recognise all the stakeholders.

• Although the structure is hierarchical nobody within the hierarchy arrives at the top or key decision making position of the organisation since it is held by more than on head of department, namely the head of IT department on one side and the other head of business departments on the other hand. This poses an array of problems both in the political context and in the managerial context.

• The measurement of success by revenue and budgets is viable since it is inconsistent within an organisation which strives towards excellence. In this context can success really be measured in terms of numbers of quality products and services or by the number of satisfied customer or cost.

• A very curious form of public/private (external customers/retail firm) partnership operates within the retailing sector. This adds a further dimension to the complex workings and hierarchies of this sector.

Chapter 4

- **Data Collection Using Questionnaire Survey**

In Chapter 4 and Chapter 5 -section 5.1 the author presented the first phase of the empirical enquiry for this research study, where the empirical data is collected from both Customers and System Developers using a qualitative and qualitative research method and involved multiple case studies/interviews. The author's objective is to find out their proposed solutions for the problems of system failures, identifying requirements and investigating the existence of the professional and intellectual culture gaps between the customer and system developer at the initial stage of requirements.

- **Reliability and Validity of Data**

- **Reliability of Data**

Basically, data is reliable if a method of collecting evidence is reliable it means that anybody using this method, or the same person using it at another time, would come up with the same results (http://www.sociology.org.uk/p1mc5n1a.htm). Reliability refers to the extent to which the author can confidently depend on the information collected through the various methods of data collection. This implies that a research methodology can be said to be reliable only when it produces similar results after repeated trails. To test the reliability of data collected for this research study, a comparison of answers given by the respondents was made. This comparison was carried out using the test-re-test reliability method whereby a selected number of 30 (in this case) of respondents were served with questionnaires one moth before the actual survey and the results were filed. The same questionnaires were served to the same group of respondents a month later and the result also filed. A comparison was then carried out between both sets of questionnaires to determine the reliability of information supplied.

- **Validity of Data**

The concept of validity refers to the extent to which the data collected gives a true measurement. In research terms, both concepts of reliability and validity go hand-in-hand. Efforts were made to ensure that data were both reliable and valid.

Chapter 5

- **Introduction**

This chapter sets the scene for discussion of the empirical case studies by describing how the retailers have integrated information technology systems (ITS), e.g. loyalty cards and recently RFID, into their business over the past fifty years, during a prolonged and unprecedented period of IT/IS investment. The programme has resulted in automation of many traditional retailing activities with the focus these days moving towards "managing customer knowledge and needs" and "e-commerce" as the technology becomes highly sophisticated.

- **Guidelines for the Change in System Development Process**

It has been shown that there are benefits to be gained from exchanging and integrating information across the organisation to provide an infrastructure that allows exchange of knowledge and the knowledge to flow freely from the IT to the non-IT departments. Therefore, the need for organisational change towards the way information systems managed and developed is once again emphasised because of the recent frequent rate of system failures In the next chapter, the focus will be on the actual change process itself.

- **How to Change the Development of Requirements Process**

There are many hard and soft methodologies used to develop an ITS but in many cases these methodologies fail to incorporate fully the human elements. One approach namely the sociotechnical approach takes the human issue more seriously than other methodologies. The sociotechnical approach usually involves small teams that gather to analyse and redesign their work. The design teams seek to optimise both human needs, business needs and technology needs by applying certain design principles. For business needs these would be minimal specification of tasks, leaving ample flexibility for creativity and future redesign, clear delineation of boundaries between subsystems, alignment of support systems as a contributing part of the total work system, and adequate feedback mechanisms. For human needs they would be attention to human values, optimisation to both the goals of the organisation and the individual, and facilitation of compatible social, technical and process factors (Avison and Fitzgerald, 2000).

- **The Need to Generate Shared Knowledge Before Requirements Can be Decided**

Knowledge is an important asset for any business organisation. Knowledge (both business and technical) is also vital in the development process of an ITS. It is the foundation of any system development process and most take appropriate steps to protect and share both business and technical knowledge. The customer and the system developer should not undervalue what each of them know, probably know more than what they think. What they know and learn from each other at the development process will help form better requirements. If they do not understand something or each other, there is no shame in admitting their ignorance of each other work. If they try to pretend they know about something the other does, they are likely to be caught out when the system fails! Knowledge as we address it here is not just about facts and figures but about people's knowledge, i.e. knowing about people can be invaluable (sociotechnical) in determining the definite and quality requirements which contributes to the development of quality and successful an ITS.

- **Common Knowledge: An Exploration of Social Learning in Retail Organisations**

- **The Role of Requirement in System Development**

Experience in developing systems has shown that an inadequate understanding of system requirements is the single most important cause of user dissatisfaction and system failure. This has led to the area of Requirements Engineering. Requirements engineering (RE) is the process of determining a complete, correct and clear specification of a future software-intensive system from the incomplete, inconsistent and ambiguous statements of need from stakeholders as diverse as end-users, managers and members of the public. Whereas conventional RE approaches focus on models and languages to express system specifications, there has been a recent shift towards a focus on engineering requirement processes (ERPs).

The prevalent view is that requirements emerge from a process of learning in which they are elicited, prioritised, negotiated, evaluated and documented. Requirements evolve with time. This necessitates managing requirements (MR) evolution and aligning requirements to organisational changes. Experience in developing systems has shown that an inadequate understanding of system requirements is the single most important cause of user dissatisfaction and system failure. This has led to our research in the area of Engineering and managing Requirements. The following sections present and discuss practical results from improvement projects in industry, focussing on the benefits gained and the criteria for success. Engineering and managing requirements is the process of determining a complete, correct and clear specification of a future software-intensive system from the incomplete, inconsistent and ambiguous statements of need from stakeholders as diverse as end-users, managers and members of the public, including people who are eliciting, writing, supplying, managing or testing requirements: project managers, requirements engineers, systems analysts, business analysts, software customers, quality managers. Whereas conventional/formal approaches (methodologies) focus on models and languages to express system specifications, there has been a recent shift towards a focus on engineering requirement processes (ERPs).

- **Managing the People Aspects of Change within Major Projects: Management Style in Retail**

Retail organisations concentrating on collaboration tend to develop different business skills and styles of operation than those seeking to cut trading partners. They are more likely to value co-operation and information exchange as a good thing in itself, as well as looking for tangible, measurable business benefits - such as lower inventory requirements, faster product/services delivery and better demand forecasts. Indeed it has to be recognised that while the right collaborative chain technology is vital, there is a major difference between recognising the benefit of such an approach and realising it in practice and the right management style is absolutely crucial in achieving collaborative commerce. Collaborative commerce is not so much about technology, it is about adopting the right management attitudes and business models, achieving trust between the partners involved and visibility across the shared business processes. In fact, there is no single collaborative chain technology. It can involve combinations of new supply chain systems, content management, customer relationship management (CRM) software and so on. For example, when the organisation makes a decision to introduce a new product, how is that decision reached? Is it done by a small group of executives in a back room or through commonly working party? And if so, how can a partner company be involved!

- **Non-IT and IT Team-Building**

It is very important to have a team of non-IT business and IT personnel. In the early days of any new business, most IT developments can be carried out by a small number of IT people. The volume of work, especially project management, is comparatively low. However, this state of affairs cannot last when the business becomes large, as it is the case in most large retailing. Professional non-IT business managers are essential for business success as the early dotcom bubble showed us what happens when amateurism takes over. Both non-IT and IT managers need a professional cast of mind that views business clearly, analytically and logically. Building business and IT teams of professional conduct and understanding is essential activity of the first stage of developing a successful ITS and to ensure survival into the next stage and for the business to grow. Unfortunately, there are few hard rules as to how this non-IT business and IT team-building is to be carried out. One rule of thumb is that the management of such team has to be capable of clearly understanding the needs of the other party, and this means that at least there is total openness, sharing ideas. Another rule, change of cultural, i.e. non-IT business personnel are not better than IT personnel and vs. versa. The management of such a team must be capable of working continuously as a team, gathering talented people is of little us if they do not understand each other, have different ideas about the organisation and pull in different directions. A good team works towards a common business goal, and most importantly uses the same routs to get to that business goal. Great teams always achieve much more than the same people could achieve while working on their own. That still leaves us with the vexing question of how to create such a team. Given the importance of personal relationships in successful teams, many like to search initially for managerial talent among the people they already know, contact in different department and so on.

Teams composed solely of friends become cosy and liable to indulge in groupthink. An objective party is often needed to face up to problems that the existing team is not prepared to confront, or has not recognised. Teams are not created overnight. They evolve, as members learn more about each other and how best to negotiate and work with each other. The bonding and understanding process that leads to shared views, knowledge and common business-IT goals takes time. This makes it more important to start building the non-IT and IT management team early, so that when the challenges of business growth begin to emerge, the team is prepared and waiting to meet them.

- **Exploring Exceptions in Customer-Centred Requirements**

The KRF project focuses on the exploration of exceptions during requirements engineering and early prototyping of customer and end-user interface designs in order to derive more complete and realistic customer-centred requirements. Consequently, the systems developed would be more robust, fault-tolerant, usable, and will yield a positive customer and end-user experience. The work in this chapter involves a combination of contextual fieldwork, customer and end-user-observation sessions in a usability postgraduate seminar groups, and remote usability evaluations in retail organisations to identify exceptions in application domains of ITS in retail. The results from these studies will lead into development of suite of techniques and a scenario-walkthrough framework to investigate and predict exceptions in the early stage (requirements) of the software development life cycle. The research work was carried out in close collaboration with industrial including the retail sector and academic collaborators.

- **Choosing a Method for Change of Requirements Process**

Throughout this research study, it is anticipated that a combination of management science and IT methods is required for successful transition of dealing with the requirements process depending on the existing state of the organisation. On the one hand a radical restructuring of business processes may be necessary to set the right internal environment to facilitate the adoption of radically new concepts. On the other hand, organisations are not machines but dynamic entities comprising of human relationships in a delicate balance with structural and technical aspects of the organisation. The transition process itself may therefore requires a co-ordinated approach and a well-orchestrated balance between the different, yet related, aspects of the organisation. This would at least to some extent ensure as smooth a transition as possible.

- **Exposing the Hidden Politics in Information Technology System Developments**

Our research started with an idea. Everyone has at least a few ideas to make a million! Many of us have an idea late at night - I would like to believe that I am one of them. But translating the great idea into reality is a very different experience. Our idea was simple but significant. It has captured the interest of the many groups (from business and developers) who participated in the study's workshops. During the workshops we ran in both the retail organisations, postgraduate, and the professional master degrees, namely MBA, MSc BIT & Finance, it was fascinating to find out that many people agreed to our principle idea of requirements are different from specification Having an idea to find a solution to the system failure is/ was not easy. Many failures happened due to misunderstanding business requirements and the non-existence of business plan. Understanding customer requirements is not easy. Writing a business plan is one way to achieve that transformation. It does not mean the idea will work but, if done properly, can identify problems before they arise and help point out traps into which we might otherwise stumble (Barrow and Barrow, 2001).

One of the biggest mistakes people going to business including the dotcom companies is not to write a plan (Aslett, 2005). Not asking the customer what does s/he want, instead of assuming what the customer wants, how will it all work? computer system design depends of figures, budget figures and time figures. Figures are plucked out of thin air with little research and less forethought. But the figures are only a small part of a real business plan, which should be viewed as a management tool. Developing a computer system is part of the planning process and a way of bringing everyone including the system developer and the customer into the business and sharing the development and the strategy. The plan of developing the system should, therefore, describe where the system and business will be in four or five years, and also say how it is going to get there, i.e. the strategy, the people, the timeframe, the costs. This will involve much research into not only business requirements of the future computer system, but the competition and the market (CBR, 2005). The "dotcom" or "dotgone" revolution has created a climate where there is great fear of losing out by not being quick enough to get great idea up and running, but it is more likely to be the best planned businesses that succeed. Many dotcoms have seen and heard an idea exactly like theirs before. It is in implementation of the idea that a business succeeds or fails e.g. Amazon. A business plan helps us get our arrow on the dartboard. No many people end up with what they thought they were starting. You have to start the wheel grinding and then modify your plan, the business plan is part of a continual process.

Regular readers of the popular computing press will be used to the numerous reports on the latest major software project to fail and miss its deadline. Air Traffic Control system is just one such story that comes to mind (Watson, 2005b), Microsoft Windows 2000 has been promised for a number of years. Many of us may be involved with projects that have either failed or are likely to fail, research has shown that the majority of software projects will not meet their deadline.

A number of authors, including (Remenyi, 1999; Schmitt and Kozar 1978; Rudelius, et al., 1982; Wise and Debons 1987; Sommerville 1992; Sauer 1993; Tiller 1999: and Flowers 1996) draw attention to many factors that lead to software failures. Several reasons exist for such failures. For example, common and frequent factors that lead to system failures are cost and time overruns due to poor initial specification, obsolescence due to rapidly changing work environment, Rolland et al (1998), and inadequate requirements analysis and problem definition. Macaulay (1996) and Gleick (1998) argued that some ITS failures are the result of mutual misunderstanding between the customer and the system developers about vital aspects of the project's requirements. It is this area which represents the focus of our research and this chapter. Getting the customer "requirements" right first time during the initial stage of the life cycle (Chapter 2-Definition of Requirements-RESG), rather than at a later stage, will save both the customer and the system developer (SD) time and money; and will have a major influence on increasing the success chance of a project, see Ishikawa (1985), Crosby (1985), and O'Callaghan (2002). The problem of failed software is not a characteristic of the UK software industry alone. It is world wide problem, for example, Sauer, (1993) discusses the famous case of the Australian Public Service Mandata system, which started in the 50s and continued throughout the 70s, eventually being terminated in 1981 with full cost not revealed. Also in the United States, where the software industry is possibly most advanced, many large-scale systems have ended in disasters, as discussed by Laudon and Laudon (1996) and Sloane (1991). A number of authors, including Schmitt and Kozar (1987), Sommerville (1992), and Tillier (1999) have identified many factors that lead to software failure. Underlying these factors are several reasons for such failures, for example, the nature of IT, the speed of development, lack of skills, legacy systems, obsolescence due to rapidly changing work environment and inadequate requirements analysis and problem definition. Macaulay (1996) and Gleick (1998) argue that many project failures are the result of mutual misunderstanding between the customer and the software engineers about vital aspects of the project's requirements and it is this area which is the focus of this research.

In addition the total quality management (TQM) concept of prevention rather than correction [Ishikawa (1985); Juran (1989); Crosby (1985); Sharp, et al (2002)] can be applied in software engineering, just as it has been effectively applied in many areas, see Al-Karaghouli (1991). It is clear that getting the customer "requirement" right first time during the initial stage of the life cycle (Definition of Requirements), rather than at later stage, will save both the customer and the software engineer effort, time and money and is likely to increase the prospects of success of a project. Of course this does not prevent problems arising due to the customer changing the requirements during the development of a project. This is quite common and indeed legitimate if the changes are dictated to the customer by external factors. Clearly the business environment is highly dynamic and requirements cannot be set in stone over the long periods that IT based systems development often takes. See Fitzgerald, et. al. (1999) for a discussion of the development of more flexible information systems, designed to accommodate change. Nevertheless it is still true that getting requirements clearly and accurately identified at the beginning of a project is going to be helpful even if some subsequent change is required as the project evolves over time.

- **Business Culture vs. Information Technology Culture**

For many retail organisations having an addition, upgrade, or replacement system is simply not appropriate due to the legacy and large system depends upon. In addition, due to culture, geographical locations, business issues, Europeans often find it more fruitful to concentrate on making the different players in the channel work together and share information more efficiently, rather than cutting them out of the chain. European organisation are more likely to have issues like exclusive relationship, interlocking ownership, and longstanding business relationships -hundreds of years in some cases, it can be difficult to dissolve. Sometimes these approaches are reinforced by legislation. On the other hand, new technology products have emerged to help organisations collaborate more closely with other organisations in the channel, enabling higher levels of business collaboration, beyond simple e-mail or complex chain management.

Chapter 6

- **Getting ITS Right for Business**

In the past, many ambitious ITS projects have failed to meet business requirements because of inadequate definition, managing, elicitation and capturing business requirements. Communication breakdown between the system developer and the customer leads to inadequate business requirements (see chapter 2). In addition, the difficulty in accessing and aggregating enterprise data became too complex, time-consuming, and expensive. To eliminate all these defects, dedicated IT and no-IT persons need to communicate effectively, productively and continuously during the development process and especially in the requirements stage of that process. Information Technology System (ITS) still exhibits a significant failure rate (see section1.5- Chapter 1). The main reasons why ITS projects seem to fail: Management agenda is too limited in that most ITS project investments are technology led and the main investment motive is only to cut costs. This narrow focus on technical capabilities and efficiency goals means that inadequate attention is given to the human and organisational issues that often determine a project's ultimate success (Gubbins, 2001). In addition, users don't influence the development process enough, senior managers do not appreciate the links between technical and organisational change, project management techniques and IT approaches seem too technical and companies fail to organise work or design jobs and roles properly (Hatton, 1999, Norman, 1998).

- **How to Change the Development of Requirements Process**

There are many hard and soft methodologies used to develop an ITS but in many cases these methodologies fail to incorporate fully the human elements. One approach namely the sociotechnical approach takes the human issue more seriously than other methodologies. The sociotechnical approach usually involves small teams that gather to analyse and redesign their work. The design teams seek to optimise both human needs, business needs and technology needs by applying certain design principles. For business needs these would be minimal specification of tasks, leaving ample flexibility for creativity and future redesign, clear delineation of boundaries between subsystems, alignment of support systems as a contributing part of the total work system, and adequate feedback mechanisms. For human needs they would be attention to human values, optimisation to both the goals of the organisation and the individual, and facilitation of compatible social, technical and process factors (Willcocks and Manson, 1987; Avison and Fitzgerald, 2000).

- **Business Requirements Process Mapping**

The process of managing an IT/IS project has taken something of a beating in recent years. A litany of failed implementation attributable to unclear business requirements, poor alignment with business goals, over-ambitious scoping of projects, incompatibility with emerging standards and methodologies; and haphazard budget justification, have given plenty of business cause to consider whether the technology can truly provide and deliver a robust but flexible gateway to vital business information and knowledge.

Looking back over the past two decades, information technology systems have spread out through business organisations. The mainframe computers that were once like dinosaurs occupying a large room or rooms, now resides on every employee's desk, as computers have shrunk in size and empowered by high speeding processors. Acquiring computer system is not just about installing software and hardware. The computer system is the tool any business benefits from. Business needs a computer system that delivers the goods and services. This research independently examines and positions these services and will present the views of the business drivers and conclusions on the direction for service provision in the future in retailing services. The software industry of tomorrow will be based on business-knowledge IT-driven by requirement power and creativity (Aurum at el., 2003; Groff and Jones, 2003). The new approach will demand a new level of understanding, innovation, cultural change, tolerance, entrepreneurship of customer (end-user) requirements and above all software reliability excellence. The convergence of communications between the customer and the system developer is an important issue, convergence rather than diverse of communications especially at the requirements stage is vital. The ITS services industry is at watershed. More and more businesses are fundamentally re-evaluating they way that their retailing business services and IT provision are aligned. Many industry sectors are fast reorganising along integrated service lines. For example, the retail sector including financial services is a sector where large IT teams remain in-house although this position is shifting. The Internet is now the ubiquitous way of transacting business and interconnecting applications and services. Service-orientated architectures, Web Services, and on-demand computing are the buzzwords of the day. Are these the great white hope of the ITS industry and will they deliver optimal IT provision and agility within the retail sector?

In the early days of computer science, programmer and programmer analyst were considered to be clever enough and maybe mad enough to do anything they understand without paying any attention to the customer (end-user) requirements (Pinheiro, 2003). From the customer view point programming and coding was a black box. Programming was difficult in those days, in fact, in the very early days no real programming languages existed. However, languages such as Fortran and Cobol did emerge, but they were not accompanied by any disciplined of formalised approach to software engineering. On the other hand there were no effective tools available to help the programmers in their task. There were many real problems began to arise: (1) Software projects were taking longer to finish than originally thought, (2) Software was costing more to develop than originally estimated, (3) Software was being delivered to the customer without proper testing which fail to produce correct results (customer expectation), (4) As a result of what has been mentioned in previous point, software projects were abandoned due to disastrous failures, due to an unacceptable costing (Arnott, 2003c; Computing, 2003).

Chapter 7

- **New IS Developments and Future Trends**

Predicting the next big thing, or the next niche market, is a game played on a knife-edge of success of failure. System developers know this precarious position as they court investors and sometimes struggle to market their products. For example, taking the networking technologies which offers a glimpse of what new wireless networking technologies may offer by helping business and IT developer in the near future. The investors are attracting to three areas within networking, namely usability, mobility and commoditisation. Usability has led business users to have increasingly high expectations, and the techies are being taken for granted! Mobility is also a huge part of what everybody does. The wireless network is a moving and changing thing. But maintaining security and quality while managing mobility is a real challenge. Commoditisation of networks in general still has a long way to go. For example, developers are still unable to develop and build a WiFi network that works first time. Ease of use in this area of technology is a real investment pursuit. Simplifying technology is not easy. In the past ten years, it was about more packets and more bits, but now speed and reliability are taken for granted, and to business that can provide a simple, rich and mobile user environment. Business and customers would be made aware in advance that a good performance would result in certain incentives, though none spring to mind at the moment.

System developers are not dissimilar to expecting people to pass a driving test before allowing them on the roads, they should tweak for business-IT environments and their products should be fully tested before passing it to customers.