Examining Organisational Flexibility in an Interorganisational Context: a Case Study of a Grocery Retail Supply Chain

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To Kostas

ABSTRACT

The objective of this thesis is to clarify the complex notion of flexibility and to explore the impact of Interorganisational Information Systems (IOS) on the flexibility of organisations. Previous studies have shown that while the utilisation of IOS can contribute significantly to organisational flexibility, it does not provide equal benefits to all trading partners.

Although flexibility is increasingly becoming more important for the survivability and competitiveness of organisations, its meaning is still ambiguous and a rigorous conceptualisation of the notion is lacking in the literature. Most researchers examining the impact of technology on organisational flexibility identify technological as well as organisational issues influencing flexibility, but fail to analyse flexibility as a dynamic concept embedded in the social context. Moreover, they mainly focus on the flexibility of the individual firm, paying less attention to flexibility as a property of the interaction between firms.

This research proposes an interpretive approach and examines the notion of flexibility by including a thorough investigation of the organisational context within which it is embedded. Since IOS involve interaction between different organisations, issues of cooperation and relationships with trading partners are also considered. Therefore, the concept of flexibility is viewed from both an organisational and an interorganisational (business network) level, referring to the interaction of trading partners.

A synthesized research framework, based on previous research and the theoretical perspectives of appreciative systems thinking and web models, enables us to perceive flexibility as a multidimensional and dynamic concept, embedded in and shaped by the organisational/interorganisational context. In the proposed framework, flexibility is presented not only as the ability of the organisation/business network to respond to environmental disturbances, but also as its capability to evolve and to change over time.

A multiple case design in a grocery retail-supply chain in Greece, comprising three suppliers and four retailers, provides the empirical data to support the argument of this thesis. The analysis of the data relates differences in organisational contexts to variations in the flexibility achieved by the organisations. It shows that IOS can provide constraints even for the more competent organisations and illustrates how the interaction with trading partners may influence the flexibility achieved at an organisational level. It finally demonstrates the dynamic nature of flexibility, it describes the relation between its different dimensions and discusses their change and evolution, following and influencing the changes of the organisational and interorganisational contexts.

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LIST OF ACRONYMS AND ABBREVIATIONS

AB	Alfa Beta Vassilopoulos (Greek retailer)
ANT	Actor Network Theory
CPFR	Collaborative Planning Forecasting and Replenishment
CRP	Continuous Replenishment Program
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
EDIFACT	Electronic Data Interchange for Administration Commerce and Transport
ERP	Enterprise Resource Planning
FIFO	First In First Out
FMCG	Fast Moving Consumer Goods
IOS	Interorganisational Information Systems
IS	Information Systems
IT	Information Technology
JIT	Just In Time
P&G	Procter & Gamble (supplier)
POS	Point Of Sales
PRICAT	Price/Sales Catalogue message
QR	Quick Response
SCM	Supply Chain Management
SKU	Stock Keeping Unit
VAN	Value Added Network
VMI	Vendor-Managed Inventory
XML	eXtensible Markup Language

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CHAPTER 1- RESEARCH ISSUES

1.1 Introduction

As a response to increasing environmental dynamism and uncertainty, organisations are reshaping themselves in order to become more efficient, more innovative and more flexible (Young-Ybarra & Wiersema, 1999; Mouritsen, 1999; Golden & Powell, 1997). The ability of an organisation to be flexible is seen as beneficial (Volberda, 1996; Brahami, 1992), since it gives competitive advantage (Golden & Powell, 1997; Avison *et al.*, 1995), helps the organisation to handle environmental uncertainty, and enables it to respond to market opportunities, changing customer demands and changing technologies (Grewal & Tansuhaj, 2001).

Although flexibility is becoming increasingly important for the survival of organisations, its meaning is still ambiguous (Golden & Powell, 2000) and an in-depth analysis of the notion is lacking in the literature. While different conceptualisations, frameworks and explanations of flexibility are still developed, e.g. (Kumar, 1999; Golden & Powell, 2000; Tan & Sia, 2006), the related concept of business agility (Mathiassen & Priers-Heje, 2006) has also emerged, further complicating the research on flexibility.

Within the field of Information Systems, interorganisational information systems (IOS) have been proposed as enablers of organisational flexibility (Lucas & Olson, 1994; Lim & Palvia, 2001). However, since the use of IOS is also associated with constraints (Webster, 1995; Angeles & Nath, 2000; Damsgaard & Truex, 2000), its impact on organisational flexibility warrants investigation (Golden & Powell, 1997).

The majority of studies examining the impact of technology on organisational flexibility focus on the individual firm and pay less attention to the flexibility of the interaction between firms. They mainly follow a positivist approach, e.g. (De Leeuw & Volberda, 1996; Golden & Powell, 1997; Zeng, 2001), and identify the technological issues as well as certain organisational characteristics that influence flexibility. However, they fail to analyse thoroughly the organisational and social context within which flexibility is embedded.

This study addresses the aforementioned issues by following an interpretive approach and conducting a qualitative case study in a grocery retail supply chain. It aims to clarify the complex notion of flexibility, as well as to examine the impact of IOS on it, by thoroughly analysing the organisational and interorganisational context that shapes and influences it. Since IOS spread beyond the boundaries of a single organisation, the study examines flexibility both at the level of the firm and at the level of the interaction between different organisations (level of the dyad/business network). To acquire a broader view, both at an

organisational and interorganisational level, the study examines the experience of three suppliers and four retailers in Greece.

The argument of this research unfolds following repeated cycles of the hermeneutic circle. Through the application of dialogical reasoning, the prior understanding of flexibility, based on the literature review and theories studied, is further elaborated by the insight gained from the case study. This iterative process between theory and empirical work leads to the development of a research framework of flexibility.

In the proposed framework, flexibility is presented as the ability to respond to events stemming from the environment or from the organisation/business network itself. It is seen as a multidimensional concept, embedded in the process of change and influenced by the organisational and interorganisational context. The explanation of the process through which the organisations/business networks respond to environmental disturbances is based on 'appreciative systems' (Checkland & Casar, 1986; Vickers, 1984) ideas, while the examination of the context, which influences the process of response, is based on 'web models' (Kling, 1987) concepts. The framework further presents flexibility as a dynamic characteristic changing over time influenced by, and influencing, the changes of the context.

The analysis of the empirical data, based on this framework, illustrates not only how differences in the social context lead to variations in the flexibility achieved, but also how the interaction with trading partners affect the flexibility attained at an organisational level. This analysis leads to a concluding refinement of the research framework as well as to a discussion of the multidimensional and dynamic nature of flexibility. It considers the relations between the different dimensions of flexibility, as well as demonstrating their evolution over time, influenced by changes of the organisational/interorganisational context. It finally discusses the socio-technical nature of flexibility and shows that the influence of the people and organisations involved is equally or even more important than that of technology.

This chapter justifies the selection of a grocery retail supply chain as the context of study. It then summarises and pinpoints the limitations and issues addressed in the literature, leading to the presentation of the research objectives and the formulation of the research questions. The chapter also briefly describes the research approach followed in this study. It finally presents the content and structure of this thesis.

1.2 The need for flexibility in grocery retail-supply chains

The competition in the grocery sector, and especially within the industry of fast moving consumer goods (FMCGs), is becoming increasingly intensive. While alternative types of stores, such as discount and convenience stores (Kurnia *et al.*, 1998), attract customers and

get a share of local markets, large multinational suppliers and supermarket chains expand across continents, acquiring an increasingly larger percentage of the global market.

To confront this increased competition, both suppliers and retailers concentrate their efforts on the satisfaction of consumers. The quality of products needs to be maintained or even continuously improved, whereas novel or innovative products need to be released at competitive prices. Besides offering products of improved quality, companies also try to improve their services to customers (Hoffman & Mehra, 2000). They negotiate for better location of their products on the stores' shelves, offer product combinations, arrange promotions and develop after sales services.

At the same time, companies aim to improve the efficiency of their operations (Whiteoak, 1999), automate and speed up their processes, cut down costs, eliminate errors and decrease the order to delivery time. They also aim to eliminate out of stocks[1], while keeping stock levels as low as possible across the supply chain.

Besides increased competition and progressively more demanding consumers, companies need often to deal with changing market needs (Hoffman & Mehra, 2000). In dynamic environments (Aitken *et al.*, 2002), the ability to understand market needs as well as to quickly respond to unforeseen changes in demand (Stank *et al.*, 1999) is imperative for companies' survival. Therefore, companies need to be able to predict, affect or react to alterations in demand through ensuring product availability, changing prices, developing and distributing innovative products, as well as quickly organising or launching promotional activities.

To deal with this increased need for flexibility, companies are collaborating closely with trading partners (Chou *et al.*, 2004). They are also investing in technologies, such as Interorganisational Information Systems (Pramataris *et al.*, 1997), which are often considered as an 'avenue' towards flexibility (Golden & Powell, 1997, p.266). In order to examine the impact of IOS on both suppliers and retailers, this study primarily examines the concept of organisational flexibility.

1.3 Organisational flexibility

Flexibility is seen as the firm's capability to face environmental discontinuities and disturbances (Ciborra, 1993), such as competitor actions, changes of consumer preferences, economic shifts, mergers or acquisitions and technological advances (Overby *et al.*, 2006). It

[1] Out of stocks are not always forgiven by consumers, who might either buy a similar product of a different brand or even change super market in order to find the missing product.

is defined as the ability to adapt when confronted with new circumstances (Golden & Powell, 2000; Monteiro & Macdonald, 1996) as well as the capability to move rapidly and take advantage of opportunities (Lucas & Olson, 1994). It is the ability of organisations to respond proactively or reactively to environmental threats or opportunities (Kumar, 1999). Although the meaning of flexibility in most definitions is similar (Evans, 1991), the conceptualisations and frameworks proposed for its analysis are varied.

The notions of time and variety of options to respond are used by many researchers, e.g. (De Leeuw & Volberda, 1996; Volberda, 1997; Evans, 1991) as indicators of flexibility. Others, e.g. (Kumar, 1999) add the issues of cost and scope of response, while some, e.g. (Lucas & Olson, 1994), additionally mention the effort that is required during the process of response. Following Evans's (1991) work many researchers try to analyse or explain flexibility in terms of its related concepts. Golden and Powell (2000; 1997) use efficiency, responsiveness, versatility and robustness as metrics of flexibility. Others, e.g. (Tan & Sia, 2006), instead of efficiency and versatility, add 'new capability' and 'ease of exit' as additional dimensions of flexibility. Regardless of their differences, the majority of these studies focus on the multidimensional nature of flexibility, with its most widely used dimensions being the temporal, range, focus and intention.

Based on these ideas, various frameworks and classifications of flexibility have been developed. Flexibility is presented as a stimulus-response framework (Kumar, 1999). It is also presented as the interaction of the control capacity of the management and the controllability of the organisation, where, depending on its impact on the organisation, it is seen as steady-state, operational, structural and strategic (Volberda, 1996; 1997). The difference between the operational and strategic types of flexibility is further examined by other researchers, e.g. (De Toni & Tonchia, 2005). However, the majority of studies, e.g. (Das & Elango, 1995; Grewal & Tansuhaj, 2001; Hilhorst *et al.*, 2005), focus on explaining and analysing the strategic type of flexibility, which is considered as the most radical and important one.

While a general agreement on how to conceptualise organisational flexibility has not been reached and new classifications and frameworks of flexibility are still proposed, the new term of business agility (Mathiassen & Priers-Heje, 2006) has emerged in the business literature. The distinction between agility and flexibility is not always clear. While some researchers treat them as synonyms, e.g. (Evans, 1991; Thomke & Reinersten, 1998), others, e.g. (Overby *et al.*, 2006; van Oosterhout *et al.*, 2006), argue that agility has a broader meaning than flexibility, since it also includes operational issues. However, this could also mean that agility incorporates both operational and strategic types of flexibility, defined by

Volberda (1996). Acknowledging that agility is a more recent term and that its meaning is still debated, this study reviews the more extensive literature of organisational flexibility.

1.4 Interorganisational systems and flexibility

IT has been identified as one of the prevalent factors influencing the flexibility of an organisation. However, the research that has so far been conducted to investigate the impact of IT on organisational flexibility is limited. In the interorganisational context the number of such studies is even smaller, whereas their theoretical foundation is relatively weak.

Interorganisational systems automate business processes, provide the electronic links and facilitate the exchange of information between trading partners (Daniel & White, 2005; Johnston & Vitale, 1988). In the grocery sector, these comprise EDI-based systems or internet-based systems, involving the exchange of EDI or XML messages.

Many researchers argue that IOS increase organisational flexibility (Chou *et al.*, 2004; Lucas & Olson, 1994), since they eliminate stages in the value chain (Golden & Powell, 1996), decrease order to delivery time (O' Callaghan, 1998), speed-up communication and reduce response time (Gunasekaran *et al.*, 2004). They decrease coordination costs (Reekers & Smithson, 1994) and enable the creation of more flexible links with trading partners (Golden & Powell, 2000). They also provide standardised system interfaces, facilitate changes in orders and enable fast and accurate processing of information (Lim & Palvia, 2001, p.207). Therefore, they improve cooperation and enable trading partners to respond effectively to changes in the market (Jimenez-Martinez & Polo-Redondo, 1998).

However, as other researchers argue, e.g. (Webster, 1995; Reekers & Smithson, 1996), argue, for many firms, traditional interorganisational systems have been more inhibitors than enablers of flexibility. The high cost (Daniel & White, 2005; Seveg *et al.*, 1997) of proprietary networks and of the software installation, as well as the problem of integrating IOS with legacy systems (Threlkel & Kavan, 1999), often prevented companies, especially small ones, of becoming part of the business network. Additionally, the problems of incompatibility, due to the existence of different networks (Golden & Powell, 1997) and EDI standards (Strader *et al.*, 1999) often inhibited the creation of new partnerships, leading to the establishment of closed business networks, unable to interoperate with each other. They also led to hub and spoke arrangements (Angeles & Nath, 2000) bringing more benefits to the powerful organisation in the centre (hub) rather than to its partners hanging on the spokes (Webster, 1995).

Some of these constraints are still faced even with the use of more advanced Internet-based technologies. Even though the Internet provides a cheaper and more open alternative to proprietary networks (Seveg *et al.*, 1997) it involves considerable security risks and its

adoption is slow (Angeles *et al.*, 2001; Threlkel & Kavan, 1999). Companies are hesitant to use it for their business-to-business transactions mainly due to the existence of different web technologies and the lack of a unified messaging standard, supporting the exchange of both EDI and XML messages. These limitations create again issues of incompatibility and problems of integration with legacy applications (Chou *et al.*, 2004; Klein & Lindemann, 1997). Therefore, whether the use of IOS increases the flexibility of organisations is still unclear and warrants investigation (Golden & Powell, 1997).

Previous studies examining the impact of technology on flexibility have pinpointed certain organisational characteristics influencing it. Those include structure (Ahmed *et al.*, 1996), processes (Kumar, 1999), IT personnel (Fink & Neumann, 2007) and management effectiveness (Volberda & Rutges, 1999). In the area of IOS, Golden and Powell (1997) have also mentioned the size of an organisation, its technological awareness and the length of time that technology is used, as factors influencing the level of flexibility achieved.

However, most of these studies have followed a positivist approach, failing to thoroughly explain the complex notion of flexibility. They have rather examined flexibility as a static characteristic of the firm and analysed its relation to predetermined organisational factors. Therefore, they have failed to analyse thoroughly the organisational context that shapes the use of technology and leads to inequalities or dissimilarities between the different organisations.

Moreover, they have mainly focused on the flexibility of the individual firm, paying less attention to the flexibility of the interaction between firms. However, as Das and Elango (1995) support, the interaction with suppliers and the formation of alliances with trading partners may also affect the flexibility achieved. For example, by eliminating the need for intermediary organisations, technology may benefit the value chain, while diminishing the flexibility of the intermediaries. Furthermore, by supporting JIT manufacturing, technology may increase the flexibility of the entire supply chain (Volberda, 1996), while decreasing the flexibility of some suppliers, forcing them to respond more quickly to customers' needs (Lucas & Olson, 1994) Therefore, a better understanding of the impact of IOS requires an analysis of flexibility both at the organisational and interorganisational levels.

1.5 Research questions and objectives

Although the focus of this research is to examine the impact of technology and specifically of IOS on organisational flexibility, its scope is extended to also include a thorough analysis of flexibility. In order to accomplish this, the study firstly considers the limitations of the literature, summarised in **Table 1.**

Limitations
A thorough analysis of the concept of flexibility is still missing in the literature.
Most studies follow a positivist approach.
Flexibility is mostly seen as a static characteristic of the firm, affected by certain organisational characteristics (often predetermined).
Whether IOS increase organisational flexibility is still debated.
The research that examines the impact of IOS on organisational flexibility is limited and theoretically weak.
The organisational context influencing the impact of technology on flexibility is not thoroughly examined.
The unequal results of IOS on different organisations are not thoroughly explained.
Most studies focus on the flexibility of the individual firm neglecting the flexibility of the interaction between firms.

Table 1: Limitations of previous research

This study aims to address the above limitations by clarifying and thoroughly analysing the complex notion of flexibility in the context of the grocery retail supply chain. The different dimensions and metrics of flexibility as well as the organisational issues that influence it, identified by previous research, contribute to the explanation and clarification of the notion. However, the analysis of flexibility as a static characteristic of the firm and the examination of its relation with predetermined organisational factors is not sufficient to develop a thorough understanding of this complex concept. Therefore, an important objective is to move beyond explanations or definitions of flexibility as a multidimensional concept, and find richer ways of describing and understanding the context-embedded nature of flexibility as well as the often controversial role of technology on it.

In order to examine the impact of IOS on the whole of the supply chain as well as explaining the inequalities or dissimilarities between different organisations, this study follows two levels of analysis. It examines flexibility both at the level of the firm and at the level of the business network (dyad or supply chain). Besides analysing the impact of technology on these levels of flexibility, the study aims to investigate the impact of additional organisational or interorganisational issues, such as structures, relationships and contractual agreements between trading partners. Therefore, an equally important objective is to analyse thoroughly both the organisational and interorganisational contexts influencing flexibility and shaping the use of technology.

These issues will be addressed by considering the following research questions:

What impact does the use of IOS have on the flexibility of an organisation?

How does the use of IOS affect the flexibility of a business network?

First and foremost, these questions require an understanding and definition of the notion of flexibility. As mentioned above, an analysis of flexibility needs to move beyond managerial explanations, which focus on its multidimensional nature, to also include an examination of flexibility as a context-embedded notion.

Acknowledging that the technical and social choices are often negotiated, this study follows a socio-technical approach to analyse flexibility and examine the impact of technology on it. Besides considering the characteristics of the use of technology, it also includes an analysis of the broader social, historical and political context, which affects flexibility both at the organisational and interorganisational levels. This study also demonstrates the dynamic nature of flexibility and its evolution over time following changes in technologies, organisational structures and trading partnerships.

As shown in the following section, the plurality of issues emerging can be better examined through the use of an interpretive approach.

1.6 Research design

As mentioned above, a thorough examination of the dynamic and context-embedded nature of flexibility cannot be conducted by testing predetermined hypotheses or by examining relations with fixed organisational factors. Therefore, the use of a positivist approach was found inadequate for this study. Positivist approaches try to understand a social setting and explain a phenomenon in terms of constructs and relationships between these constructs (Cavaye, 1996). They are thus often criticised as neglecting the social context and failing to capture the richness of reality.

In contrast, interpretivism (Walsham, 1995a; Walsham, 2006) is concerned with approaches aiming at the understanding of reality. Interpretive approaches attempt to understand social phenomena through the meanings that participants assign to them (Klein & Myers, 1999; Walsham, 1995a). They seek relevance to the research by explicitly investigating the context of the phenomenon under study. Therefore, an interpretive perspective was found more suitable for the detailed examination of the organisational and interorganisational contexts influencing flexibility.

A case study, in a grocery retail-supply chain in Greece, provided the empirical data needed to support the study's argument. In order to understand how different organisational contexts influence the impact of technology, I conducted research in five organisations (2 suppliers

and 3 retailers), which use EDI-based systems in their business-to-business transactions. These organisations are also currently involved in pilot projects for the implementation of internet-based electronic marketplaces. To acquire a more complete view of the market I also examined two organisations that had not implemented IOS.

In order to examine different organisational contexts, I selected field sites based on certain organisational characteristics, such as company size, technological awareness, organisational structure and technological infrastructure. The empirical work was carried out over a period of 28 months and involved frequent visits to the field sites. The data gathered is mainly qualitative and was collected through semi-structured interviews, documentation and limited participant observation.

When the fieldwork started, an initial research framework of flexibility, mainly based on the literature review, was already developed. This prior understanding of flexibility, acquired from previous research, was further elaborated through the insight gained by the empirical work. The interpretive field research was conducted through repeated cycles of the hermeneutic circle (Klein & Myers, 1999). In a hermeneutic circle the process of interpretation moves from an understanding of the parts (flexibility of operations or departments) to the whole (flexibility of organisations - parts of dyads), and from a global understanding of the whole context (flexibility of dyads or business networks) back to an improved understanding of each part (organisation). Through repeated cycles of the hermeneutic circle, the data that emerged from the empirical work was juxtaposed with the theoretical conceptions of flexibility. As Checkland and Holwell (1998) argue thinking about a phenomenon in the world and having experience in it cannot be separated. "The experiences are interpreted by, but also serve to create, ideas and concepts which in turn make sense of (new) experience" (Checkland & Holwell, 1998, p.11). Following this viewpoint, the research presented in this thesis is an outcome of traversing the learning cycle shown in **Figure 1** several times.

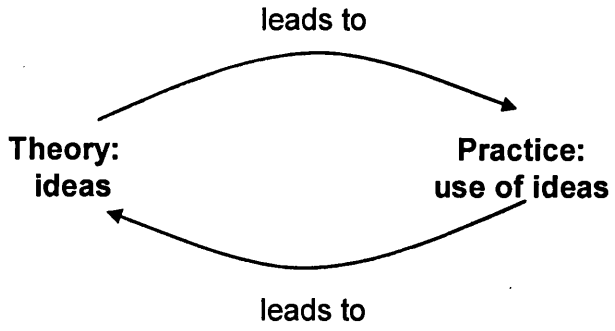

Figure 1: The learning cycle in which theory and practice create each other. *Source Checkland and Holwell, 1998, p.11*

This iterative process between theory and empirical work led to the development of the research framework, which was used as a basis for the analysis of the empirical data. This analysis formed the foundations for a discussion, which led to a further refinement of the framework.

1.7 Content and structure of the thesis

This thesis contains 8 chapters including this introduction. As mentioned above, the research itself moved back and forth between theory and empirical work. However, for reasons of clarity, the theories used and the framework developed are presented first, followed by the findings, analysis and then discussion, which reflects back to the research framework and further elaborates it.

The first chapter (Chapter 1) pinpoints the main issues raised in this study. It briefly describes the area of research and identifies the limitations of previous literature, leading to the formulation of the research questions and objectives. Finally, it summarises the research design and methodology followed in this study.

The second chapter (Chapter 2) provides a review of the literature on supply chain management and interorganisational systems, as well as on organisational flexibility. It also expands some of the themes and issues raised in this introduction. The first part of the chapter considers the challenges of supply chain management in general and of grocery retail supply chains in particular. It presents the different types of IOS used in the grocery sector and describes their benefits. It also discusses the technical, organisational and interorganisational constraints associated with their use. It concludes by arguing that the impact of IOS on organisational flexibility is still unclear. The second part of this chapter reviews previous studies of flexibility, by focusing on those examining organisational flexibility. It discusses the definitions and various classifications of flexibility and develops a research framework, presenting the different dimensions of flexibility. Further expanding the ideas put forward, this chapter concludes by arguing that flexibility needs to be analysed not only as a multidimensional, but also as a context-embedded notion.

Following this argument, Chapter 3 draws upon theories that attempt a comprehensive and wide-ranging view of the phenomenon under study. It primarily discusses the multidisciplinary nature of information systems and argues that a better understanding of their impact on organisational flexibility can be provided through a socio-technical approach. The chapter presents relevant theoretical perspectives, discusses their strengths and questions their applicability to this research. It then suggests the use of appreciative systems thinking for the analysis of the process through which organisations respond to environmental disturbances. Based on this approach, flexibility is seen as a property of the organisational

discourse. It is also perceived as a dynamic characteristic, changing over time, influenced by human actions or changes of the organisational context. Although clearly showing the dynamic nature of flexibility, 'appreciative systems thinking' is weak on explaining the context of technology. Therefore, the chapter draws on alternative theoretical perspectives and suggests web models for the analysis of both the organisational and interorganisational contexts surrounding the technology. The combination of these theoretical perspectives, with the first framework of flexibility, leads to the development of a more complete research framework, presented in the final part of the chapter. The way in which this framework is developed and applied in this research, is explained in the next chapter.

Chapter 4 presents the predominant research approaches and methodologies used in the information systems field. It elaborates on their differences, discusses their strengths and limitations, as well as examining their relevance to this study. It justifies the selection of an interpretive approach and discusses its linkage to appreciative systems thinking and web models perspectives. It also justifies the selection of a multiple case study approach, which not only enables the examination of the flexibility of the interaction between firms, but also demonstrates how differences in organisational contexts may lead to differences in flexibility. Further explaining the research approach followed, the chapter presents the principles of *hermeneutic circle*, *contextualisation*, *abstraction* and *generalisation*, *dialogical reasoning* and *multiple interpretations*, proposed by previous research as the main principles of interpretive field research of a hermeneutic nature. It discusses their application in the study and describes the gradual development of the research framework, based on the principles of hermeneutic circle and dialogical reasoning. The chapter additionally describes the research design, the methods of inquiry and data collection, the design of the interviews and the methods used for data analysis.

Chapter 5 describes the case study, giving an overview of the Greek market and presenting the ECR-Hellas strategic initiative, which involves the implementation of management practices and technologies to improve the supply chain. The chapter also discusses the implementation of EDI in the Greek market, pinpointing the reasons for its slow adoption. It then focuses on the description of the organisations studied, presents their profiles and describes the findings regarding the impact of IOS. The findings in two multinational suppliers, using IOS since 1999, are presented first, juxtaposed with those of a small supplier that still uses traditional product replenishment. The chapter also presents the findings in the four retailers, two of which are using IOS, one which has unsuccessfully implemented it, and one still using the traditional way of ordering.

Chapter 6 presents the findings related to the impact of IOS on the interaction between suppliers and retailers. It focuses on the suppliers and discusses their cooperation with each

of the retailers. The chapter demonstrates that the benefits associated with the use of IOS differ in each dyad, influenced by differences in the organisations involved.

Chapter 7 incorporates both the analysis of the findings and the discussion of the main themes emerging in this study, regarding the understanding of the complex notion of flexibility. The analysis of the findings, both at the organisational and interorganisational levels, is based on the research framework. It examines the process through which the organisations/dyads respond to environmental disturbances. It also examines the organisational and interorganisational contexts influencing this process of response. The discussion reflects back to the multidimensional nature of flexibility, elaborating on the relations and potential tension between the different dimensions. It also shows the dynamic nature of flexibility and demonstrates its change and evolution over time, influencing and following changes of the organisational/interorganisational context. It further discusses the socio-technical nature of flexibility by elaborating on the roles of technology, people and organisations. It finally reflects back to the research framework, identifies its weaknesses and proposes a last refinement.

The last chapter (Chapter 8) provides a synopsis of the research. It begins by offering a brief presentation of the objectives and theoretical background of the study, as well as of the research approach followed. It then summarises the findings, presents the research conclusions and elaborates on the contributions of this study. It finally discusses the limitations of this thesis and addresses the possibilities for future research.

CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction

Before presenting a detailed literature review of the notion of flexibility, the chapter discusses issues, problems and opportunities concerning supply chain management in general and grocery retail supply chains in particular. It argues that increased competition reinforces the requirement for efficiency and flexibility and strengthens the need for collaboration, not only between trading partners, but also among competitors. On that basis, it presents contemporary business strategies, practices and standards concerning supply chain management in the grocery sector. It also demonstrates the role of technology in the support of management practices, mainly involving the process of replenishment. It focuses on IOS, such as EDI and Web-based systems, used in the interaction between suppliers and retailers, and presents their characteristics. It describes the benefits and constraints of these technologies and discusses their impact on the realisation of CPFR (Collaborative Planning Forecasting and Replenishment), as well as on the flexibility of organisations. The first section concludes by arguing that the impact of IOS on organisational flexibility needs to be examined more effectively and that a better understanding of the notion of flexibility is required.

The second section reviews previous research on flexibility by focusing on studies that specifically analyse organisational flexibility. After discussing several classifications and frameworks, it argues for an analysis of flexibility as a multidimensional concept. Based on these ideas, a research framework for flexibility is proposed. This framework was used at the beginning of the empirical work but, as will be shown in the following chapters, it was further enriched with additional theoretical ideas after experience of working with the concept of flexibility.

2.2 Supply chain management

2.2.1 Importance

In most industries, intense competition forces organisations to search for ways to improve their efficiency, functional effectiveness, quality of products and services to customers. In the past, they could remain competitive simply by changing at a functional level as well as by improving the efficiency of production and transportation of goods. In the current business environment, operational efficiency is insufficient for the survival and competitiveness of organisations that also have to improve their communication and coordination of activities. Strader *et al.* (1999) argue that this is needed in order to take decisions, obtain resources and ensure that services and products are made available at the

right time and place (Aitken *et al.*, 2002). This improved communication is imperative not only between directors, managers or employees of an organisation, but also between different organisations that cooperate in a supply chain. Since competition is driven by the requirements of customers, it is only through effective collaboration along the supply chain that organisations can offer high quality products and services at low prices (Chou *et al.*, 2004). Therefore, to acquire strategic advantage, improve market share and increase corporate profit, companies need to replace 'standalone' business strategies with strategies that include their trading partners (Iansiti & Levien, 2004). The result is seen by some as a paradigm shift in business:

"One of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains" (Lambert & Cooper, 2000, p.65).

This need has been reinforced by the establishment of global markets. Globalisation, occasioned by the reduction in trade barriers, improved communications and transport, has resulted in the global sourcing of products and services in order to meet the demands of increasingly competitive product markets. Spurred on by notions of core competence, producers outsource increasingly significant portions of their activities to providers who can meet the demands of price, speed and quality. This globalisation, in turn, requires the support of global supply chains that stretch across the world from countries with a production advantage, often from cheap labour, to unfettered consumer markets. *The Economist* (2006) likens the resulting network to 'the physical internet' where goods and components shift around the world as efficiently as information on the internet.

In this competitive global business environment, "supply chain management (SCM) is one of the key factors for enhancing organizational effectiveness and competitiveness" (Park *et al.*, 2005, p.335).

2.2.2 SCM definitions and components

Supply chains exist in virtually every industry, particularly industries that involve product manufacturing. A supply chain can be described as consisting of all organisations that are involved in the successive stages such as design, manufacturing, distribution, marketing and retailing of a product or a service (Holland, 1995).

As a term, SCM first appeared in the early 1980s (Cooper *et al.*, 1997) and has been in widespread use ever since. It involves the efficient management of materials, processes and information along the whole supply chain, from raw materials through first and second-tier suppliers to final customers. It also involves knowledge sharing between trading partners

(Malhotra *et al.*, 2005). Therefore, it extends "beyond the scope of the organisation to also include interorganisational relationships" (Strader *et al.*, 1999, p.361).

There are various definitions of SCM (Gibson *et al.*, 2005; DeWitt *et al.*, 2001; Groom *et al.*, 2000; Mouritsen *et al.*, 2003). Lambert & Cooper (2000, p.66) use the following definition: "Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders."

They regard SCM as integrating and managing the following business processes along the supply chain:

- Customer relationship management
- Customer service management
- Demand management
- Order fulfilment
- Manufacturing flow management
- Procurement
- Product development and commercialization
- Returns

Others (DeWitt *et al.*, 2001) see SCM as comprising:

- Demand forecasting
- Production planning
- Inventory management
- Distribution management
- Purchasing
- Marketing
- Sales
- Customer service

From an information systems perspective, the key issue is the need to integrate the various components (processes and trading partners) through robust interorganisational information systems. All of the above processes are information intensive in that, for example, production planning for a factory in Eastern Europe may require reliable information regarding orders and demand trends in the markets of Western Europe and the USA. Similarly, information concerning inventory levels and distribution arrangements needs to be included in this production plan.

The notion of an efficient and integrated supply chain can be seen in the just-in-time (JIT) manufacturing strategy of the 1980s (Kalakota & Whinston, 1996; Harrison, 1992), where inventory holdings were minimised by ensuring that the right components arrived precisely when needed. This notion evolved into the 'lean production' of the 1990s (Oliver *et al.*, 1994; Warnecke & Huser, 1995), where manufacturing costs were cut back through the dramatic reduction in waste and slack time, which in turn depended on zero defects and very tight quality control.

SCM ideas are relevant to most manufacturing operations, although they clearly need to be adapted to particular products or industries (Aitken *et al.*, 2003). While the term SCM seems to emphasise the importance of supply-side activities, many markets are dominated by consumers or buyers. Thus, various authors, e.g. (Vollman *et al.*, 2000; Frochlich & Westbrook, 2002), developed the notion of demand chain management that emphasises the role of consumers in driving the chain backwards to suppliers.

A good example is the clothing industry, where demand is particularly subject to the vagaries of fashion. Here supply chains developed based on a strategy known as Quick Response (Lowson *et al.*, 1999) where the supply chain needs to be highly flexible in terms of responding very quickly to actual sales, regarding styles, sizes and colours of clothing. Product life cycles are very short and highly uncertain (Lee, 2002).

Another example is the grocery industry, where efforts are made both on the supply and demand sides. The supply and replenishment processes are improved to better meet competition and changing market needs, while actions are also taken to promote products and influence consumer demand.

SCM ideas are also becoming increasingly relevant to service operations (Chase *et al.*, 2004) as these are transferred to external suppliers through business process outsourcing (Allen & Chandrashekar, 2000; Halvey & Melby, 2007). As demonstrated below, regardless of the industry, SCM objectives and challenges are similar.

2.2.3 SCM objectives

The most commonly referenced SCM objectives are presented in **Table 2**:

SCM objectives	References
Improved demand planning	(Frochlich & Westbrook, 2002)
Speed	Reduction of lead time (Buxmann *et al.*, 2004), speed of delivery
Control and reliability	(Ross, 2004; Schnetzler, Nobs, & Sennheiser, 2004; Slack *et al.*, 2004)
Reduction of cost	These comprise production, transportation and purchase costs (Buxmann *et al.*, 2004), as well as inventory-driven costs including product returns (Callioni *et al.*, 2005)
Reduction of inventory	Inventory turnover (Premkumar, 2000)
Quality of service	(Hoffman & Mehra, 2000) Improved customer service (Premkumar, 2000)

Improved cooperation	Sharing of demand information, synchronised planning and tight coordination (Lee, 2002). Conduct of joint improvement activities (Liker & Choi, 2004) Alignment of business interests of partners (Premkumar, 2000)
Flexibility	Responsiveness and flexibility to the changing and diverse needs of the customers as well as "ability to minimise the back-end risks of supply disruptions (Lee, 2002, p.114) Flexibility in products, mix, volume and delivery (Lowson *et al.*, 1999) Ability to make rapid design changes, adjust capacity quickly, make rapid volume changes, offer numerous product features or a variety of different products (Boyer & Lewis, 2002)

Table 2: SCM objectives

These mostly do not require further comment here, except to note that they tend to conflict, such that some form of trade-off is often needed (Boyer & Lewis, 2002). For example, air freight may optimise speed but at the expense of the 'low cost' objective. Similarly, reliability, flexibility and quality need to be balanced against cost. As noted above, for example, JIT seeks to minimise inventory and this has been highly successful – in some cases feeding through directly to companies' profit margins (Callioni *et al.*, 2005). Excess inventory not only ties up capital but often requires (expensive) warehouses and staff to look after it. Furthermore, if the product is perishable or has a short product life cycle, that inventory is gradually declining in value as it sits in the warehouse. These costs and risks have to be balanced against the economics of large batch production and the need to hold stock in case of unexpected demand.

One particular trade-off, or tension, is between providing a high level of customer service and operating an efficient, low-cost supply chain (Heikkilä, 2002). This is particularly difficult when customers are segregated, such that the best customers are provided with a higher service level than the others. Such a strategy makes excellent marketing sense but adds considerable complexity to the underlying supply chain.

Even though companies need to take into account the potential conflict between the different objectives, they should not underestimate their importance. Slone (2004) discusses the case of Whirlpool electrical goods where supply chain staff used to be seen as 'sales disablers' who were unable to provide product availability or a low-cost supply chain. He goes on to explain how a rejuvenated supply chain considerably improved the company's competitive performance. This shows the importance of SCM and suggests that, in order to succeed, supply chains need to meet the above objectives.

These objectives are easier to meet though improved cooperation and exchange of information between trading partners. Acknowledging the benefits of close cooperation, partners have developed strategies for improving their relationships in terms of sharing data, plans and, in some cases, staff and facilities in order to improve the effectiveness of the supply chain. The importance of interorganisational relationships is discussed by numerous researchers. Lemke *et al.* (2003), for example, explore the various types of supplier-manufacturer partnership, while Bensaou (1999) examines different buyer-supplier relationships. Liker & Choi (2004) discuss the success of Toyota and Honda in building relationships with their American suppliers. Corbett *et al.* (1999) offer a framework that combines SCM, change management, marketing and logistics within the context of improving supply chain partnerships. Finally, Iansiti & Levien (2004) see 'strategy as ecology' and talk about the interdependent 'business ecosystem'. For them, the growing interdependence of trading partners means that in formulating their business strategies, companies must be careful to include their trading partners within the strategy.

This improved cooperation is further facilitated through the use of technology, and specifically of IOS, which integrates business processes along the supply chain, facilitates the processing of information, and supports the sharing of knowledge between trading partners (Malhotra *et al.*, 2005; Lowson *et al.*, 1999; Premkumar, 2000). The use of appropriate information technology does not only improve the efficiency of the supply chain, but also increases its ability to deal with uncertainty (Sammon & Hanley, 2004).

2.2.4 SCM and uncertainty

One of the main challenges that SCM has to face is environmental uncertainty (Hsu, 2005). Davis (1993) distinguishes between manufacturing uncertainty (e.g. machine breakdowns, computer errors and poor product design that affect the quality of products and cause disruptions or bottlenecks in production), demand uncertainty (changes in demand and irregular orders that lead to wrong forecasts and excessive inventory) and supply uncertainty (inability to supply on time due to defective material or natural disasters during transportation etc.). Wernerfelt and Karnani (1987) add competitive uncertainty, referring to the strategies of competitors and their response to the focal firm's strategies.

Lee (2002) examines markets where demand uncertainty is high (what he calls, innovative products, such as fashion clothing and pop music) and where demand uncertainty is low (functional products, such as basic groceries and electricity). He also looks at the supply side, distinguishing low uncertainty (or stable) processes (e.g. basic manufacturing) from high uncertainty processes (e.g. weather-related production such as farming and hydro-electric power). From this he produces a 2x2 matrix that suggests certain SCM strategies for

each high/low supply/demand quadrant. While this could be seen as a little simplistic, it does emphasise the prevalence of uncertainty throughout many supply chains and the need for reliable and timely information to mitigate the uncertainty.

In other articles, Lee *et al.* (1997; 2004) describe the 'Bullwhip Effect' where retailers, at the downstream end of the supply chain, distort consumer demand. They may extrapolate actual sales over-optimistically, or worry about potential shortages, but the result is that their orders exceed actual sales. This sends an incorrect signal back up the supply chain to distributors, manufacturers and raw material suppliers who increase production excessively with the result that all the stakeholders end up with excess inventory. For the next period the retailer reduces orders too much, to clear the inventory, and this again distorts demand. Thus the orders from the retailer show much greater variance than actual sales and this distortion is amplified as the signal is transmitted up the supply chain, producing dramatic and inefficient changes in production and costly inventories, alternating with out of stocks.

In addition to the 'everyday' uncertainties of supply and demand, there are also 'Acts of God'. *The Economist* (2006) describes the case of Nokia and Ericsson which both relied on a particular semiconductor plant in New Mexico for components for mobile phone handsets. This plant was badly damaged by fire and production virtually halted. Nokia was agile enough to obtain supplies elsewhere, mopping up all available capacity, while slow-moving Ericsson was left with a serious shortage of parts. This led Ericsson to stop making handsets on its own, in a sense leaving the industry. *The Economist* (2006) uses this case to highlight the dangers of excessively lean supply chains where there is no slack, or 'plan B', if something unexpected goes wrong. Such supply chains are arguably too rigid; should a node or link break, then the entire chain collapses.

The problem of uncertainty, both everyday and acts of God, strongly implies a need for flexibility in supply chains (Chou *et al.*, 2004) that need to adapt efficiently to sudden changes in supply and demand.

2.2.5 Summary

The management of supply chains is complicated due to the large number of activities that must be coordinated across organisational boundaries (Strader *et al.*, 1999). One of the problems faced by supply chains is the need to match supply with demand as well as satisfy forecast demand, especially in an environment characterised by uncertainty (Strader *et al.*, 1999). This involves improving planning and demand forecasts, coordinating the production capacity and product availability along the value chain, and avoiding out of stocks while keeping inventory as low as possible. It also involves the coordination of activities, sophisticated communication and sharing of information between trading partners.

The issues addressed above are further elaborated in the following sections that focus on the characteristics of grocery retail supply chains. These sections describe their business processes, as well as discussing their problems, challenges and the impact of information technology.

2.3 Grocery retail supply chains

Grocery retail supply chains[2] are becoming more and more competitive. By the beginning of the 1990's alternative store formats, such as discount stores, convenience stores (e.g. 7-eleven) and "category-killers", which offer specialised discount goods (e.g., sports goods), had started to emerge (Kurnia *et al.*, 1998). The appearance of these types of stores, as well as the more recent emergence of hypermarkets, highlighted the inefficiencies of traditional supermarkets and their supply chains (Harris & Swatman, 1997).

Meanwhile, large suppliers and multinational supermarket chains gradually spread across countries and continents, gaining an increasing share of the global market and offering reduced prices. The expansion of multinationals into local markets, and their consolidation through mergers and acquisitions, threaten smaller companies, lacking the power, competence and technological awareness of these new competitors. Therefore, local markets tend to become oligopolistic (Burt & Sparks, 2003).

Besides this increased global competition, companies need also to deal with progressively more demanding consumers and continually changing market needs. In this demanding environment the quest for optimising processes, improving service levels to consumers (Hoffman & Mehra, 2000), eliminating inefficiencies and cutting down costs is imperative for the survival and competitiveness of both suppliers and retailers. The traditional way of operating, whereby suppliers try to sell as much as possible at high prices while retailers aim to buy as little as possible at low prices, proved to be inefficient (Kurnia *et al.*, 1998; Harris & Swatman, 1997). Although making a profit at the expense of supply chain partners may generate short-term gains to an organisation, it creates administrative overheads and leads to increased inventory throughout the supply chain (Harris & Swatman, 1997). Therefore, to better satisfy consumer demand, companies need to change from a *push system*, in which suppliers push products into the supply chain, by continually offering deals to buyers, to a "*pull system*, in which products are pulled down the supply chain" based on consumer demand (Harris & Swatman, 1997; Kurnia *et al.*, 1998, p.126).

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[2] This thesis focuses on the distribution of Fast Moving Consumer Goods (FMCGs), which are products that have relatively low cost and a quick turnover (although the profit margin per item is small, profit is accumulated through the selling of large quantities of products). FMCGs involve packaged food products as well as other types of Consumer Packaged Goods (CPG), such as toiletries, soap, cosmetics and cleaning products.

Lee (2002) argues that grocery retail supply chains are characterised by low demand uncertainty, since most of the products are 'functional' in that they satisfy basic needs that do not change over time. He also argues that the supply uncertainty is equally low, since for most products the manufacturing process is stable and well established. Based on this reasoning, he concludes that grocery retail supply chains need primarily to be efficient. However, the increased competition, which often leads to low profit margins, forces companies to introduce innovative products, change the packaging, offer stickers or banded pack products. This leads to lower product life cycles, increasing variety and unpredictability. It also affects the manufacturing process which needs to be adjusted accordingly. Therefore, grocery retail supply chains need also to be responsive and flexible not only to satisfy customer requirements (IBM, 2004; Stank *et al.*, 1999) and changing market needs (Hoffman & Mehra, 2000), but also to beat the competition.

To increase their efficiency, responsiveness and flexibility, companies have realised that they need to collaborate both at a national and international level. They have also realised that in order to maximise benefits, they need to closely cooperate not only with trading partners, but also with competitors. Driven by this objective, leading suppliers and retailers have begun to work together towards the development of common management practices and standards. This perceived need for collaboration led to the establishment of a committee under the name of ECR (Efficient Consumer Response).

2.3.1 The ECR initiative

The term Efficient Consumer Response (ECR) first emerged in the 1992 annual conference of the Food Marketing Institute (FMI) in the USA (Kurnia *et al.*, 1998). It is a 'strategic initiative' that involves a collection of management methods, technologies and cooperative practices, enabling suppliers, distributors and retailers to work together, in order to deliver better value to consumers (Pramataris *et al.*, 1997). Its objective is to establish "a responsive, consumer-driven" supply chain, in which waste and inventory are eliminated, cycle times are reduced, customer satisfaction is maximised, operations are optimised and costs are minimised (Kurnia *et al.*, 1998, p.1; Pramataris *et al.*, 1997; Corsten & Kumar, 2005).

ECR builds on older QR techniques (introduced in the mid-80s) (Harris & Swatman, 1997), but addresses a much wider range of issues. The differences between QR and ECR relate to the different characteristics of the industries in which they are applied (Kurnia *et al.*, 1998; Pramataris *et al.*, 1997). The ECR initiative, which started in the mid-90s, is centred on the grocery market. Its aim is to raise the performance levels across the entire industry, by redesigning processes and altering traditional business practices. It is considerably more complex than prior managerial innovations, because of the high level of trust and

cooperation required between trading partners (Brockman & Morgan, 1999; Kurnia & Johnston, 2000).

ECR focuses on the efficiency of the supply chain as a whole rather than on the improvement of individual parts or specific aspects of the value chain (Pramataris *et al.*, 1997). It intends to overcome traditional barriers between trading partners and aims to maximise benefits by strengthening collaboration (Corsten & Kumar, 2005) between manufacturers, suppliers, distributors and retailers. The idea is that by working together trading partners can exchange information and improve efficiency, including order management, inventory replenishment and delivery management (Whiteoak, 1999). They can also better assess customer needs and achieve consumer satisfaction, as well as improving their flexibility to unforeseen requests (Stank *et al.*, 1999). Therefore, ECR supports an ongoing effort of improvement (Pramataris *et al.*, 1997) by introducing principles of collaborative management along the supply chain (Hoffman & Mehra, 2000).

ECR addresses these issues by focusing on the following four areas: demand management, supply management, their enablers and integrators. As demonstrated in **Figure 2**, these areas are not independent, but interrelated. Because of their impact across the supply chain, they cannot be achieved by individual organisations alone and require close cooperation between trading partners.

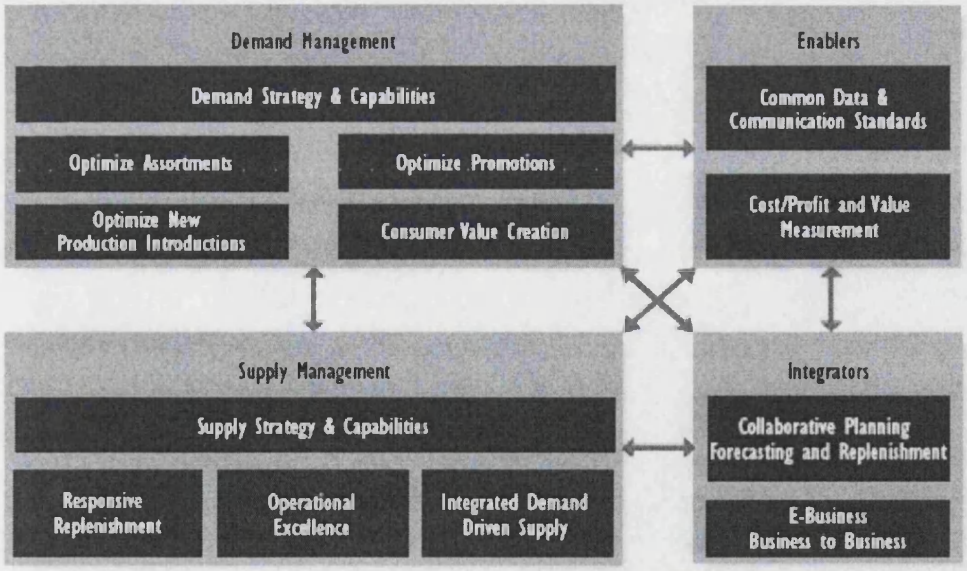

Figure 2: Focus areas of ECR. *Source www.ecrnet.org (ECR Europe)*

Demand management is associated with understanding and managing the demand for products and services. It involves collaborative practices to stimulate consumer demand through joint marketing and sales activities (Corsten & Kumar, 2005). It concerns the

effective categorisation of products as well as the improved introduction and promotion of products or services. Therefore, it includes the following areas:

Demand strategy and capabilities: refers to the development of a clear demand strategy in cooperation with trading partners. It involves the design of well-organised processes supported by IT.

Collaborative shopper value creation: based on collaborative customer relationship management, it refers to the effort of suppliers in collaboration with retailers to create additional value to consumers through the provision of product combinations, additional information or services.

Optimise assortments: closely linked to category management (Brown & Bukovinski, 2001), which is the process of managing complementary or similar products (Pramataris *et al.*, 1997), it involves understanding the role of a category as opposed to individual brands. It addresses issues, such as how many and which type of items, in what sizes/flavours/packages, can be carried in a category and how much space they should be given. It also involves improving their shelf management and at the store level (Kurnia *et al.*, 1998) as well as eliminating poorly performing SKUs (stock keeping units). Therefore, it requires cooperation and exchange of information between suppliers and retailers (Pramataris *et al.*, 1997).

Optimise promotions: involves an attempt to optimise the selling strategy (Brown & Bukovinski, 2001) and to align promotion strategies with the needs of each category. It aims to address inefficient promotional practices and to eliminate 'forward buying' (Brockman & Morgan, 1999, p.405).

Optimise new product introduction: aims to align new product strategies with business objectives and consumer needs. It involves the selection of new products (Brockman & Morgan, 1999) and the planning of their introduction.

Supply management: addresses the need for quick and efficient replenishment of products across the supply chain. It aims at improving the flow of products and information, from production up to point of sales, by encouraging the establishment of close relationships between trading partners.

Efficient replenishment: addresses all issues involved in the movement of goods from the manufacturer to the retailer's point of sale (Pramataris *et al.*, 1997). It involves collaborative practices to optimise product flow across the supply chain (Corsten & Kumar, 2005). Its objective is to decrease the time and cost of replenishment, shorten the ordering cycle, increase its efficiency, balance inventory levels and increase service levels to consumers. It

aims to achieve "the provision of the right product to the right place at the right time and in the right quantity" (Kurnia *et al.*, 1998, p.129), by quickly replenishing products at POS based on data regarding consumer demand. Its successful implementation requires the use of advanced information technology (Brockman & Morgan, 1999).

Integrated demand driven supply: aims to synchronise production with consumer demand. It involves planning and control methods that align the frequency and volume of raw material, packaging and product supply, with the actual demand. It aims to establish shorter lead times[3], more frequent feeding of stores, lower inventory levels and increased responsiveness, balanced against costs.

Operational excellence: involves the application of management methods to increase the reliability of operations, such as avoiding out-of-stocks, defective products, delays in deliveries and administrative errors. It focuses on building effective production and efficient deliveries, as well as reliable store operations (including in-store inventory and product shelving).

Enablers: are applied methods and technologies that support operations related both to demand and supply management. They include technologies, such as EDI and CRP (continuous replenishment program), which are presented in the following section, CAO (computer assisted ordering)[4], as well as techniques, such as cross docking[5].

Integrators: refer to ways of operating and collaborating that integrate management practices with advanced technologies. "They involve collaborative information technologies and process improvement tools to support joint relational activities" (Corsten & Kumar, 2005, p.81). ECR mentions two main integrators:

- E-Business or Business to Business e-commerce, which explores new ways of doing business using computer networks and standards of communication, and

[3] Shorter lead times mean that manufacturers no longer depend on long range forecasts that may lead to inaccurate estimations, additional costs and increased inventory. To accomplish that, manufacturers move from a 'fixed-volume, variable-sequence' to a 'variable-volume', 'fixed-sequence' production schedule (GlobalSchorecard.net)

[4] Computer assisted ordering (CAO) also known as computer-aided ordering, handles the replenishment of products from the retailer's central warehouse to its stores (supermarkets). Based on POS (current and historical) data as well as on sales forecasts, it automatically generates retail stores' orders, when the shelf inventory drops below a predetermined level (Pramataris *et al.*, 1997; Harris & Swatman, 1997).

[5] The aim of cross-docking is to speed up the flow of products from the supplier to the retailer by reducing storage and management of products in the warehouse. It involves reception and immediate reassembling of products for delivery and shipping to stores, (Harris & Swatman, 1997).

- Collaborative Planning Forecasting and Replenishment (CPFR), which is considered as the ultimate efficient replenishment facilitator, aiming to provide an integrated electronic environment supporting buying, selling, forecasting, planning and replenishment.

This thesis focuses on the supply side of ECR and specifically on the processes of buying, selling and replenishment. It thus examines the interaction between suppliers and retailers as well as the information technologies that support it.

2.3.2 The role of information technology in ECR

Technology plays an important role in the implementation of the management practices specified through ECR. It provides valuable and accurate information, allows the exchange of information between trading partners, supports knowledge sharing and facilitates decision making (Pramataris *et al.*, 1997). It automates business processes, enables electronic commerce, as well as enhancing 'the communication and relationships between companies' (Kurnia *et al.*, 1998, p.127).

From the broad set of technologies supporting operations in the grocery retail supply chain, this study focuses on interorganisational systems (IOS) that have been widely used to handle business processes involving interaction between trading partners (Holland, 1995). Interorganisational systems are defined as computer-based information systems that facilitate the exchange of information electronically using telecommunications between different organisations' computer systems (Johnston & Vitale, 1988). They are described as information and communication technologies that transcend and blur organisational boundaries, enabling the flow of information from one organisation to the other (Hong, 2002). They involve all aspects of using networked computers for business purposes including office automation, electronic mail, corporate intranets, extranets and electronic document exchange (Kalakota & Whinston, 1996). They include interconnected ERP systems (Tarn *et al.*, 2002; Buxmann *et al.*, 2004), electronic data interchange (Swatman & Swatman, 1992) and internet-based systems (Lancioni *et al.*, 2003; Chou *et al.*, 2004).

In the context of grocery retail supply chains IOS have been used to support and facilitate the materialization of management practices, such as efficient replenishment (Lowson *et al.*, 1999), vendor-managed inventory (Waller *et al.*, 1999) and collaborative planning forecasting and replenishment (Pramataris *et al.*, 2003).

Within the broad group of interorganisational systems EDI is still considered as one of the most important applications with considerable impact on the way business is conducted (Angeles *et al.*, 2001). EDI is a subset of the interorganisational systems' concept (Swatman & Swatman, 1992), introduced in the early 1980's (Chou *et al.*, 2004).

By the end of the 1990's more advanced systems, mainly based on the internet and XML emerged. Although these technologies promise to eliminate the constraints and increase the benefits associated with traditional IOS, they have limitations (Seveg *et al.*, 1997) and their adoption has been relatively slow (Threlkel & Kavan, 1999).

Recognising that these technologies are still not widely used, and that the literature examining their impact is fairly limited (Barry & Doyle, 2006), this chapter primarily discusses the characteristics and implications of EDI-based systems. Besides providing a brief description of EDI messages used in the grocery retail supply chain, the following sections also present a more advanced EDI-based system called CRP (Continuous Replenishment Program). They additionally discuss the development and use of more contemporary technologies supporting CPFR.

2.3.2.1 EDI

EDI (electronic data interchange) is a key enabling technology for efficient replenishment (Brockman & Morgan, 1999). It supports the electronic exchange of business documentation in a standardised format that can be translated and processed (Jimenez-Martinez & Polo-Redondo, 1998; Swatman & Swatman, 1992; Park *et al.*, 2005). The architecture of EDI consists of the following components (Jimenez-Martinez & Polo-Redondo, 1998, p.814):

- Equipment (hardware and software) that issues and receives information,
- a communications network that connects the equipment and
- a common language (EDI standard).

The equipment requirements can be fulfilled by any kind of computer, in which specialised software, called an EDI-translator, is installed. This software translates the messages received into a format that is readable by the firm's internal information system and vice versa (Jimenez-Martinez & Polo-Redondo, 1998).

In traditional implementations, the communication networks, called VANs (value added networks), are usually based on the X400 or X435 protocols. They are proprietary and expensive networks offered by VAN providers. Besides providing the means of communication, VANs also offer services, such as routing, delivery and tracking of documents exchanged (Peppart, 1993). Different VAN's are often incompatible and their linking usually requires bridging software.

The barriers erected by proprietary VANs have in many instances fallen to the Internet (Ghosh, 1998). The Internet provides an inexpensive alternative (Burgess & Cooper, 1998) to VANs and represents a massive opportunity for companies to communicate not only with customers or suppliers, but also with other business partners (Seveg *et al.*, 1997). By being

public and cheap, it also allows small and medium-sized firms to participate in electronic transactions (Angeles & Nath, 2000).

Besides the medium of communication, the selection of the messaging standard is also an important factor affecting the implementation of EDI (Fliedner, 2003; Angeles & Nath, 2000). Over the years several document translation standards, such as ANSI X12, Tradacoms and GTDI (General Purpose Trade Data Interchange), have been developed (Swatman & Swatman, 1992). The problems of incompatible standards led to the development of the EDIFACT (Electronic Data Interchange for Administration Commerce and Transport) standard by UN-JEDI (United Nations Joint European and North American Working Party) (Swatman & Swatman, 1992; Damsgaard & Truex, 2000).

The most common types of EDI messages, supported by EDIFACT and exchanged between suppliers and retailers, are electronic price catalogues (PRICAT), electronic invoices and electronic orders.

PRICAT messages are sent when new products are issued or old ones are changed. They include product information, such as name, identifier and code, as well as logistics data, such as shape, weight, volume, number of items per case, cases per layer, layers per pallet and volume of the pallet. The exchange of PRICAT messages provides suppliers with an efficient way to inform their customers regarding product changes. It also enables retailers to automatically update their product catalogues, eliminate mistakes and use logistics data for storage and orders.

Electronic invoices are used to automatically inform retailers of the cost and details of their order. They reduce mistakes and speed up the process of payment. They can be sent before product delivery and used by retailers as a check list for the products received.

EDI orders replace traditional fax-based orders. They reduce the cost of ordering and enable the automatic update of order data in both suppliers' and retailers' information systems. By eliminating data entry they also reduce errors. In more sophisticated forms of EDI implementations, aiming to support Efficient Replenishment, the orders are issued automatically when the stock level drops beneath a certain level. Based on demand forecasts, the EDI-based ordering system calculates the quantity of products to be ordered to maintain an optimum level of stock.

These types of systems are complicated and require detailed information (e.g. product code, weight, size, units per box and cases per pallet) for every product of every supplier. Such systems can only be implemented by large and competent retailers, having the ability to monitor the demand of all products from all suppliers. Besides technological awareness and expertise, their use also requires close cooperation between retailers and suppliers.

2.3.2.2 CRP

An alternative EDI-based system supporting Efficient Replenishment is CRP (Continuous Replenishment Program). CRP is the implementation of vendor-managed inventory (VMI) in the grocery sector. VMI is a significant development supporting collaboration and information sharing in supply chain management (Mishra & Raghunathan, 2004). It transfers ordering and inventory-monitoring costs to suppliers (Mishra & Raghunathan, 2004), who become responsible for generating orders to meet demand as well as for maintaining inventory at pre-agreed levels (Shister, 2006). In VMI, ordering and inventory costs are reduced (Sarpola, 2007), out of stocks are less frequent and the bullwhip effect, that is the distortion of demand information from the retailer to supplier, is minimised (Çentinkaya & Lee, 2000; Disney *et al.*, 2004).

Similarly, in CRP the responsibility of ordering is shifted from the retailer to the supplier (Harris & Swatman, 1997). CRP extends the use of EDI links to accommodate the exchange of inventory information. In its most common form, the retailer's central warehouse sends an inventory report to the supplier, including information such as stock availability, stores' orders and products in-transit (Pramataris *et al.*, 1997). The system at the supplier's side interprets this inventory data and produces a suggested order to replenish products, while maintaining inventory at reduced levels (Raghunathan & Yeh, 2001).

CRP is not a fully automated procedure, since a person responsible for its usage is needed. This person, called the CRP user or analyst, is responsible for checking the automatically produced order to identify mistakes or handle product changes and promotions. Once finalised the order is sent to the retailer, which may request changes[6].

An agreement between the retailer and the supplier specifies the time that the retailer sends the stock availability, as well as the time that the supplier will replace the missing stock. With CRP shipments can be as frequent as daily. In other forms of CRP the service may also be provided by a third party (Pramataris *et al.*, 1997).

EDI provides the standardised format for the transmission of inventory and order data, but this is not sufficient for the implementation of CRP. A rudimentary decision support system is also used (Waller *et al.*, 1999) to predict consumer demand and product flow, based on a detailed and continuously updated history of demand. Leading edge CRP applications may also support promotional planning (Pramataris *et al.*, 1997).

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[6] Since CRP optimises ordering and aims to keep inventory as low as possible, the orders it produces are most of the times accepted by the retailers.

It is argued that the use of CRP provides more benefits than traditional EDI (Pramataris *et al.*, 1997; Raghunathan & Yeh, 2001). As mentioned above, in traditional EDI ordering, retailers (who sell various products of multiple brands) are responsible for generating orders (Mishra & Raghunathan, 2004). This is especially complex when promotions are scheduled, old products are replaced, or new ones released. Conversely, in CRP the responsibility of ordering is shifted to suppliers, who can better control their own products as well as more easily handle changes in demand, seasonal products and promotions. Therefore, the complexity of ordering is decreased. Nevertheless, close cooperation between suppliers and retailers is still required, mainly for the collection of the sales history and the prediction of demand.

In CRP, the history of consumer demand is built through the inventory data sent regularly from the retailer's central warehouse. However, a more effective and precise planning of demand also requires the gathering of POS data, which is one of the aims of CPFR.

2.3.2.3 CPFR

CPFR is considered as a management strategy, but also as a set of interoperable technologies enabling the integration of production with demand. Compared to the earlier EDI-based supply chain practices, CPFR is a much broader cooperative arrangement (Kim & Mahoney, 2006) through which trading partners set mutual business objectives, develop joint sales, operational and replenishment plans, as well as collaborating to generate sales forecasts (Pramataris *et al.*, 2003). Therefore, CPFR is an "attempt to coordinate the various activities including production and purchase planning, demand forecasting and inventory replenishment between trading partners" (Fliedner, 2003, p.14) across the supply chain.

Since, CPFR is relatively new, there is little empirical data to evaluate its impact (Fliedner, 2003). Nevertheless its expected benefits comprise increased sales, faster order response times, lower product inventories and faster cycle times (Småros & Främling, 2001 ; Fliedner, 2003). CPFR also aims to improve forecast accuracy (Slone, 2004), as well as to reduce uncertainty by enabling the sharing of internal information between trading partners (Park *et al.*, 2005). The exchanged information may include forecasts, pricing, promotions and inventory data, as well as production and shipping schedules (Chou *et al.*, 2004). It also includes retail POS data (Kim & Mahoney, 2006; Pramataris *et al.*, 2003).

The sharing of information is conducted through the use of IOS and depends heavily on the selection of EDI and XML standards (Gelinas & Markus, 2005). The most commonly used IOS are Internet-based systems, which are now 'indispensable for supply chain forecasting, planning, scheduling and execution' (Gunasekaran *et al.*, 2004, p.88).

However, the use of advanced web technologies is not sufficient for the implementation of CPFR. For collaborative commerce to succeed these Internet-based systems need to be fully integrated with the information systems (Gelinas & Markus, 2005) or the ERP planning systems of each organisation along/across the supply chain (Fliedner, 2003). But, the existence of different Internet-based platforms and varied messaging standards has complicated the development and delayed the adoption of integrated CPFR applications (Gelinas & Markus, 2005).

2.3.3 Benefits associated with the use of interorganisational systems

The impact of IOS on the entire business network, as well as on individual firm's place within it has attracted the attention of many IS researchers – e.g. (Johnston & Vitale, 1988; Holland, 1995; Webster, 1995; Chan & Swatman, 1998; Angeles *et al.*, 2001). As a consequence, much research has been conducted to reveal the benefits and problems associated with the use of IOS and especially of EDI, the most widely used technology of this type.

The use of IOS is associated with a number of benefits (Park *et al.*, 2005). The ability to exchange data electronically reduces transaction and administration costs (Chwelos *et al.*, 2001), improves the speed of communication and increases throughput. IOS, and especially EDI, allow business to better cope with the avalanche of paperwork used for purchases, orders, invoices, confirmation notices, shipping receipts and other documents (Hoogeweegen & Wagenaar, 1996; Kalakota & Whinston, 1996). They increase process automation, contribute to labour-savings, reduce delays in data handling, diminish the need for data entry and minimise the occurrence of errors (Saxena & Wagenaar, 1995; Reekers & Smithson, 1996; Roberts, 1996). In some cases they also enable error investigation, control and correction (Saxena & Wagenaar, 1995; Roberts, 1996). Therefore, in addition to operational efficiency, IOS increase the legitimacy, accountability and reliability of organisations (Iacovou, 1995).

Besides facilitating the accurate, frequent and timely exchange of information (Strader *et al.*, 1999), IOS also enable the materialization of management practices, such as Efficient Replenishment. They reduce the order to delivery time, decrease inventory and cost of storage (Park *et al.*, 2005), while eliminating out of stocks. They further enable quick response to customers/trading partners, facilitate access and sharing information, improve quality of service (Angeles *et al.*, 2001) and increase responsiveness to consumers.

IOS also support the establishment of cooperative relationships between trading partners (Pramataris *et al.*, 1997; Christopher, 2000; Hong, 2002; Sammon & Hanley, 2004). They are seen as vehicles of collaboration enabling trading partners not only to interact at the

points of buying and selling, but also to cooperate in marketing, logistics and planning (Webster, 1995). They permit intensive sharing of information between organisations (Webster, 1995; McLaren *et al.*, 2004; Cunningham & Tynan, 1993) and lead to improved trading relationships. Besides intensifying interactions between organisations (Williams, 1997), IOS may also facilitate the restructuring of partnerships (Bakos & Treacy, 1986) and in the long run change the structure of the industry. As Hong (2002, p.262) argues 'IOS-enabled partnerships and alliances make it possible to seek business opportunities via new organizational and market relationships'. Therefore, IOS are often seen as key strategic tools in the re-conceptualisation of the entire business network and the individual firm's place within it (Reekers & Smithson, 1994).

Through their impact on business relationships, IOS may additionally influence the flexibility of the supply chain.

2.3.4 Interorganisational systems and flexibility

Golden and Powell (1996) identify the altered business relationships and the restructuring of organisational boundaries, enabled by technology, as the prevalent causes of increased flexibility. They state that the use of IOS enables the organisation to explore new markets and facilitates the creation of trading partnerships. It also allows for changes in interorganisational interaction, by facilitating the addition of new messages into the conversation (Moore, 2001).

Reekers and Smithson (1994) argue that the improved collaboration and intensive interaction, facilitated by the reduction of coordination costs, enables companies to react more flexibly to customer and market demands. Lim and Palvia (2001) state that flexibility is provided by the speedy and accurate processing of information, which contributes to the availability of products, as and when needed by the customer. This is further supported by Jimenez-Martinez & Polo-Redondo (1998) who argue that interorganisational systems enable rapid response to changes in the market by facilitating the exchange of information, as well as by providing information regarding changes in sales trends. Rapid response is also accomplished through the decreased order to delivery time (O' Callaghan, 1998), since as Whiteoak (1999) argues the shorter the replenishment cycle, the less time it takes to fix situations, such as out of stocks. Therefore, IOS and especially EDI may offer increased 'flexibility in meeting requirements of customers' (Stank *et al.*, 1999, p.36).

The use of the internet is expected to further increase flexibility (Chou *et al.*, 2004) through facilitating the electronic integration of business processes with those of other supply chain members, through supporting the provision of world-wide customer service as well as through reducing service cost and response time (Gunasekaran *et al.*, 2004). Besides

providing ubiquitous reach and real time access, the Internet is also argued to provide access to smaller organisations (Threlkel & Kavan, 1999). Further benefits are expected by the use of XML, which may offer a more scalable and flexible standard than EDIFACT (Power, 2005).

However, as will be shown in the following sections, IOS also raise a number of problems that constrain their diffusion, influence their implementation (Chan & Swatman, 1998) and limit their realised benefits. These problems are not only technological, but also organisational and interorganisational.

2.3.5 Technological, organisational and interorganisational constraints

One of the main inhibitors of traditional IOS adoption was and still is the difficulty of integrating EDI with the organisation's existing processes and information systems (Threlkel & Kavan, 1999). It cannot be implemented quickly or inexpensively and is therefore inappropriate for many companies (Moore, 2001). According to Swatman and Swatman (1992) some firms face several problems in order to adjust these systems to their internal procedures or business strategies. They often need to change their internal information system or reorganise their business processes in order to achieve integration. However, not all organisations have the resources or the time to make the required changes. They further may not be able to recruit or train the employees required for the usage of these systems. All these issues inhibit the successful adoption of EDI, which primarily depends on the motivation of trading partners to get involved (Barry & Doyle, 2006).

Additional constraints, hindering the implementation of EDI, are its high cost (Daniel & White, 2005) and the existence of multiple EDI standards (Damsgaard & Truex, 2000). The lack of a common messaging standard has caused difficulties (Strader *et al.*, 1999) especially for smaller firms who did not have the resources to support the multiple standards needed to supply different customers. Therefore, the existence of different standards may produce virtually closed user groups, focused on particular industries (Reekers & Smithson, 1994).

Further problems were faced due to the use of the proprietary, expensive and incompatible VAN networks. The difficulty of interconnecting different VANs creates several problems in interorganisational cooperation (Golden & Powell, 1997). This could pose a logistical nightmare to firms that might need to subscribe to incompatible VANs in order to work with different trading partners (Angeles *et al.*, 2001).

Due to these problems of interoperability, the process of changing partners was often difficult, time consuming and expensive (Moore, 2001). As a result, traditional IOS could lead to the creation of isolated networks of productivity, unable to communicate with each

other. They could also strengthen existing commercial relationships and lock partners into a business network (Steinfield *et al.*, 1995). Therefore, "although collaborative IOS was the vision behind the clustering of firms into networks, the reality in the marketplace was often that of a `lopsided' IOS, with the power accruing to the centre of the network, which was usually a large customer with a prominent presence in industry" (Angeles & Nath, 2000, p.243). It was mainly the dependency of trading partners on a large customer/supplier that gave the latter the 'power' to encourage EDI adoption (Chwelos *et al.*, 2001).

A representative case in the grocery retail supply chain is that of Tesco in the UK (Webster, 1995; Cunningham & Tynan, 1993). After implementing EDI-based transactions, Tesco forced its suppliers to employ EDI, by using the phrase "EDI or die". Although this tactic encouraged some suppliers to comply, it tended to exclude many others, especially the smaller ones. In contrast, the suppliers that did implement EDI with Tesco found that they could not easily interact with other customers, due to differences in standards and VANs used. As a result, some suppliers were locked into the business network.

Similar examples can be found in other sectors, reinforcing the argument that most IOS (especially EDI links) tended to be 'hub–and–spoke' arrangements (Premkumar, 2000; Damsgaard & Truex, 2000; Webster, 1995) with a big customer in the middle and a large number of suppliers hanging onto the spokes (Kalakota & Whinston, 1996; Angeles & Nath, 2000). As Reekers and Smithson (1994) state, such unilateral linkages rarely mean true partnerships based on cooperation, trust and consensus, but instead are characterised by interdependence and domination. "Proprietary networks by their very nature confer advantage upon their proprietors and disadvantage upon the non-owners" (Webster, 1995, p.38). Because of their purchasing power, 'hubs' can dictate the terms on which they do business with the 'spokes'. On the other hand, spokes (such as small suppliers) have little choice but to accept the solutions imposed by their large customers (Kumar, 1996). This domination typically leads to an inequitable sharing of costs and benefits.

Such solitary efforts proved to be inefficient and the need to move towards more integrated and agile business networks was reinforced (Angeles & Nath, 2000). As a result, companies belonging to the same industry have realised that they needed to work together towards the adoption of a common standard (EDIFACT - for most industries in Europe) and interoperable VANs.

Besides agreeing upon a common standard and interconnected VANs, EDI-aware companies have also started to exploit the cross-platform and user-friendly environment of web technologies. This has led to the development of electronic marketplaces, offering Internet-based platforms for the handling and exchange of information between different

organisations. By offering a cheap alternative to VANs (Chou *et al.*, 2004), as well as providing a more open and interoperable infrastructure, these web applications are expected to facilitate interorganisational transactions. Further benefits are expected by the use of XML and the development of EDI/XML[7], which are scalable and flexible standards enabling the exchange of information between applications (Power, 2005).

Even though these Internet-based applications provide more cost effective and cross-platform solutions for interorganisational communication, they involve technical concerns (Chou *et al.*, 2004) and have not yet eliminated the constraints imposed by traditional IOS.

One of the main weaknesses constraining the diffusion of Internet-based interorganisational systems is that they rely on a public network, involving security and privacy risks (Ghosh, 1998; Angeles *et al.*, 2001). Knowing that reliability and security are critical for the successful implementation of interorganisational systems (Angeles *et al.*, 2001), providers of internet-based platforms are developing similar services to those of VANs. However, this requires additional manipulation and processes, which often increase the cost.

On the other hand, to maintain their customer base and prevent firms from moving their EDI transactions to Internet providers, VAN providers are either lowering their rates (Seveg *et al.*, 1997) or even reworking their practices to also jump to the Internet (Threlkel & Kavan, 1999). As a result the Internet is not always an appealing and cheap alternative for interorganisational transactions (Seveg *et al.*, 1997).

Additional reasons that prevent the adoption of internet-based interorganisational platforms are the proliferation of technologies (Threlkel & Kavan, 1999) and the problems faced in their integration with the different companies' legacy systems (Chou *et al.*, 2004). The electronic marketplaces, developed so far are based on varied technologies, such as BizTalk[8], RosettaNet[9], ebXML[10] and web services (Chou *et al.*, 2004). The variety of technologies has again created problems of incompatibility between the different marketplaces and has

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[7] An open standard supporting the exchange of EDI messages over the Internet.

[8] BizTalk is an industry initiative headed by Microsoft to promote XML as the common data exchange language for e-commerce and application integration on the Internet. Aiming to develop a common XML message-passing architecture to tie systems together, it provides guidelines, referred to as the BizTalk Framework, for how to publish standard data structures (schemas) in XML and how to use XML messages to integrate software programs.

[9] RosettaNet is a consortium of more than 400 companies aiming to develop and implement an open E-Business standard. It offers a robust solution comprising data dictionaries, business messages schemes and business process specifications (Sammon & Hanley, 2004)

[10] ebXML (Electronic Business XML) is a project to use XML to standardize the secure exchange of business data. Among other purposes, ebXML also accommodates the exchange of EDI messages. This project was launched by the United Nations body for Trade Facilitation and Electronic Business Information Standards (UN/CEFACT) and the Organization for the Advancement of Structured Information Standards (OASIS). It has 75 member companies, including large IT vendors and trade associations around the world.

additionally limited integration capabilities of current technologies across the supply chain (Fliedner, 2003).

The exchange of XML messages supported by most electronic marketplaces is not on its own sufficient for the implementation of cross-platform applications. Such applications primarily require the development of a common messaging standard (PeopleSoft, 2004; Småros & Främling, 2001). However, due to the immaturity of current XML standards and the widespread use of EDI messages, it will take some time before a clearer convergence of messaging standards emerges (Angeles *et al.*, 2001).

The constraints and integration capabilities of current technologies have encouraged many companies to keep their EDI-based links and put off the adoption of web applications and XML. It is, therefore, argued that 'non-Internet based EDI-networks will continue to account for a sizeable portion' of total interorganisational transactions (Angeles *et al.*, 2001, p.330), at least until a critical mass of companies is willing to adopt compatible standards and interoperable technologies (Fliedner, 2003).

2.3.6 Concluding remarks

In the global and demanding environment, of the grocery sector, the quest for efficiency and flexibility is imperative for the survival and competitiveness of both suppliers and retailers. To optimise their business processes and increase efficiency, organisations are working together under the umbrella of ECR. They also invest in technologies, especially IOS, which improve collaboration with trading partners, automate business processes, support knowledge sharing and facilitate decision making.

IOS arguably increase the efficiency of organisations by automating and speeding up processes, by decreasing the costs of administration and communication, as well as by eliminating data entry and considerably reducing errors. They also seem to increase the flexibility of organisations by decreasing cycle times and increasing responsiveness to consumers' changing needs.

However, IOS also suffer from constraints related not only to technological, but also to organisational and interorganisational issues. Their high cost inhibits smaller organisations from participating in electronic partnerships. Furthermore, the limited capabilities of integration and the incompatibility between networks and standards often lead to closed business networks, lock-in effects and inequitable sharing of benefits between trading partners. Therefore, whether IOS can provide flexibility to all organisations is still debatable.

As IOS have both organisational and interorganisational implications, their impact on flexibility needs to be examined both at the level of the firm and at the level of interaction

between firms. Nevertheless, an understanding of the issues involved primarily requires an understanding and clarification of the complex notion of flexibility.

2.4 The notion of flexibility

The notion of flexibility is complex and 'multifaceted' (Evans, 1991), with diverse meanings and definitions in various contexts. Most definitions, though, address the problem of adjusting available means to respond to environmental disturbances (Evans, 1991). Flexibility does not only refer to the ability to adapt to changing environmental conditions (Fitzgerald & Siddiqui, 2002), but also to the capability to move rapidly and take advantage of opportunities (Lucas & Olson, 1994). Therefore, flexibility is especially critical in cases where the environment is intensely competitive, continuously innovative and contains uncertainties about which there can be little or no prior knowledge (Evans, 1991).

Anchored in different disciplines, flexibility has received various conceptualisations and explanations. It has interested researchers in several fields, such as manufacturing management, e.g. (Shewchuk & Moodie, 1998; Sethi & Sethi, 1990), computer science, e.g. (Janson *et al.*, 1997; Jardin, 1996), information systems, e.g. (Fitzgerald, 1990; Eardley *et al.*, 1997), and organisation and management studies, e.g. (Evans, 1991; Volberda, 1996).

2.4.1 Flexibility in manufacturing systems

Since the "emergence of microprocessor technologies, the concept of flexibility has become a key consideration in the design, operation and management of manufacturing systems" (Sethi & Sethi, 1990, p.289).

According to Schewchuk and Moodie (1998, pp.328-329) manufacturing systems comprise equipment and machines (e.g. material handling, processing or assembly equipment, inspection stations) as well as operating and control algorithms that determine the operation of the equipment. As they argue "these items determine the *capability and capacity envelope* for the system". They further state that the main function of a manufacturing system is to transform a given stream of *inputs* (e.g. raw materials, components) into *outputs* (finished products), in accordance with certain *production requirements* and *performance objectives.* Nevertheless, the definition of the boundary of a manufacturing system is often a source of confusion, since besides factory floors or machines, it may also include employees or suppliers (Upton, 1994).

The flexibility of a manufacturing system is concerned with how well a system performs "under a variety of conditions", as well as with the ability of machines or groups of machines to adapt to change (Mandelbaum & Brill, 1989, p.603). Flexible manufacturing is also associated with small-batch production tailored to the needs of highly differentiated market

niches. It may additionally involve changes in the way workers do their jobs (e.g. increased skill requirements, giving workers greater responsibility for quality control or creating multifunctional teams) (Gale *et al.*, 2002).

A more general definition is given by Upton (1994, p.73) who argues that flexibility refers to the "ability to change or react with little penalty in time, effort, cost or performance". Similarly, Tincknell and Radcliffe (1996, p.20) define flexibility as the ability "to cope with the uncertainty of change efficiently and effectively". From the point of view of managers, manufacturing flexibility is related to the ability to reduce the cost and lead time of product development, as well as to the capability to keep up with environmental changes (Zukin & Dalcol, 2000).

To explain the complex concept of flexibility in manufacturing, several researchers have identified different types of flexibility.

Sethi and Sethi (1990) further clarify the eight different types of flexibility, originally proposed by Browne *et al.* (1984). They extend this classification by adding: *market flexibility*, *production flexibility* and *flexibility of material handling*. These categories, presented in **Table 3**, represent the most commonly referenced classification of flexibility in manufacturing. With this work, Sethi and Sethi have placed manufacturing flexibility in the wider context of the organisation and business environment (Beach *et al.*, 2000).

Type of flexibility	Definition
Machine flexibility	The various types of operations that the machine can perform without requiring prohibitive effort in switching from one operation to another.
Flexibility of material handling	The ability of the system to move different part types efficiently for proper positioning and processing through the manufacturing facility it serves.
Operation flexibility	The ability of a part to be produced in different ways.
Process flexibility	The set of part types that the manufacturing system can produce without major setups.
Product flexibility	The ease with which new parts can be added or substituted for existing parts.
Routing flexibility	The ability of a manufacturing system to produce a part by alternate routes through the system.
Volume flexibility	The ability of a manufacturing system to be operated profitably at different overall output levels.

Expansion flexibility	The ease with which the capacity and capability of a manufacturing system can be increased when needed.
Program flexibility	The ability of the system to run virtually untended for a long period.
Production flexibility	The universe of part types that the manufacturing system can produce without adding major capital equipment.
Market flexibility	The ease with which the manufacturing system can adapt to a changing market environment.

Table 3: Different types of flexibility. *Source Sethi and Sethi, 1990*

Upton (1994) identifies fifteen different types of manufacturing flexibility from the literature. Besides those described above, these also include *action, state, long-term, short-term, labour* and *design-change*. However, as he argues there are practical difficulties in using all these different types of flexibility, which often overlap, to analyse and solve managerial problems. Therefore, he proposes *range*, *mobility* and *uniformity*, as three distinct 'elements' that demonstrate and measure flexibility at a given period of time.

Tincknell and Radcliffe (1996) present a framework of flexibility based on the notions of *capability* (is the physical range of functions or operations that a machine or system can perform) and *versatility* (ability of the system to change intentionally or to exist in different states).

Finally, Shewchuk and Moodie (1998, p.336), based on an extensive literature review, analyse five dimensions of flexibility, which, as they argue, do not overlap and cover the different interpretations of flexibility. The definitions of these dimensions are presented in the following table (**Table 4**):

Type of flexibility	Definition
Operational flexibility	The ability to utilize the elements of a manufacturing system, in alternative ways (Shewchuk & Moodie, 1998, p.336).
Range flexibility:	The use of multiple configurations, the larger is the set of different configurations possible (i.e., size of the capability and capacity envelope), the more flexible the system will be (Shewchuk & Moodie, 1998, p.336). The total envelop of capability or range of states which the production system is capable of attaining (Slack, 1987, p.39).
Response flexibility	The ease of moving from one manufacturing system configuration (or state) to another (Shewchuk & Moodie, 1998). The ease (in terms of cost, time, or both) with which changes can be made within the capability envelope (Slack, 1987, p.39).

Action flexibility	The capacity to take new actions to meet new circumstances. That is, the ability to change the capability and capacity envelope of a manufacturing system (Shewchuk & Moodie, 1998, p.337).
State flexibility:	The ability of the system to continue functioning effectively, despite change. It measures "how capable is the system over the set of static states or how performance varies over the set of dynamic states" (Shewchuk & Moodie, 1998, p.337).

Table 4: Types of flexibility in manufacturing

While undeniably contributing to the understanding of the concept of flexibility these categorisations underscore the complexity and variety of the related issues with which managers need to deal (Beach *et al.*, 2000). Furthermore, despite two decades of research on manufacturing flexibility, there is still no general agreement on how to conceptualise, define or measure flexibility (Benjaafar & Tirupati, 1998; Shewchuk & Moodie, 1998). Nevertheless, this research has influenced flexibility studies, both in information systems and management.

2.4.2 Flexibility in information systems

The analysis of the concept of flexibility can also be found in the field of information systems. In fact, this research has been recognized as an important subset of flexibility research in business. The disappointment of companies, which have invested in IT to gain competitive advantage, and the failure of many IT implementations, demonstrated not only that IT is sometimes rigid and inflexible, but also that it can often become a barrier to change. Therefore, two types of research regarding flexibility can be identified in the IS field: studies that analyze the flexibility of technology and those concerning the impact of technology on the flexibility of organizations.

2.4.2.1 Flexibility of information technology

In IS considerable research has been conducted into the development of more enduring and flexible technologies. Defining and analysing IT flexibility has interested many researchers, e.g. (Fitzgerald, 1990) as IS failures have increasingly demonstrated the need to build adaptable information systems that are able to grow, change and evolve with their environment (Lycett *et al.*, 1997). In addition to a lack of flexibility in IT, Gebauer and Lee (2005) note the limitations in terms of usability (excessive complexity) when the technology offers too much flexibility.

Knoll and Jarvenpaa (1994) address flexibility in the context of IT alignment in highly turbulent environments. They distinguish between flexibility in functionality (robustness, scalability and slack where the system's inputs change), use (adaptability to changing goals)

and modification (adjustment to changing processes through feedback). They go on to demonstrate these issues in terms of client-server technology.

Gebauer and Lee (2005) argue that there is a trade-off between flexibility to use and flexibility to change an information system. The former may offer flexibility in terms of (a range of) functionality, ability to handle varying amounts and types of data, different user interfaces and ability to cope with varying numbers of users or transactions. Such a system can probably cope well with a changing environment, in normal terms, but the cost and effort of providing such flexibility (to use) is likely to limit the flexibility to change in the future, when totally different conditions apply. In discussing flexibility to change, they take most of their concepts from the IT infrastructure literature, e.g. (Byrd & Turner, 2000; Duncan, 1995).

Byrd and Turner (2000, p.172) define IT infrastructure flexibility as: "the ability to easily and readily diffuse or support a wide variety of hardware, software, communications technologies, data, core applications, skills and competencies, commitments, and values within the technical physical base and the human component of the existing IT infrastructure".

In a later paper (Byrd & Turner, 2001), they distinguish between the technological and human elements of infrastructure flexibility, where the former comprise data transparency, compatibility (in terms of sharing information), application functionality and connectivity, while the latter comprise technical, boundary and functional skills, as well as technology management. Chung *et al.* (2003) use a simpler model where infrastructure flexibility is characterised by compatibility, modularity, connectivity and IT personnel skills.

The extent of flexibility built into a particular information system is usually determined during development and, in particular, within the requirements elicitation phase. However, this phase has been identified by many researchers, e.g. (Land & Hirschheim, 1983; Fitzgerald, 1990) as a main weakness of the traditional life cycle model, where requirements are captured too early in the development process and then frozen. Meanwhile the environment changes and the implemented system becomes obsolete. Fitzgerald (1990) recommends a 'flexibility analysis' to identify potential changes and their probability, as well as the cost of incorporating the desired flexibility. Although such an analysis will require more effort in the development phase, this may extend the life of the system considerably and prove a worthwhile investment.

This notion is taken further in the work of authors, such as Truex *et al.* (1999), who see the need for flexibility being met by systems that evolve in use, such that a final requirements

specification is never prepared and requirements elicitation never stops. In this scenario, developers are constantly adapting the system to a dramatically changing environment.

A rather different route focuses on development tools, artefacts and technologies that enable modularity and scalability. These include object-oriented techniques (Graham, 1994) that attempt to facilitate flexibility to change through reuse and extendibility by taking advantage of the properties of inheritance, encapsulation and the minimisation of interdependencies between objects. They also include service oriented architectures, such as web-services (Chung *et al.*, 2003). In the interorganisational context, efforts are centred on the development of cross-platform applications, based on the Internet and on XML, which is seen as a flexible and scalable mark-up language.

Information technology, especially if it is flexible, is usually considered as an enabler of organisational flexibility. Nevertheless, rigid information systems may also constrain the ability of organisations to change (Fitzgerald & Siddiqui, 2002). As demonstrated below, these issues have attracted much IS research.

2.4.2.2 Impact of information technology on the flexibility of organisations

Previous studies showed that the use of IT can make a major contribution to organisational flexibility, such that organisations gain competitive advantage and are able to respond more quickly to changes (Fink & Neumann, 2007). IT enables and facilitates adjustments and changes to business processes (Nelson & Ghods, 1998). It has the potential to increase organisational flexibility by altering the time and place of work, by affecting the nature and pace of work (Lucas & Olson, 1994) as well as by speeding-up and reducing the cost of operations, such as material requirement planning and products' design (Kumar, 1999).

IT increases the flexibility of information requests by speeding up information retrieval (Fink & Neumann, 2007). It also speeds up information processing enabling firms to respond quickly to changing market conditions (Lucas & Olson, 1994). This is further supported by Overby *et al.* (2006) who claim that IT plays an important role in enabling the sense and responding capabilities of a firm, by facilitating the processing of information, which often surpasses human capacity. They further argue that IT can also affect a firm's flexibility, indirectly, by providing IT-enabled capabilities, or rich information (e.g. information regarding customer purchase behaviour) facilitating decision making. Finally, van Oosterhout *et al* (2006) show how IT increases an organisation's range of options, based on the case of a telecommunications company that used IT to beat its competitors through flexible customer contracts. Therefore, IT is a resource that "provides the intelligence behind strategy and the means by which a strategy might be implemented" (Monteiro & Macdonald, 1996, p.182).

However, although many organisations have invested to IT to increase their competitiveness, they realised that their technology was neither flexible nor adaptable (Fitzgerald & Siddiqui, 2002). IT is often a barrier to change and might decrease an organisation's flexibility, by increasing the time, effort and cost to change systems, workflow and organisational structure (Lucas & Olson, 1994). It may provide constraints and limit the range of responses available to a firm e.g. when there are issues of incompatibility between the software applications of a company (Overby *et al.*, 2006).

Furthermore, rigid information systems inhibit the ability of organisations to exploit business opportunities by preventing a change in business strategy (Eardley *et al.*, 1997). Traditional centralised systems do not bend, are difficult to be adapted and therefore do not allow organisations to change and remain competitive for long (Allen & Boyton, 1991). This is further supported by van Oosterhout *et al* (2006) who argue that large complex information systems with hard-coded embedded business knowledge are very difficult to change. They use as an example the millennium problem and the euro conversion, which cost many companies a lot of money and effort to adjust their information systems. Criticism is also made of ERP systems for their lack of flexibility (Soh *et al.*, 2000) and inability to accommodate change in the predetermined and standardised workflow of activities.

Less constraints seem to be provided by more decentralised, distributed and network centric information systems (Allen & Boyton, 1991). As mentioned previously these include interorganisational systems, which can increase flexibility, by automating transactions, by facilitating the exchange of information, by speeding up and improving data processing, by eliminating stages in the value chain, as well as by altering and improving business relationships (Golden & Powell, 1996; Lim & Palvia, 2001; Jimenez-Martinez & Polo-Redondo, 1998; Chou *et al.*, 2004). However, as also demonstrated above, for many firms, interorganisational information systems can be inhibitors rather than enablers of flexibility.

Most studies examining the impact of technology on flexibility have analysed the technological features enabling or constraining organisational flexibility – e.g. (Overby *et al.*, 2006; van Oosterhout *et al.*, 2006). Nevertheless, some have demonstrated that organisational characteristics can also influence the impact of technology, e.g. (Fink & Neumann, 2007). Technology, either flexible or inflexible, cannot on its own lead to flexible business processes or organisations. Kumar (1999) argues that investments in information systems may need to be augmented by additional investments and process changes in order to derive organisational flexibility. Ahmed *et al* (1996) concur that the flexibility and responsiveness of an organisation cannot only be achieved by flexible technology, but also require flexible and integrated resources, such as people, processes, information and structure. The organisation's ability to react to environmental changes may be also facilitated

by skilled IT personnel able to work cooperatively in cross functional teams (Chung *et al.*, 2003). Therefore, issues such as the organisational structure and resources, the people involved and their cooperation seem also to contribute to the level of organisational flexibility achieved.

Similar observations were made from research in the area of interorganisational systems. Golden and Powell (1997) found that the degree of flexibility achieved is influenced by the organisation's technological awareness, the integration of the IOS with other IS within the organisation, and the length of time that the system has been in operation. They also found that initiators of the IOS project or larger organisations are more likely to achieve flexibility than non-initiators or smaller firms.

Therefore, the impact of technology on organisational flexibility is greatly influenced by organisational and interorganisational issues. However, the examination of the effect of these contextual issues firstly requires a detailed analysis of organisational flexibility itself.

2.4.3 Organisational flexibility

Throughout the 1980's the "flexibility debate" concerning changing rigidities in labour and employment patterns (Wood, 1989), was an important element in industrial policy making and industrial relations. The model of a flexible firm proposed by Atkinson (1985) received much criticism, but also defence (Procter *et al.*, 1994). This model claimed that firms were increasingly seeking and achieving greater flexibility from their workforce. This flexibility was of three kinds: numerical, functional and financial. *Numerical flexibility* refers to the ability to adjust quickly and easily the number of people employed in order to meet fluctuation in demand; *functional flexibility* concerns the ease with which the tasks performed by workers can be changed in response to varying business demands; *financial flexibility* is the extent to which compensation practices encourage and support the other types of flexibility.

As the environment becomes more competitive and turbulent, organisations become less and less capable of meeting the demands placed on them (Miles & Snow, 1992). As a result their priorities and needs are altered. In order to remain competitive and survive, companies have to deal with high volatility and variability (e.g. unpredictable demand, high product variety and rapid technological change). Successful organisations are able to deal more effectively with change and the opportunities it presents (Fitzgerald & Siddiqui, 2002). Therefore, flexibility is becoming imperative for their survival.

The quest for flexibility is driven by the need for shorter product cycles, global competition, rapid technological change (Young-Ybarra & Wiersema, 1999), reduced costs and increased

responsiveness to shareholder and customer demand (Nelson & Ghods, 1998). To deal with these issues, organisations try to optimise their business processes and establish collaborative partnerships, which increase flexibility by blending capabilities, distributing risks and generating options (Brahami, 1992). They also invest in IT that considerably reduces the cost of processing and exchanging information, not only within but also between organisations (Malone *et al.*, 1987). Therefore, rather than focusing solely on their workforce, organisations try to achieve flexibility through collaboration with customers, lateral organisational arrangements, new technologies and innovation (Mouritsen, 1999).

The increased need for flexibility in various aspects of business has inspired much management research. Besides examining flexibility in different industries (e.g. airlines (Monteiro & Macdonald, 1996) and the automotive industry (Adler *et al.*, 1999)), studies have also examined flexibility in areas, such as strategic management (Volberda & Rutges, 1999), outsourcing (Tan & Sia, 2006; Lacity *et al.*, 1995), BPR (Fitzgerald & Siddiqui, 2002) and SCM (Christopher, 2000).

In most studies, flexibility is concerned with adjusting the available means to better achieve current and anticipated future ends (Evans, 1991). Flexibility is "the degree to which an organization has a variety of actual and potential managerial capabilities, and the speed at which they can be activated, to increase the control capacity of management and improve the controllability of the organization[11]" (Volberda & Rutges, 1999, p.102; Volberda, 1997; 1996). Flexibility is "the ability to adapt" (Golden & Powell, 2000; 1997, p.268) or conform when confronted with new or changing situations (Kumar, 1999). It provides the organisation with the ability to respond quickly to market forces and uncertainty in the environment. A flexible organisation is capable of multiple responses to its environment (Philips & Tuladhar, 2000). It is able to defend quickly against threats and move rapidly to take advantage of opportunities (Lucas & Olson, 1994).

These definitions of flexibility distinguish between the ability of an organisation to respond to an environmental threat or its capability to exploit an opportunity or foresee a potential future threat and take actions in order to cope with it. A more recent concept aiming to address these issues in the business environment is agility (Aitken *et al.*, 2002).

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[11] The control capacity refers to the ability of management to create or promote capabilities for situations of unexpected disturbance. It refers to its ability to respond at the right time and in the right way. The controllability of the organisation refers to the capability of the organisation to react in the right time in the directed way. It depends on the creation of the right conditions to foster flexibility (Volberda, 1996).

2.4.3.1 Business agility: Is it another term for organisational flexibility?

Business agility is a relatively new term that refers to the ability to maintain competitive advantage in an uncertain business environment (Mathiassen & Priers-Heje, 2006). Evans (1991) argues that agility and flexibility have related meanings. Brahami (1992) states that being flexible is to be agile and move rapidly to take advantage of opportunities. However, in the recent literature there seems to be confusion between flexibility and agility. While some researchers adopt Evans's view, e.g. (Thomke & Reinersten, 1998), or replace the term organisational flexibility with business agility, others treat them as different, compare them and reveal their differences, e.g. (van Oosterhout *et al.*, 2006). Nevertheless, the origins of agility, as a business concept, lie in flexible manufacturing systems (Christopher, 2000).

Christopher (2000, p.37) argues that agility is "a business-wide capability that embraces organizational structures, information systems, logistics processes, and, in particular, mindsets". It involves quickness, referring to the "speed with which an organisation can respond to customer requests, market dynamics and emerging technology options", as well as adaptability showing "how well an organisation can respond to changing market needs, threats or opportunities" (Mathiassen & Priers-Heje, 2006, p.116). Therefore, it "relates to an organisation's ability to sense and respond rapidly to unpredictable events in order to satisfy changing customer demands" (Holmqvist & Pessi, 2006, p.146; Overby *et al.*, 2006). Yusuf *et al.* (1999, p.37) provide a more detailed definition of agility arguing that it "is the successful exploration of competitive bases (speed, flexibility, innovation, proactivity, quality and profitability) through the integration of reconfigurable resources and best practices in a knowledge-rich environment to provide customer-driven products and services in a fast changing market environment".

Therefore, agile organisations are not only capable of successfully implementing change, but are also nimble (Lyytinen & Rose, 2006) and able to respond quickly to both expected and unexpected events (Mathiassen & Priers-Heje, 2006). To accomplish this they need resources, such as processes, an agile workforce (Breu *et al.*, 2001) and IT (van Oosterhout *et al.*, 2006; Fink & Neumann, 2007).

Agility is not only examined as a property of individual organisations, but also as a characteristic of supply chains. Christopher (2000) distinguishes between the speed (meeting consumer demand in the context of shortened delivery lead times), the leanness (doing more with less) and the agility (responding quickly to changes in demand in terms of both volume and variety) of a supply chain. Holmqvist and Pessi (2006) argue that an agile supply chain should be market sensitive in terms of its ability to understand and respond to demand. It should use IS/IT to communicate and share data with trading partners, as well as to develop

closer and more agile relationships with them. Finally, Lee (2002, p.134) defines agile supply chains as "supply chains that utilise strategies aimed at being responsive and flexible to customer needs, while the risks of supply shortages or disruptions are hedged by pooling inventory or other capacity resources". As he argues, these supply chains can deal with uncertainties in both demand and supply. They have "the capability to be responsive to the changing, diverse and unpredictable demands of customers on the front end, while minimising the back-end risks of supply disruptions".

Since, flexibility is a key characteristic of the agility of an organization or supply chain (Aitken *et al.*, 2002), the distinction between these concepts is not always clear. Fink & Neumann (2007) quote De Leeuw's and Vollberda's (1996) definition of flexibility to explain agility. They also state that the main difference between agility and flexibility is that agility puts emphasis on speed. However, the dimension of speed (efficiency, responsiveness) is also embedded in flexibility (Golden & Powell, 2000). Van Oosterhout *et al.* (2006) argue that business agility is the ability to change businesses and processes beyond the level of flexibility. They further explain this by arguing that agility is the ability to act quickly both on the strategic and operational levels. This is additionally supported by Overby *et al.* (2006) who argue that enterprise agility is different than strategic flexibility, because it also applies to operational issues. Nevertheless, it could equally be argued that business agility incorporates both operational and strategic types of flexibility, as defined by Volberda (1996).

Therefore the boundaries between agility and flexibility are blurred. Acknowledging that business agility is a more recent term and that there is "no consensus as to what exactly agility is, nor on how one could assess and achieve agility" (van Oosterhout *et al.*, 2006, p.133), this study focuses on the conceptualisation of organisational flexibility. Additionally, the richer and more extensive literature on organisational flexibility provides a broader knowledge base for this research.

2.4.3.2 Classifications and frameworks of flexibility

In order to explain the broad scope of the concept, many researchers have tried to identify different categories and classifications of flexibility. Some of the meanings, explanations and categorizations that have been given to the notion of flexibility are presented in the following paragraphs.

Evans (1991), in trying to clarify what is meant by the term flexibility, analysed several related concepts, such as adaptability, agility, corrigibility, elasticity, hedging, liquidity, plasticity, pliability, resilience robustness and versatility. He further classified these concepts based on the temporal and intentional dimensions of strategic flexibility. The temporal

dimension comprises an ex ante mode, that is preparing in advance for some future transformation, and an ex post mode, which refers to adjustments (or organisational change) undertaken after the occurrence of a triggering episode (environmental disturbance). The intentional dimension consists of an offensive mode, which refers to "creating and seizing an initiative" and a defensive one, which means "guarding against threatening and predatory moves or correcting past mistakes" (Evans, 1991, p.75).

	Ex ante	**Ex post**
Offence	Agility Versatility	Liquidity Elasticity
Defence	Robustness Hedging	Corrigibility Resilience

Table 5: Synonyms of flexibility. *Source Evans, 1991*

According to Evans (1991, pp.72-74) *agility* implies "a sense of being nimble in moving into an advantageous position". *Versatility* "provides a variety of responses repertoires for dealing with unexpected or novel situations, in an offensive manner, which is developed ex-ante". *Robustness* is defensive in an ex ante sense providing the "capability to withstand or deflect the consequences of an unanticipated contingency so that a strategy can remain viable in spite of changes in the environment", whereas, *hedging* is "a practice which enables a potentially damaging contingency to be insured against".

Liquidity is used to "describe an asset which can be readily converted into some alternative form of wealth with minimal switching costs", while *elasticity* implies susceptibility (openness / inclination) of modification. Finally, *corrigibility* involves making the necessary corrective moves to confront an environmental disturbance, whereas *resilience* refers to the ability of an organisation to "tolerate the infliction of some sort of disturbance so as to return to normal when conditions revert to the former state".

The description of the concepts with a "family resemblance" to flexibility and their classification according to the temporal and intentional dimensions reveal the plurality of closely related meanings embedded in the notion of flexibility and contribute to its better understanding. However, as my aim is to conceptualise flexibility as a context-embedded notion, the application of Evans's framework with its additional overlapping and abstract concepts would be more likely to confuse than clarify the meaning of flexibility, when applied in a complex interorganisational environment.

Based on similar concepts, Tan and Sia (2006) analyse flexibility, in terms of robustness, modifiability and new capability, which were originally proposed by Brahami and Evans

(2004). For them, *robustness* is 'the ability to endure variations and perturbations, withstand pressure, or tolerate external changes', *modifiability* is the ability of an organisation to make modifications to cope with less foreseeable events when they occur' and new capability is 'the ability to innovate in response to dramatic changes or situations' (Tan & Sia, 2006, p.184). Since the focus of their research is outsourcing they also add a fourth measurement called *ease of exit*, referring to the ability of an organisation to transfer outsourced services to another vendor or bring them back in-house. Although this classification provides a thorough view of flexibility, it does not necessarily facilitate its analysis, since the meaning of modifiability or new capability is equally broad as that of flexibility.

From an alternative point of view, Volberda (1996) uses the notion of variety, along with speed of response to identify different types of flexibility. He considers the *variety of managerial capabilities* to confront the emergence of potential opportunities or threats, as well as the *speed* with which management is able to activate these capabilities in time. Based on these notions, he distinguishes four types of flexibility: steady-state (low variety, low speed), operational (low variety, high speed), structural (high variety, low speed) and strategic (high variety, high speed).

As Volberda (1996, p.362; 1997, pp.171-172) argues, *steady-state flexibility* "consists of static procedures to optimise firm's performance, when the nature and levels of throughput remain relatively stable over time". *Operational flexibility* refers to "routine capabilities that are based on the current structure or goals of the organisation". It "relates to the volume and mix of activities rather than the kinds of activities undertaken within the firm". *Structural flexibility* "consists of managerial capabilities to change the organisation's structure and its decision and communication process, to suit changing conditions in an evolutionary way". Finally, *strategic flexibility* "consists of managerial capabilities related to the goals of the organisation or the environment". "This most radical type of flexibility is much more qualitative and involves changes in the nature of organizational activities".

The last three types of flexibility are further divided in terms of internal (the management's capacity to adapt to the demands of the environment) and external (the management's capability to influence the environment so that the firm becomes less vulnerable to change) flexibility (Volberda, 1996; 1997). Examples of each of these types are given in **Table 6**.

Capacity for manoeuver	Type of flexibility: Internal	Type of flexibility: External
Routine	*Internal operational flexibility* Variation of production volume Building up inventories Use of crash teams	*External operational flexibility* Use of temporary labour Multisourcing Reserving capacity with suppliers
Adaptive	*Internal structural flexibility* Creating multifunctional teams Changing managerial roles Alterations in control systems	*External structural flexibility* Purchasing components from suppliers with a short delivery time (JIT) Purchasing subassemblies from suppliers (co-makership) Developing subcomponents together with suppliers (co-design)
Strategic	*Internal strategic flexibility* Dismantling current strategy Applying new technologies Fundamentally renewing products	*External strategic flexibility* Creating new product market combinations Using market power to deter entry and control competitors Engaging in political activites to counteract trade regulations

Table 6: Internal and external types of flexibility. *Source Volberda, 1997, p.171*

Besides Volberda, other researchers, e.g. (Upton, 1994), also distinguish between similar levels of flexibility. Some studies, e.g. (De Toni & Tonchia, 2005), examine the operational and strategic types of flexibility, compare them and reveal their differences. Nevertheless, the majority of business literature focuses mainly on the analysis of strategic flexibility. Various definitions of strategic flexibility are presented in **Table 7**.

Strategic Flexibility
The ability of the organisation to adapt to substantial, uncertain and fast-occurring (relative to the required reaction time) environmental changes that have a meaningful impact on the organisation's performance (Aaker & Mascarenhas, 1984, p.74).
Strategic flexibility is "the ability of an organisation to respond to changes in the environment in a timely and appropriate manner with due regard to the competitive forces in the marketplace". It can be understood in terms of three dimensions: speed of change, cost of change and amount of change (Das & Elango, 1995, p.62).
The number of strategies a company could readily adopt if it wishes to replace or extend its current ones (Price *et al.*, 1998).
The organisational ability to manage economic and political risks by promptly responding in a proactive or reactive manner to market threats or opportunities (Grewal & Tansuhaj, 2001, p.72).
The speed of variation of the competitive priorities, the range of strategic options (within a business), the variety of the possible new businesses and the rapidity of movement between businesses (De Toni & Tonchia, 2005)
The degree in which organizations in a turbulent environment can respond to competing demands while being in control (Hilhorst *et al.*, 2005). It involves fast response to: (1) changes in aggregate customer demand, (2) customize a product or service to suit an individual customer, (3) new product or service launches by competitors, (4) introduce new pricing schedules in response to changes in competitors' prices, (5) easily expansion in new markets or regions, (6) adopt and apply new technologies to produce faster, better and cheaper products and services, (7) fundamentally renew products, (8) cooperate or easily switch in co-makership, co-design or just-in-time purchasing to avail of lower costs, better quality or improved delivery times.

Table 7: Definitions of strategic flexibility.

Although involving differences, the various definitions and classifications of flexibility also include similarities. They all explain flexibility as a process of response involving speed and variety of options. This is also supported by Kumar (1999), who argues that most explanations and definitions of flexibility involve some kind of change (stimulus) and some kind of response to this change. He thus suggests that flexibility can be described in terms of a stimulus-response framework (**Figure 3**). He suggests that organisations can be either reactive (think of a response after a stimulus[12]) or proactive (e.g. foresee a change in market needs and try to build appropriate responses) to that stimulus. He further argues that their ease of response (degree of flexibility) can be understood in terms of three interrelated dimensions: the response time the cost of response, and the scope of response.

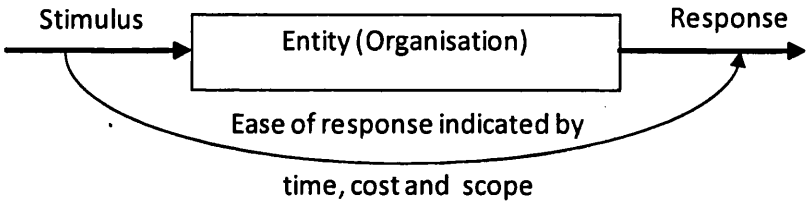

Figure 3: Stimulus-response framework. *Source Kumar, 1999*

Although Kumar's framework can be characterised as being abstract and simplistic, it succeeds in schematically representing the fundamental meaning of organisational flexibility. Furthermore, it demonstrates its multidimensional nature and uses the notions of time, cost and scope of response as indicators of the degree of flexibility achieved by an organisation.

As shown in this section, the notions of speed, cost, scope and variety are used in many researchers' definitions and classifications of flexibility. Following the majority of research, this study aims to explain the complex concept of flexibility by also focusing on the analysis of its different dimensions.

2.4.3.3 Dimensions of flexibility

By reviewing previous research on flexibility, Golden and Powell (2000) identified time, range, focus and intension as the dominant dimensions of flexibility. Furthermore, by expanding Evans's work, they proposed efficiency and responsiveness, as well as versatility and robustness as metrics for the temporal and range dimensions, respectively.

[12] change of customer needs, implementation of a new technology

Temporal

The ***temporal*** dimension shows the length of time that an organisation needs to respond to environmental changes. It also shows the organisation's ability to adapt within specific time constraints. In order to better analyse the temporal dimension of flexibility, Golden and Powell (2000) propose ***efficiency*** as one of its metrics.

The meaning of efficiency is not always clear and its conceptualisation may vary depending of the context. Upton (1994) defines the efficiency of a manufacturing system as the ability to maintain uniformity of some performance measure, such as ensuring quality, within a range of possible production. Lin and Shaw (1998) explain the efficiency of an ordering process as the reduction of the order fulfilment cycle time. Monteiro and Macdonald (1996) relate organisational efficiency with the use of technology and define it as the capability to use information to carry out routine activities. Finally, linking efficiency with flexibility, Philips and Tuladhar (2000 p. 26) argue that an "efficiency measure along with a suitable flexibility measure should explain and predict long-term corporate performance as measured by sustained profitability and growth, and increasing market capitalization and market share".

The term 'efficiency' is also often confused with effectiveness. To clarify the different meanings of these concepts, Drucker (1971) argues that efficiency has the meaning of "doing things right" as opposed to effectiveness, which means "doing the right things". In supply chain management Mentzer *et al.* (2001) relate efficiency with cost reduction and effectiveness with customer service. Finally, in terms of responding to environmental disturbances, Fink and Neuman (2007) argue that efficiency is primarily defined in terms of time, while effectiveness can be defined in terms of alignment to organisational goals.

The tension between efficiency and flexibility has been studied by many researchers e.g. (Monteiro & Macdonald, 1996; Hanseth *et al.*, 1996). For them, efficiency refers to the automation, standardisation and speeding up of operations and is often considered as a constraint to flexibility. Others, e.g. (Adler *et al.*, 1999, p.43) challenge this view and argue that 'organisations need to shift efficiency/flexibility trade-off to attain both superior efficiency and superior flexibility'. However, these views differ from Golden and Powell's (2000) conceptualisation of efficiency as part of the process of change.

Acknowledging the plurality of explanations that can be attributed to the term efficiency, this study follows Golden and Powell's (2000) definition, which describes efficiency as the ability of the organisation to quickly accommodate change with minimal degradation of performance. It also adopts ***responsiveness*** as an additional metric of the temporal dimension of flexibility. According to Golden and Powell (2000) responsiveness is the capacity to

respond to change within an appropriate time limit. It measures the time needed to adapt to new circumstances.

Again the distinction between efficiency and responsiveness is not always clear, since a decrease in time delays, which suggests responsiveness could also mean efficiency. Nevertheless, the notion of efficiency additionally indicates issues of performance, effort or cost-effectiveness, which are not included in responsiveness.

Range

The notion of range (or variety) is used by many researchers as a dimension of flexibility. Volberda (1996) uses it along with the speed of response to identify its different dimensions of flexibility. Ashby (1957), in the Law of Requisite Variety, demonstrates that to be able to respond to all circumstances, a firm must have a variety of capabilities at least as great as the variety of disturbances in the environment. Finally, Kumar (1999, p.319) argues that "flexibility produces value because it generates options (alternative courses of action) for the firm in terms of responding to uncertainty".

According to Golden and Powell (2000), the *range* dimension demonstrates the variety of planned or unplanned options to respond to environmental disturbances. ***Versatility*** is defined as "the ability to respond to a wide range of scenarios ahead of time" (Evans, 1991, p.74). It provides "a variety of responses repertoires for dealing with unexpected situations" (Evans, 1991, p.76). It is the ability to take different actions and apply different capabilities depending on the requirements of the specific situation (Brahami, 1992). It is also defined as "the ability of an organisation to have flexibility within a specific range of possible future options, which the organisation has allowed for, or planned for, to accommodate foreseen future changes" (Golden & Powell, 2000, p.381). On the other hand, ***Robustness*** refers to the capacity of the firm to respond to unforeseen environmental change (Golden & Powell, 2000). It measures the capability of an organisation to respond to changes, which had not been planned for (Rosenhead, 1989). It is also defined as "the ability to absorb, deflect or endure the impacts of unanticipated contingency, so that a strategy can remain viable in spite of changes in the environment" (Evans, 1991, p.76). It is finally explained as "the ability to endure variations and perturbations, withstand pressures or tolerate external changes" (Tan & Sia, 2006, p.184).

For Golden and Powell (2000), the main difference between versatility and robustness is that the former responds to foreseen events whereas the latter to unforeseen ones, defined as substantial, fast-occurring changes taking place in an uncertain environment. Therefore, they argue that robustness is the ability to maintain flexibility under conditions of high uncertainty. Others, e.g. (Evans, 1991; Tan & Sia, 2006), do not necessarily adopt this view

arguing that the primary meaning of robustness is yielding to pressure, while that of versatility is the capacity for new situations.

The focus of this research is to examine whether an organisation can respond to environmental changes, regardless whether they are foreseen or unforeseen. It is not so much to examine its capability to endure or deflect change, but rather its ability to be nimble, take advantage of opportunities and increase its competitiveness. Nevertheless, in the context of the grocery retail supply chain, an organisation should be able to endure small variations in demand and cope with them without needing to take special actions. This could be also considered as robustness, but not in the highly uncertain environment suggested by Golden and Powell (2000).

To avoid this confusion, this study analyses the range dimension by examining the variety of options that an organisation has to respond to environmental change, as well as by considering the organisation's ability to react to, deflect or endure a variety of environmental disturbances.

Focus

The *focus* dimension distinguishes between the *internal* and *external* types of flexibility. This distinction was first made by Ansoff (1965) and adopted by Volberda (1996, p.362), who defined internal flexibility as "the management's capacity to adapt to the demands of the environment" and external flexibility as "the management's capability to influence the environment so that the firm becomes less vulnerable to environmental changes".

Influenced by the work of Das and Elango (1995), Golden and Powell (2000) argue that internal flexibility can be attained through flexible manufacturing, flexible people and organisational structure, while external flexibility can be achieved through outsourcing, alliances with suppliers and multinational operations. They further argue that external flexibility refers to an organisation's ability to switch between the products of its suppliers or even more to switch suppliers.

In a different conceptualisation Starkey, Wrights and Thompson (1991) distinguish between the flexibility of a firm and flexibility as a property of the relationship between firms. The former is seen as a "characteristic of the range of strategic responses open to the individual firm" (Starkey *et al.*, 1991, p.166). It involves the capability to produce a range of different products at low cost, as well as the ability to quickly change customised products and technologies. The latter refers to aspects of vertical disintegration, which implies a narrower range of output at the level of the firm, but a greater degree of flexibility at the level of the

industry. It also refers to dynamic networks, which are flexible structures able to accommodate complexity, while maximising specialized competence (Miles & Snow, 1986).

As Golden and Powell (2000) argue the focus dimension demonstrates that the realization of flexibility is no longer constrained within the boundaries of an organisation (Mouritsen, 1999), but is also achieved through external links with other organisations (suppliers or customers). Following these ideas, this study employs the focus dimension to analyse flexibility both at the organisational level (level of the firm) and at the interorganisational level (level of the dyad or the business network).

Intension

The *intension* dimension indicates whether the organisation takes an offensive or defensive stance towards flexibility (Golden & Powell, 2000). As mentioned above, Evans (1991) distinguished between the ability of an organisation to respond in an *offensive* (create and seize an initiative) or a *defensive* (guard against unforeseen competitive moves and environmental threats or correct past mistakes) manner. According to Golden and Powell (2000), those who take an offensive stance attempt to influence or control environmental change in order to gain competitive advantage, while those who are defensive react in order to minimise the impact of events that have already occurred. Although this dimension adds to the understanding of flexibility it is not examined in this study.

2.4.4 A conceptual framework of flexibility as a multidimensional concept

In this research we focus on the first three dimensions, that is ***time***, ***range*** and ***focus*** and we include an additional one revealing the ***scope*** of response (Kumar, 1999) that is the scale of organisational change.

As mentioned above, the focus dimension refers to the distinction between the organisational and interorganisational levels of flexibility, whereas the range dimension demonstrates the variety of available options that an organisation has to respond to environmental disturbances. The temporal dimension reveals the length of time that an organisation needs to respond to environmental changes (*Responsiveness*) or the ability of the organisation to adapt quickly, with relatively low cost and minimal degradation of performance (*Efficiency*).

The analysis of the scope of response is based on Volberda's (1996; 1997) classification of operational, structural and strategic flexibility. These three types are further refined and redefined in order to apply both at the level of the firm as well as at the level of business network. Thus, ***"Operational flexibility"*** is now defined as the ability of the organisation/business network to quickly respond to changing customer needs, as well as to easily handle short-term changes in demand or supply (Lee, 2002), either by using current

operations or by changing the volume and mix of activities based on current structure and goals (Volberda, 1996). ***"Structural flexibility"*** is the capability of the organisation/business network to adapt its decision and communication processes, and to transform its current structure or workflow of activities. The structure of a business network refers to the overall pattern of relationships, between the participating organisations (Reekers, 1995). Therefore, at the interorganisational level, structural flexibility refers to creating new partnerships or dismantling old ones. ***"Strategic flexibility"*** is the most radical form of flexibility, involving changes in the nature of activities, as well as the fundamental renovation of products, services and structures. It refers to the ability of firms/business networks to reposition themselves in a market, change their plans or their current strategies. Nevertheless, strategic flexibility is also associated with the range of strategic[13] options that a firm/business network may have to respond to environmental disturbances "in a timely and appropriate manner with due regard to the competition" (Das & Elango, 1995, p.62).

It should be noted that the above types of flexibility are interrelated. Operational flexibility may sometimes require structural changes, while structural flexibility is often imperative for the attainment of strategic flexibility. As Daniel and White (2005, p.189) argue, in volatile environments organisations should be able to form linkages with other organisations quickly as well as 'to dissolve them rapidly and form new linkages as market conditions dictate'. But, for many researchers, e.g. (Young-Ybarra & Wiersema, 1999), this is considered as strategic flexibility rather than structural. Although the boundaries of the different types of flexibility overlap, this study keeps this classification for analytical purposes, enabling the demonstration of variations in the level of flexibility achieved by the organisations.

The insight gained through the review of the literature and the various dimensions of flexibility, led to the development of an initial conceptual framework. This framework, presented in **Figure 4**, is an expansion of Kumar's stimulus-response representation of flexibility.

[13] In this study, the term 'strategic' is used to describe any influence that has a lasting effect on the competitiveness of the organisation.

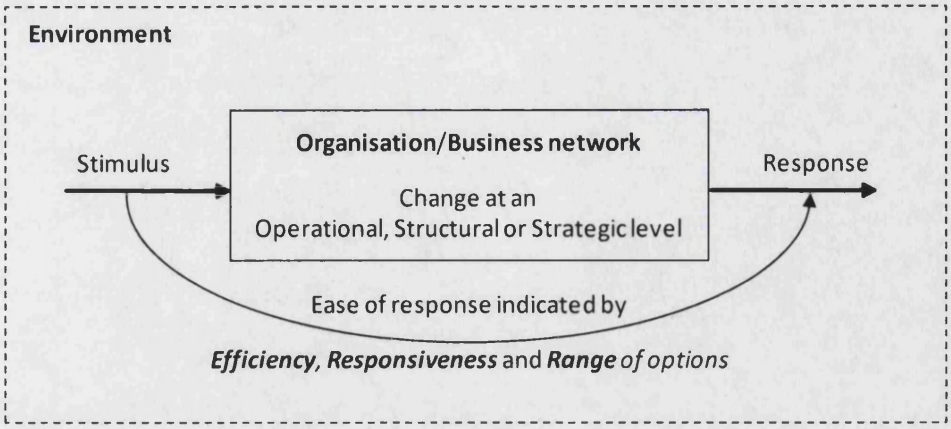

Figure 4: Initial framework of flexibility

Based on this framework an organisation or a business network can respond to a stimulus (environmental disturbance) through making a permanent or temporary change at an operational, structural or strategic level. The ability to change at each one of these levels reveals the operational, structural or strategic flexibility, respectively. This ability/ease of response is indicated by the *responsiveness* and *efficiency* of response as well as by the *range* of options to respond.

2.4.5 Flexibility as a context embedded notion

The framework presented in the previous section guided the data collection of the initial stages of our empirical work, as well as the analysis of some preliminary data. However, as was quickly realised, a better understanding of flexibility also requires a detailed analysis of the organisational context.

De Leeuw and Volberda (1996) demonstrated how the organisational context affects flexibility. They examined flexibility as a dual control perspective, that is, as a function of the control capacity of the management and the controllability of the organisation. They argued that, as a managerial task, flexibility involves the creation or promotion of capabilities for situations of unexpected disturbance. But, the management's ability to allocate and use this capacity with success is dependent upon organisational conditions, such as technology, structure and culture (Volberda, 1996). According to De Leeuw and Volberda (1996) these conditions determine the controllability and responsiveness of the organisation.

Although this approach contributed to the development of a clearer and more comprehensive meaning of flexibility, it has some limitations. This positivist perspective sees organisational technology, structure and culture as properties of the organisation design task. It, thus, views them as static characteristics, rather than as dynamic concepts changing over time. Moreover, by examining flexibility in terms of the control capacity of management, it

provides a narrow perception of flexibility and does not analyse it as an outcome of organisational discourse and action.

Rather, flexibility needs to be perceived as a dynamic concept, embedded in and influenced by the organisational context. Moreover, since it involves the ability to change temporarily or permanently in order to respond in environmental threats or opportunities, it needs to be examined using an approach capable of explaining organisational change.

In the information systems field, there are numerous studies demonstrating the situated nature of change (Orlikowski, 1996). Many researchers (Ciborra, 2000; Avgerou, 2002) showed the local dynamics of change and analysed the organisational structure, as well as the people's roles or relationships that constrain, enable or shape the change achieved. Avgerou (2002) argues that an analysis of the process of change requires an understanding of the origins of the organisational action. It also requires an understanding of the context in which action is conducted (Walsham, 1993). Following these ideas, this study analyses the process of response (that is the decisions, actions and interactions of people involved in the course of change/response (Pettigrew, 1987)), by also including a detailed analysis of the organisational/interorganisational context that influences it.

2.5 Concluding remarks

This chapter described the challenges and objectives of supply chain management, by focusing on the context of the grocery retail-supply chain. It considered issues of uncertainty and integration and showed that both efficiency and flexibility are imperative for the survival and competitiveness of organisations. It discussed the role of technology and presented the interorganisational systems used to support the process of replenishment in the grocery sector. It also described the benefits and constraints of these systems and discussed their potential impact on flexibility.

A literature review of the notion of flexibility revealed the varied conceptualisations adopted by researchers. The chapter discussed the differing frameworks and classifications from previous research and concluded that the concept of flexibility should be analysed as a multidimensional concept. A stimulus-response framework based on the dimensions of *focus* (organisational and interorganisational flexibility), *time* (efficiency and responsiveness to respond), *range* of options to respond and *scope* of response (ability to change at an operational, structural and strategic level of flexibility) was thus suggested for the analysis of flexibility.

The framework presented in this chapter was used to guide the initial phase of the empirical work. However, the analysis of preliminary data showed that examining flexibility as a multidimensional concept and analysing its relation to predetermined organisational factors

is not sufficient to develop a thorough understanding of this complex notion. In order to clarify the broad concept of flexibility, a detailed examination of the process of response as well as a thorough analysis of the organisational/interorganisational context influencing it, are also required.

CHAPTER 3 – THEORETICAL DEVELOPMENT

3.1 Introduction

The analysis of flexibility as a multidimensional concept, proposed in the previous chapter, provides an understanding of the notion but it does not enable us to perceive flexibility as a property of the organisational discourse and as being embedded in and influenced by the organisational/interorganisational context. As mentioned in the previous chapter, the importance of analysing the context has been increasingly demonstrated in information systems research (Avgerou, 2001; Pettigrew, 1985; Walsham, 1993) and is supported by various theories, many borrowed from other disciplines.

As Walsham (1993, p.6) argues "there are not correct or incorrect theories" but rather various theoretical approaches that shed light on interesting aspects of the question under consideration (Avgerou, 2002). A theory offers a way of seeing and examining the phenomenon under study but, at the same time, it can blind the researcher to other perspectives at the moment of its application (Walsham, 1993). A theory can, not only be used as a tool for understanding the subject of study, but also as a method/scheme to guide the analysis of empirical data.

A socio-technical approach, based on a multiple theoretical perspective, is used in this thesis. The combination of theoretical ideas into a synthesized research framework enabled the development of an understanding of the complex notion of flexibility and guided the analysis of the data. As will be explained in the following chapter (Chapter 4), the theoretical development, including the synthesis of the conceptual framework, was conducted during the first year of the empirical work, while further improvements were made after the analysis of the data.

Although the research itself moved back and forth between theory and empirical work, for clarity the theory is presented first, followed by the findings (Chapters 5 and 6) and then the analysis (Chapter 7). This chapter discusses the socio-technical nature of information systems and provides an overview of relevant theories and perspectives. Theories, such as structuration and actor network that were initially considered for this study are mentioned and their limitations are briefly discussed. An approach examining organisational change through the analysis of the context and the process of change is then proposed for the analysis of organisational flexibility. The use of appreciative systems thinking (Vickers, 1984; Checkland & Casar, 1986), for the analysis of the process of change, and of web models (Kling, 1987), for the analysis of the context, is suggested. The strengths and limitations of these perspectives are examined and their synthesis into a theoretical framework, linking context and process, is justified. This framework is further enriched

through the incorporation of the temporal and range dimensions of flexibility, demonstrating the ease of response to environmental disturbances, as well as the scope dimension showing the organisation's ability to change at operational, structural and strategic levels.

3.2 Socio-technical approaches to information systems

In the 1970's the predominant stream of research in information systems was mostly limited to the construction of reliable technical systems aimed at improving organisational efficiency. It was also centred to the development of engineering principles for the cost-effective construction of these systems. It was only at the beginning of the 1980's that researchers began to emphasise the social aspect of IS (Kling & Scacchi, 1980; Land & Hirschheim, 1983), demonstrating the effect of technology on work practices (Mumford & Weir, 1979).

These efforts sensitised the field to the significance of the social aspects of an organisation in which technology is embedded and provided the basis for the development of the socio-technical approach (Avgerou, 2002). For many years, the socio-technical approach relied mostly on systems thinking (von Bertalanffy, 1968; Emery, 1969; Trist, 1981) that, although providing a promising way of studying machines, organisations and societies, was criticised as taking a narrow view of the social context (Avgerou, 2002).

The socio-technical effort primarily influenced research into systems development. Work on systems development methodologies centred around the idea that job enrichment could contribute positively to both employee satisfaction and organisational performance. Mumford's ETHICS methodology (Mumford & Weir, 1979) provided a way to design both a technical system and the surrounding work processes. The underlying objective was to build efficient and desirable software applications, as well as to increase job satisfaction through the application of work quality principles, such as multi-skilling. Alternative development methodologies and principles of development were also proposed and adopted in practice; for example, participative systems development (Land & Hirschheim, 1983), which requires users to take an active part in the analysis and design of a technical system.

These approaches were challenged by interpretive social studies, arguing that what constitutes an efficient and attractive work environment, as well as what are the desirable benefits of technology can be subject to interpretation. A representative example of such an interpretive study is Checkland's (1981) work on soft systems methodology, proposing a way to implement a technical system by taking into account multiple interpretations (or 'world-views') of various participants. The researcher or practitioner needs then to be able to take into account all parties' views and facilitate a consensus.

This position was in turn criticised by critical theoretical approaches (Flood & Jackson, 1991), which highlight the difficulty of reaching consensus by trying to compromise opposing 'world-views'. They put emphasis on the issue of power, which can distort the business environment and strongly influence decisions concerning the development and implementation of technical systems.

Contemporary efforts to build socio-technical theory no longer centre on systems development. Studies have shown that changes and developments in IT are not always designed but often improvised and emergent (Ciborra & Lanzara, 1994; Ciborra, 2000). They have increasingly supported that following changes in IT, work practices may also change (Orlikowski, 1996); social roles and relationships may be altered, business processes and distribution of control over work (Kling & Iacono, 1984) may be modified and hierarchies may become more or less salient (Orlikowski & Iacono, 2001). Therefore the aim of more recent socio-technical approaches rather concerns building an understanding of the interrelationship between the development and use of IT and the organisational and social context that shapes it.

These ideas can be traced back to the 1980s when theories analysing the relationship between the implementation of technology and organisational change were examined (Markus & Robey, 1988) and theories elaborating the connections between technology and the organisational context were developed. These include Kling and Scacchi's (1982) and Kling's (1987) research on 'web models', which perceives IT as being part of a 'web' of equipment, techniques and applications and analyses the social context by taking into account the history of commitments in making up that web, the infrastructure that supports the development and use of technology and the social relations of people using it.

Following these early efforts, studies have increasingly elaborated on the ideas that IT is socially shaped (Ciborra, 2000), that its implementation is an ongoing social process, that contexts and relationships are complex, that expertise at work is inherently tacit/implicit rather than explicit (Kling, 2000) and that organisational knowledge is continuously created, exploited and accumulated (Nonaka, 1994). However, in an effort to emphasize the social aspect of IT, researchers have started to give central theoretical significance to the social context within which technology operates (Orlikowski & Iacono, 2001).

To better analyse the social dimension of information systems, various theoretical ideas from the social sciences have been incorporated in the mainstream of IS research. These include structuration theory (Giddens, 1984), which focuses on the duality of structure, whereby human action and structure are in a recursive relationship, each shaping and influencing the other. Structure refers to sets of rules and resources organised as properties of the social

system, which consists of knowledgeable human agents and their situated activities "reproduced across time and space" (Giddens, 1984, p.25). Through their actions, agents reproduce and change social life and structure. Therefore, "agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality, whereby structure is drawn on in human interaction and thus produced and reproduced by it. The structural properties of social systems are both medium and outcome of the practices they recursively organise" (Giddens, 1984, p.25). Social structure is thus produced by actors, provides the resources to support their actions and constrains the outcome of their interaction.

The attractions of structuration theory have justified its use in various IS studies (Barley, 1986; Orlikowski, 1992; Sydow & Windeler, 1998; Walsham, 1993; Yates & Orlikowski, 1992). Nevertheless, the theory has been criticised as not thoroughly analysing the mechanisms and dynamic processes provoking or influencing changes of the social system and structure (Garsney & Kelly, 1995). It has also been criticised as not being able to thoroughly explain how IT innovation is related to organisational change (Avgerou, 2002; Monteiro & Hanseth, 1996). Furthermore, the absence of the IT artefact is seen as one of the theory's main weaknesses. IS studies (Barley, 1986; DeSanctis & Poole, 1994; Orlikowski, 1992; Orlokowski & Robey, 1991) have incorporated the concept of technology in their analysis, but their treatment of technology has been debated (Monteiro & Hanseth, 1996) and additional conceptualisations have been proposed (Psoinos, 1998; Orlikowski, 2000). Therefore, within structuration theory it remains unclear how to deal with IT.

Articulations of the role of technology and of its interdependence with social context are missing from classic social theory, where technology is often 'black-boxed' (Latour, 1987). Recognising the weakness of many IS studies that treat the IT artefact as a 'monolith' separable from its context of use, Latour (1987) and Callon (1991; 1986) developed actor network theory (ANT), aiming to provide a balance between the technical and social aspects of IS.

ANT's concept of a network, consisting of human and non-human actors (Latour, 1988), and its methodology offer a promising vehicle for IS research (Walsham, 1997; Monteiro., 2000). However, the symmetry of the social and the technical is criticised (Walsham, 1997; Kallinikos, 2001), since a technical artefact operates without being influenced by feelings, relationships and interests. Applied in particular contexts, ANT tries to trace and explain the processes whereby relatively stable networks of aligned interests are created and maintained (Walsham, 1997) through the enrolment of a sufficient body of allies and the translation of their interests. However, its methodology, based on tracing the translations and inscriptions (Callon, 1991) made by actors each time the network changes, is unnecessarily complex and ungainly for analysing responses to unexpected situations. Sometimes these changes are

made very quickly on an ad hoc basis, and might soon return to their original state, without any alliance being achieved between actors.

The analysis of flexibility requires an approach that enables the examination of the process through which organisations respond to sudden environmental changes that may or may not have a lasting impact on the organisation. These ideas are better analysed in systems thinking approaches, such as open systems (Emery, 2000), appreciative systems (Checkland & Holwell, 1998; Vickers, 1984) and systems dynamics (Garsney, 1993). Systems ideas are still used in IS research (Galliers *et al.*, 1997) and there still exist active strands of systems theory, such as critical systems thinking (Flood & Jackson, 1991) and autopoiesis (Maturana & Varela, 1980; Mingers, 1995; Von Krogh & Roos, 1995).

Besides an analysis of the process of response, the study of flexibility also requires a thorough examination of the organisational context. This study follows a socio-technical approach and aims to analyse this context without overemphasising the social perspective or neglecting the role of the technology. According to Kling (2000), in order to view IT as socio-technical networks, various elements need to be given special attention. These include people (in various roles and relationships), support resources (e.g. equipment, training) and information structures (content, content providers, and rules/norms/regulations, including those that authorize people to access and use systems and information in specific ways).

Following these ideas, this study puts emphasis on the interplay between the social and the technical but does not recognise their symmetry, as suggested in ANT. It argues that even a type of technology able to 'take decisions', such as a CRP system, cannot be compared to humans, since these decisions are not influenced by feelings, relationships and personal interests. Therefore, in this study, technology is seen neither as an independent nor as a dependent variable, but instead as an 'embedded system' (Orlikowski & Iacono, 2001, p.126), that is, as being enmeshed with the conditions of its use. This view is similar to the one articulated by Kling and Scacchi (1982) in their work on 'web models' that focuses on understanding how technologies, embedded in particular contexts, come to be used in particular ways. Further elaborating on these ideas, Kling (1987) examines how social influences shape the implementation and use of technology and provides a theoretical base to analyse the context of technology.

Therefore, the examination of flexibility in this study is based on a context/process type of analysis that aims to thoroughly examine not only the process under which organisations respond to environmental disturbances, but also the organisational context that influences it.

3.3 A context/process analysis

A context/process type of analysis is already well known in information systems research, mainly through Pettigrew's contextualist method (Pettigrew, 1985; 1987). Pettigrew's approach has been widely used (Madon, 1993; Walsham, 1993; Walsham & Waema, 1994) for the study of IS and organisational change. According to Walsham (1993) its main strength in understanding organisational change is its clear emphasis on multilevel contexts, on process and on the links between process and context. Such an approach guides the analyst to explore the *content* of change that takes place in an organisation, the *process* under which change is conducted and the *context* that influences and is influenced by this change.

"Contexualism is concerned with the event in its setting" (Pettigrew, 1985, p.59). It seeks to analyse processes in their organisational, social, political and business context. Studies following this approach should involve a continuous interplay between the content, the process and the context of change.

The content "refers to the particular areas of transformation under examination" (Pettigrew, 1987, p.657) and can involve changes of technology, processes, manpower, products or corporate culture. In this study the content is described by the outcome of actions taken to respond to an environmental disturbance.

The context refers to the "antecedent conditions of change" (Pettigrew, 1987, p.650). It comprises the *inner context* referring to the internal structural, cultural and political context within which decision making occurs, as well as the *outer context* referring to the social, economic, political and competitive environment in which the firm operates and from which much of the legitimacy for change is derived (Pettigrew, 1985; 1987). In this study, the outer context, or interorganisational context, not only refers to the broader political and economic environment, but also to the relationships between organisations. Technology is also seen as being part both of the inner context (intra-organisational systems or legacy systems) and of the outer context (interorganisational systems used by partners or competitors).

The process is seen as a "continuous, independent sequence of actions and events" that is being used to explain the "origins, continuance and outcome" (Pettigrew, 1987, p.656) of an initiated change. It refers to the actions, reactions and interactions of various parties involved in the course of change.

A contextualist approach involves a process analysis that traces the unfolding of events in terms of interdependencies between higher or lower levels of contexts. Therefore, a contextualist analysis is both multilevel (vertical analysis) and processual (horizontal analysis) (Pettigrew, 1985; 1987; 1990). The vertical level of analysis refers to the interdependencies between higher or lower levels of context analysis whereas the horizontal

level refers to the sequential interconnectedness among phenomena in historical, present and future time.

In a study of flexibility where temporary or permanent changes occur more frequently, without usually involving such a large scale of change, such an in-depth horizontal level of analysis is not feasible unless only one organisation is studied and a strategic type of flexibility[14] examined. However, to acquire a more thorough view, the historical unfolding of certain events, demonstrating the development and change of the context as well as the dynamic nature of flexibility, is examined.

More emphasis is given to a vertical level of analysis where interdependencies between different layers of context such as the market as a whole, the members of ECR-Hellas, the trading partners and the context of individual organisations or departments are demonstrated. The layered contextualist analysis is thus used in this thesis to address flexibility as a property of multiple socio-technical interactions expanding beyond the boundaries of a single department/organisation to also include trading partners.

According to Pettigrew (1987, p.656) in a contextualist analysis "the way that the contextual variables in the vertical analysis are linked to the processes under observation" is crucial. The context needs not to be seen solely as a 'descriptive background' or as a list of factors shaping and constraining the process of change. It is rather the interplay between context and process that needs to be given specific focus. Therefore a contextualist approach needs to recognise that processes are both constrained by the organisational context and shape the context, either in the direction of preserving it or altering it.

Another point that needs clarification is the distinction between the content and the context of change. The content of change involves the introduction of new technologies or changes in the current technological infrastructure or in manpower. However, the distinction of technology and manpower as content and of the social, economic and political environment that it influences as context is an "oversimplification" (Avgerou, 2002, p.10; Callon & Law, 1989). Technology needs to be treated as part of the organisational context so that the complex interaction and interdependencies between the technical and the social are revealed. Conversely, the social and political changes following alterations of the technical infrastructure need also to be considered in the analysis of the content of change.

Acknowledging the interwoven relationship between the content and context of change, in this thesis the content is not analysed separately. The content of change involves changes to

[14] Strategic flexibility is often associated with considerable change, which has a long and lasting impact on the organisation.

the context occurring through the process of change and can thus be examined through the analysis of the process of change and its impact on the context. Furthermore, it is not the content of change that is of interest in this study but mostly the processes through which temporary or permanent changes occur as a response to environmental disturbances as well as the context that shapes and affects them. This study thus focuses on a context/process analysis emphasising the reciprocal relationship between the process of change and its context.

3.4 Analysing the process of change

According to Pettigrew (1987) the process refers to the action and interactions of people involved in the course of change. The analysis of the process or processes under investigation can be conducted through the use of existing or novel theories of process (Pettigrew, 1985). The contextualist analysis requires a theory of the process of change, capable of explaining how this process is constrained by its context and also contributes to its shaping. Walsham (1993) uses cultural and political metaphors to analyse the process of change. He states that culture is viewed as an active, living and changing phenomenon whereas the exercise of power and the taking of political action are seen as an endemic and continuous process. Although Walsham (1993, p.58) argues that these approaches "emphasize the process of creation and re-creation occurring in the social context" the link between the process and the context of change seems to be relatively weak. He thus uses the sociological model of structuration theory (Giddens, 1984) to conceptualize the linkage between context and process in social systems.

Although the aforementioned approach uses a strong theoretical base to describe the relation between the changes of the context and the processes through which they occur, it has certain limitations regarding its application to this study. The use of a political and cultural perspective analyses the process of change as being driven solely by power relations and cultural issues. It thus restricts the analysis of actions guided by business, economic and technological factors. Moreover, structuration theory emphasizes the way changes occur to the social context, but is relatively weak in explaining how the technological infrastructure changes or shapes change.

Since technology is a focal factor of our research, we need an approach that enables us to analyse the interplay between human actors and technological artefacts. We also need a theoretical perspective that enables the analysis of flexibility as the process through which the organisation or the business network responds to environmental disturbances.

The notion of flexibility, as a property of interaction between the organisation and its environment is explained in systems thinking, whose core comprises the concept of a whole

entity (organism) that can adapt and survive within limits in a changing environment (Checkland, 1999). As early as the 1950's, organisations were seen as dependent upon their environment and therefore as interactive with other organisations. Flexibility is seen as the capacity of an organisation to endure change without severe disorganisation (Feibleman & Friend, 1969) and the interaction between organisation and environment is examined through the dynamic sequence of stimulus-response and effect.

3.4.1 Systems thinking

Systems thinking refers to the process of thinking about the world using systems ideas (Checkland, 1981; 1999). These ideas were derived directly from "our intuitive or causal knowledge of organisms." (Checkland, 1999, p.49). They emerged from ideas about organisms that were extended to complex and adaptive wholes (systems) (von Bertalanffy, 1968; Checkland, 1981). *System* is a fundamentally abstract concept, which may be used as a descriptive device for making sense of natural and designed wholes as existing in the world (Checkland, 1999). According to Ackoff (1999) a system is a whole, consisting of parts or elements, that satisfies the following conditions:

1. The whole has one or more properties or functions that define its role in larger systems, in which it may be a part.

2. The behaviour of each element/part has an effect on the behaviour or properties of the whole.

3. There is a subset of parts that is sufficient for carrying out the defining functions/ properties of the whole. These parts are essential since without any one of them the system would not exhibit the same functions. Systems may also contain nonessential parts that affect their functioning, but not their defining properties.

4. The way that each essential part (or a subset of parts) of a system affects its behaviour or properties depends on the behaviour or properties of at least one other essential part (or subset) of the system.

A system cannot be divided into independent parts without loss of its essential properties or functions. Moreover, systems may exhibit properties that are not present in any of their parts and thus the system (whole) is more than the sum of the parts (Checkland, 1981; 1999). Seen as a system, an organisation is found to be both more and less than the sum of its parts. It is less because of the organisational constraints and it is more since, when organised, components can do together what none could do alone or all could do independently (Vickers, 1983a).

Therefore, the systems approach stresses the need "to treat any system as a whole, hence the need to go beyond *systematic thinking* (that of using an analytic approach) to *systemic* thinking (that of interpreting from the systems viewpoint, which is both analytic and synthetic)" (Angell & Smithson, 1991, p.16). While an analytic approach can provide information on the composition and structure of systems, a synthetic approach can also yield understanding of their functions, purpose and role in the environment where they operate (Angell & Smithson, 1991).

According to Checkland (1999, pp.49-50), in order to understand and use the system's concept, "we need a handful of further ideas, which, together with the idea of the adaptive whole, constitute the bedrock of systems thinking". He thus argues that:

1. For an observer to choose to see some complex entity as a whole, separable from its environment, it must have properties, which for that observer at least are properties of it as a single entity: so called *emergent properties.*
2. Wholes having emergent properties may well have smaller wholes with their own emergent properties....Equally the larger whole may be only a part of a yet larger whole, with its own emergent properties....In other words systems thinking includes the idea of *layered structure.*
3. If our entity is to survive in environments which change it must have available to it ways of finding out about its environments and ways of responding internally to them; it must have processes of *communication* and *control,* which may be automatic (control of core temperature in our bodies) or created by human beings (e.g. rules within a university).

By definition, "the complex natural wholes, which have evolved and survived are those with good processes of communication and control" (Checkland, 1999, p.51). Communication between elements of a system is needed in order for it to regulate and manage its actions and reactions, to alter or adjust itself while interacting with its environment (Angell & Smithson, 1991). Control is an act of communication and "consists in reducing degrees of freedom in the self-selection of events" (Baecker, 2001). Control is also a means by which a whole entity retains its identity under changing circumstances (Checkland, 1981).

A system is also understood to have a *boundary,* which separates it from its *environment.* However, the perception of the boundary can be uncertain especially in the case of social systems comprising subsystems that are also part of the environment (Angell & Smithson, 1991). Therefore, the idea that organisational boundaries need to be questioned (Jackson, 1997) is commonplace, especially in interpretive and critical systems approaches (Galliers *et al.*, 1997).

All these ideas are conveyed in a wide variety of systems approaches, involving different ontological assumptions and deriving from different disciplines, such as economics, engineering, management and social sciences. The broad spectrum of systems thinking approaches is presented in Appendix I.

The approach followed in this study is part of the soft systems thinking orientation. Soft systems approaches take a *process* view of organisations (Checkland & Holwell, 1998), abandoning the notion that reality consists of systems that can be engineered (Checkland, 1995). They are premised upon an alternative theoretical assumption, in which social reality is seen as continuously socially '(re)constructed' (Galliers *et al.*, 1997, p.269). Although, soft systems researchers regard the world as complex and problematic, they accept that the process of inquiry into it can be organised as a learning system (Checkland, 1999). Therefore, they shift systemicity from the world to the *process of inquiry* into the world (Checkland, 1999).

Checkland (1991; 1995) introduces the soft orientation by referring to Vickers's (1968; 1972; 1983a, 1983b) work on appreciative systems. Vickers's core idea is that of 'appreciation' and the 'appreciative process', which "constitutes - whether or not we consciously organise it as such - a system" (Checkland & Casar, 1986, p.3). Vickers takes a *process view of organisation* and explores the way in which people in organisations inter-subjectively attribute meaning to their world, perceive situations and take actions, maintaining or changing relationships (Checkland & Holwell, 1998). Vickers's approach on appreciative systems is adopted by this study, as it satisfactorily explains the process through which individuals or groups of people 'appreciate' an environmental threat, disturbance or opportunity and, based on judgements, decide upon an action to take in order to respond to it.

The main concepts of Vickers's theoretical approach are described in the following paragraphs, the limitations and weaknesses of this approach are discussed, and the models of appreciative systems and organisational discourse developed by Checkland and Casar (1986) and Checkland and Holwell (1998) are presented.

3.4.2 Appreciative systems

Vickers's (1968, 1972, 1983a, 1983b, 1984) work on appreciative systems brought to management thinking "a distinctive point of view reflecting his background and varied career[15]" (Blunden, 1985, p.107). Vickers was opposed to the prevailing developments in management thinking of the 1960s and was critical of what he considered as the "mechanical and mathematical models of decision-making which emphasized action at the expense of judgement" (Blunden, 1985, p.107). He found that the construction of "man as a calculator

[15] Vickers was a City lawyer who later became an industrial manager. Being involved in small and large institutions in both public and private sectors, he accumulated forty years of experience, influencing his theoretical contribution to management thinking (Blunden, 1985). Although accepting, in his mid-eighties, the appointment as visiting Professor in the Department of Systems at the University of Lancaster, he was never a professional academic and this might, according to Checkland and Casar (1986), be the reason why his contribution has been relatively neglected by academics in general and social theorists in particular.

in search of a continuous satisfaction of wants and realization of purposes" was not plausible (Johnson, 1994, p.29). For him, the meaning of 'rational' was understood as the capability to act reasonably and the ability to distinguish fact from value in the identification of choices and the making of judgements (Johnson, 1994).

Vickers sensed that systems thinking had a much broader relevance to problems of organisation, communication and control at the individual, organisational and societal levels (Blunden, 1985). Vickers (1983a) discusses the usefulness of systemic thinking as a means to better understand human systems. He argues that systems thinking provides basic concepts with which to describe the circular processes of perceiving, judging and acting that characterise human affairs. He also states that the problem of wholes and parts has always been relevant to the context of human individuals and their relations with each other and with the societies of which they are part. He further states that his concern is to take into consideration the cultural issues, which "diversify both human experience and the different ways in which this is perceived and interpreted in different human societies" (Vickers, 1983a, p.9).

However, Vickers argues that systems theory as applied to computing throws no light on the source of the standards by which a social system is regulated. It does not contribute to the understanding of the way regulative standards "emerge, grow, change and sometimes perish in the ongoing life of men", organisations and societies (Vickers, 1983a, p.8). In one of his letters to Peter Checkland in 1974 (Checkland, 1995, p.6) Vickers argues that the goal seeking paradigm is inadequate to describe human activity since regulatory activity consists in "attaining or maintaining desired relationships through time or in changing and eluding undesired ones" (Checkland & Casar, 1986, p.16). He further argues that the cybernetic model is equally inadequate, since the human regulator does not have a single course given outside the system (as in the case of a helmsman that steers a ship) (G. Vickers, personal communication in Checkland, 1995).

> The human regulator, individually or collectively, controls a system which generates multiple and possibly mutually inconsistent courses. The function of the regulator is to choose and realise one of many possible mixes, none fully attainable. In doing so it also becomes a major influence in the process of generating courses [G. Vickers, personal communication in Checkland, 1995, p.6].

Vickers (1983a) argues that human systems are different from man-made systems in that they also have a vital ethical dimension. An additional distinction between human societies and other kinds of systems is their capacity to generate and change the settings of their own systems (Blunden, 1994). Human behaviour is also characterised by 'exceptional selectivity', derived from men's capacity to communicate, store and, above all, process information (Vickers, 1984, p.153). The concepts of information, communication and control, not only

developed in systems thinking but also widely applied in psychology and the social sciences, are of high importance (Vickers, 1984). Based on these concepts Vickers (1968) developed a model of what he calls appreciative behaviour. A model he describes as: "rough and speculative but better than no model at all" (Vickers, 1984, p.152).

Comparing his work with Simon's Administrative Behaviour (Simon, 1960) Vickers (1983b, p.22) argues that he adopts a more "dynamic conceptual model of an organisation and of the relations, internal and external of which it consists, a model which applies equally to all its constituent sub-systems and to the larger systems of which it is itself a part". This model enables him to represent managers as regulators "setting and resetting courses of standards, rather than objectives", simplifying the difficulties inherent in descriptions in terms of means and ends (Vickers, 1983b, p.22). He argues that the intrinsic confusion between means and ends arises from the fact that "no end can ever be more than a means, if an end is equated with a goal" (Vickers, 1972, p.128). For instance, he says that getting a job can be indifferently an end, a means and a goal; it is mainly an opportunity for new relationships.

According to Checkland and Casar (1986, p.4) the major recurring themes in Vickers's thinking are:

- the concept that everyday life is experienced as a flux of interacting events and ideas;
- A concept of relationship maintaining or changing, as a richer concept of human action than the popular but 'poverty-stricken' notion of goal seeking.
- A separation of judgements about what is the case, 'reality judgements', and 'value judgements' regarding what is good/bad, acceptable and unacceptable.
- A concept of "action judgements' stemming from reality and 'value judgements".
- A notion that 'the cycle of judgements and actions are organised as a system'.

3.4.2.1 Life experienced as a flux of interacting events and ideas

Vickers argues that human social systems are historical in two senses. He states that the development of ideas in the individual's head has a history distinct from the history of events though linked to it by "close mutual bonds" (Vickers, 1968, p.151). The history of events and the history of ideas unfold side by side in a close relationship, while each has its own 'logic', its own 'dynamic' and its own 'time scale' (Vickers, 1983b, p.15; 1972, p.200). This unending interaction of events and ideas in individuals' lives forms the attitudes of mind that people bring to meetings (Vickers, 1968). These attitudes might further change, both by the event of the meeting but also by the exchange of ideas that it involves.

Further elaborating these concepts, Vickers (1983b) argues that the ideas put forward and the decisions taken to deal with a specific situation are influenced not only by the situation but also by relevant past decisions. These new decisions in turn will "influence future decisions not only by their effect on the history of events, but also by the precedents which they set and the changes which they make in the way decision makers in the future will see, interpret and respond to an event" (Vickers, 1983b, p.15); a development that Vickers labels as the history of ideas.

3.4.2.2 Appreciation and action

Appreciation is the process of "representing to ourselves situations relevant to our concerns and comparing these situations with standards defining what we should expect them to be and if this is different, what we should like them to be" (Vickers, 1983a, p.57). Its first and most critical result is to classify a situation as one that must be accepted and preserved or one that human action should change (Vickers, 1983b). It is the process of observing the 'actual' and comparing it with the 'norm' (Vickers, 1968), and even if it does not engage overt action, it involves understanding, which is also considered as an activity.

To appreciate a situation, within a specific context relevant to our concerns, we need to understand how it arose and to what it might lead (Vickers, 1983a), a process that involves three mental activities. The first activity is based on 'rationality' and is the capacity for logical deduction. The second is called 'intuition' and is the capability for contextual understanding. Finally the third, mentioned as 'empathy', is applicable when other humans are also involved, and represents the "power to present to ourselves their subjective states", a power which might be misleading (Vickers, 1983a, pp.57-58).

Appreciation is thus a mental activity, "partly subjective, largely inter-subjective, that is based on a shared subjective judgement" (Vickers, 1983a, p.55). According to Vickers, a person's capacity for appreciative judgement depends on "i) the quality of his relevant mental faculties, which seem to vary widely between individuals; ii) the materials at his disposal, whether in memory or externally accessible or derivable from these by further mental process; and iii) his current state of readiness to see and value things in one way rather than another", defined as his 'appreciative setting' (Vickers, 1968, p.158).

A person's appreciative setting is influenced by standards (Vickers, 1972) generated in previous history. 'Standards' or 'norms' are given particular attention in Vickers's work, since the observation of the actual and its comparison with standards or norms are inseparable in the process of appreciation (Vickers, 1968; 1984). Vickers (1983b, p.56) defines **standards** as ways of operating "that need to be shared by any society in order to remain stable". He focuses on standards by which organisations and societies are regulated

(Blunden, 1985) and argues that any internally generated control depends on the existence of standards. He also defines **norms** "as specific, but tacit standards of what is socially and individually acceptable" (Vickers, 1984, p.194). According to Vickers the norms that men pursue are largely self-set by a partly conscious process (Blunden, 1985).

The standards or norms brought into a process of appreciation are changed and developed by the very process of applying them. They might be changed or developed by the impact of judgements conducted, by the influence of each participant on the others; and by "the exercise of their own minds as they apply standards in one hypothesis after another in a search for a better fit" (Vickers, 1984, p.158).

Appreciation is thus seen as being constantly challenged or confirmed by experience. Experience is viewed as the readiness "to notice particular aspects of a specific situation, to distinguish them in particular ways and to measure them against standards of comparison, which have been built in similar ways" (Vickers, 1972, p.102). The appreciative setting is thus itself a product of past experiences of appreciation and may be confirmed or further changed in subsequent processes of appreciation (Vickers, 1968).

Appreciation may or may not call for or evoke an action (Vickers, 1968; 1984). If a situation is classified, through appreciation, as one that human agency needs to change, a 'problem'[16] begins to emerge and 'solutions' are sought (Vickers, 1983b). Possible responses and actions to be followed are then identified and evaluated with the aid of various criteria (Vickers, 1983b). According to Vickers (1984), the choice and conduct of action are separable from the appreciation of a situation.

Vickers (1968; 1984) calls action "regulative action" and sees appreciative behaviour as distinguishable from regulative behaviour. For him regulation is a concept referring to something much more like a structure of interdependencies and he repeatedly uses the term in a sense equivalent to something like adjustment, mutual adaptation and responsiveness to external disturbances (Johnson, 1994). He does not see regulation as always being associated with an externally generated set of rules but also as a process of establishing, maintaining and managing relationships between individuals (Johnson, 1994). In that sense the actions taken as an outcome of the process of appreciation are perceived as relationship maintaining or changing, without rejecting the significance of striving to achieve goals (Checkland & Holwell, 1998).

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[16] Vickers (1983b, p.55) argued that "without concerns there would be no problems and that without criteria (which often conflict) there would be no solutions".

> ...activities have indeed their own goals. The complex negotiation has an object; the difficult meeting must reach some conclusion; but these ends derive their meaning from the ongoing relations which they mediate [Vickers, 1983b, p.32]

Further developing this argument Vickers (1983b) describes policy making as the setting of governing relations or standards, rather than as the setting of goals, objectives or ends, which is the more common definition. He states that "policy does not consist in prescribing one goal or even a series of goals; but in regulating a system over time in such a way as to optimise the realisation of many conflicting relations without wrecking the system in the process" (Vickers, 1972, p.116). Without denying that people sometimes seek goals he stresses a different aspect of activities involving the management of relationships over time (Vickers, 1983b).

The concept of relationship management in Vickers's work seems to be used in a broad sense to describe all types of changes that can be conducted in a social and organisational environment. These changes not only involve relationships between people, departments or organisations, but also the use of resources, modification of certain operations, changes of employee's position etc. Therefore, relationship managing refers to all types of alterations that may directly or indirectly affect human or organisational relationships.

For instance, Checkland and Casar (1986), in a case study describing changes made at an Information and Library Services Department (ILSD), describe the provision of an efficient, effective and timely supply of information to other parts of the company as a scenario of relationship managing. The shift of ILSD's focus from a reactive function, responding quickly and competently to users' requests, to a proactive function that could occasionally inform actual and potential users is mentioned as an adjustment that required relationship managing. Further explaining this, Checkland and Casar (1986, p.8) argue that such an adjustment involved changes both to internal relationships (how different should they be to support a proactive function) and to the external relationships, referring to those of the department with the rest of the company.

Summarising, it should be noted that appreciation refers to the process of understanding and evaluating a situation, based on standards generated in previous history. These standards are changed or developed by the very process of applying them, influencing or altering subsequent processes of appreciation. Therefore, appreciation is a subjective process, constantly challenged or confirmed by experience. It may involve identification of possible responses, consideration of the relationships that they will affect, debate and decision upon an action to take. According to Vickers (1968; 1983b), this process is manifested through time in the exercise of mutually related reality judgements (what is the case), value

judgements (what ought to be the case), and action judgements, further analysed in the following section.

3.4.2.3 Judgements

Most of the situations that humans evaluate and most of the problems that they try to solve are influenced or set by their own appreciative judgements, which consist of 'reality', 'value' and 'action' judgements (Vickers, 1984).

'Reality' judgements revise the currently accepted view of external reality (Blunden, 1985). They refer to judgements of fact about a situation, influencing not only internal, but also external relations. They include judgements about what the impact of the situation "will be or might be on various hypotheses as well as judgements on what it is and has been" (Vickers, 1983b, p.40). Although based on the present (and influenced by the past), reality judgements are primarily concerned with the future, which can be affected by any change made now (Vickers, 1984; 1968). These judgements might thus be 'actual or hypothetical, past present or future' (Vickers, 1983b, p.40).

Reality judgements are not only involved with what is actually happening in the world of ideas, but also with what is likely to happen in the world of events, while also potentially leading to an assessment of alternatives (Vickers, 1984). They entail analysis and synthesis involving the handling, association or dissociation of individuals' ideas and concepts (Vickers, 1984) as an attempt to determine the relevant aspects of a situation or facts (Vickers, 1983b). The selection of relevant facts can be based on statistics, history of past experiences of similar situations, opinions or estimates, which might be conflicting (Vickers, 1984). This selective and critical activity (Vickers, 1984), enables participants to select facts that they consider as relevant and significant from a mass of confusing stimuli (Blunden, 1985). Although this implies that participants need to know "what the situation is, what the conditions are prevailing in it, what claims on resources are at issue, what demands are being presented, and so on" (Johnson, 1994, p.30), awareness of all aspects of a situation may not be required. Therefore, the relevant facts are a selection of issues that might have been noticed (Vickers, 1983b, p.72). Normally "the more complex the subject matter is, the more the relevant facts are matters of judgement" (Vickers, 1983b, p.72). They are selected for their 'relevance' and are evaluated through value judgements revealing significance and validity (Vickers, 1983b).

'Value'[17] judgements are the judgements of the significance of these facts to the people involved in the process of appreciation and to their society. They are concerned with the standards of what an organisation should expect of itself and others (Blunden, 1985). These standards are implicit in every major decision and constantly change over time through the process of applying them. Therefore, latent in every value judgement is the process of the resetting of standards which are being applied.

"Reality judgements and value judgements are inseparable constituents of the process of appreciation" (Vickers, 1983b, p.40), connected through a close and mutual relationship (Vickers, 1984). They correspond with the observation of 'facts', their comparison with the 'norm' (reality judgements) and their evaluation (value judgements), forming the first segment of any regulative cycle (Vickers, 1983b). Vickers describes these judgements as a set of 'readinesses' to distinguish some aspects of a situation rather than others and to value them in specific ways (Blunden, 1994). These 'readinesses' are learned through experience and are enabling while also limiting. "They facilitate further learning consistent with the pattern they create, but they create 'unreadinesses' to see, to value and to respond in ways inconsistent with those patterns" (Blunden, 1994, p.12).

The third type of judgements, following reality and value judgements, are 'action' judgements, involving thinking about what to do regarding a current situation. Action judgements are the most studied form of judgement in problem solving and entail finding appropriate means of achieving an anticipated end. Vickers (1984) criticized mathematical and algorithmic models in that they mainly focus on action judgements, implying that typical decision making situations involved problem solving and optimizing, while neglecting what is 'tacit' and 'discretionary' (Blunden, 1985).

According to Vickers (1984), action judgements are involved in answering any question concerning what shall be done about a specific situation that has been defined by judgements of reality and value. In implementing a decision, similar or related questions may have to be asked several times. Each decision sets a more precise problem for the next stage of action judgement, while at each stage a set of additional criteria (supplied by further judgements of reality and value) are assumed for distinguishing between different solutions (Vickers, 1984). Therefore, action judgements do not involve an exhaustive search of all possible solutions, but the scanning of likely solutions until one is found that is satisfactory.

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[17] Vickers defines **values** as explicit but general statements of principle, of which the content is continually changing through changing norms, changing circumstances, changing policies and the accompanying ethical debate (Vickers, 1984, p.194)

3.4.2.4 Appreciation organised as a 'system'

To describe all elements of the process of appreciation Vickers uses the term 'appreciative system'. He calls them a system because "they seem to be organised as a whole ... being so interrelated that a change in one part of the system is likely to affect and be dependent on changes elsewhere" (Vickers, 1983b, p.67). An appreciative system is an 'interpretive system' (Vickers, 1968, p.12) representing "readinesses to distinguish some aspects of a situation rather than others and to classify and value them in particular ways' (Vickers, 1983b, p.67). Therefore, it is a system of standards, developed by individual and social experience and influenced by individual concerns (Vickers, 1984). It has the threefold task of "mediating communication", "guiding action" and "making personal experience meaningful" (Vickers, 1984, p.348). Besides involving mechanisms of communication, the appreciative system also involves mechanisms of control. Communication builds and constantly renews the appreciative system, which is both its product and interpreter. Control shapes the appreciative system and is exercised by the consideration of 'standards' in the process of appreciation. Human control is thus expressed as the "power and duty of the human mind to make judgements" (Vickers, 1984, p.151), based on standards, and deciding upon actions to take.

The appreciative system tends to be self-perpetuating and it can change at a limited rate, unless it fails in one or more of its functions so that a larger change is required (Vickers, 1984). For Vickers (1983b) the development and change of an appreciative system, at once enabling and limiting, is the inner history of individuals, organisations and even societies. Therefore, he is particularly concerned with the reciprocal process by which the appreciative system is itself changed by every exercise of appreciative judgement.

This study does not analyse the concept of appreciative system, but focuses on the description of the process of appreciation, which constitutes the main contribution of Vickers's work. Influenced by his main concepts regarding the process of appreciation, the making of judgements and the potential choice of action, Checkland and Casar (1986) developed a model of appreciative systems, described in the following section.

3.4.3 An appreciative systems 'model'

Checkland and Casar (1986, p.3) argue that expressing Vickers's appreciative process in the form of a model would offer a richer way of expressing his theoretical ideas, making them "operational" as well as subjecting them to "critical scrutiny". They modelled the process of appreciation as a set of abstract entities or components, which are linked and organised as a system. This system has as an *emergent property* its ability to express the process of

appreciation, since it is only the system as a whole that can enact appreciation as a social process (Checkland & Casar, 1986).

The basic form of the model, shown in **Figure 5**, demonstrates the main theoretical components, which are linked with arrows that have the meaning of 'leads to'. "The starting point for the model is the interacting flux of events and ideas unfolding through time." The events and ideas generate appreciation, which "is occasioned by our ability to select and to choose. Appreciation perceives (some part of) reality, makes judgements about it, contributes to the ideas stream, and leads to actions that become part of the events stream" (Checkland, 1995, pp.6-7).

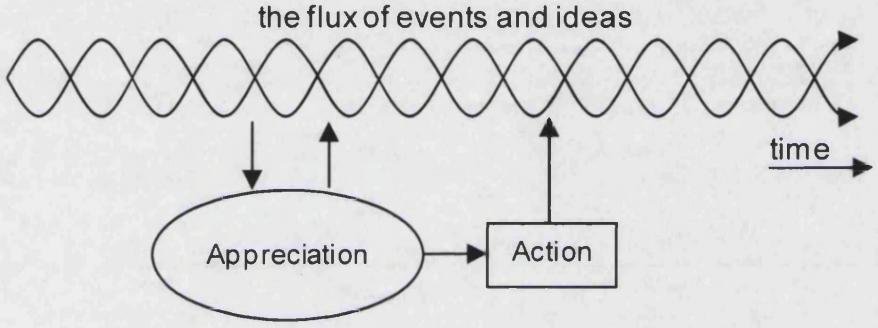

Figure 5: The structure of an appreciative system. *Source Checkland and Casar, 1986, p.5*

The discussion and debate that leads to action is one in which those taking part make judgements of 'fact' and 'value'. That is, judgements about both 'what is the case' ('reality judgements') and about its evaluation as 'good', 'bad', 'satisfactory' or 'unsatisfactory' ('value judgements) (Checkland & Holwell, 1998). Both reality and value judgements are based on *standards* generated by previous history (Checkland & Casar, 1986). Since, in Vickers's approach, the focus on goals is replaced by one of managing relationships, these judgements lead to a view on how to act to maintain, modify or avoid relevant relationships (Checkland, 1995). Therefore, as shown in **Figure 6**, the decision upon an action to take (action judgement) is based on the consideration of the relationships that may be affected, also influenced by standards.

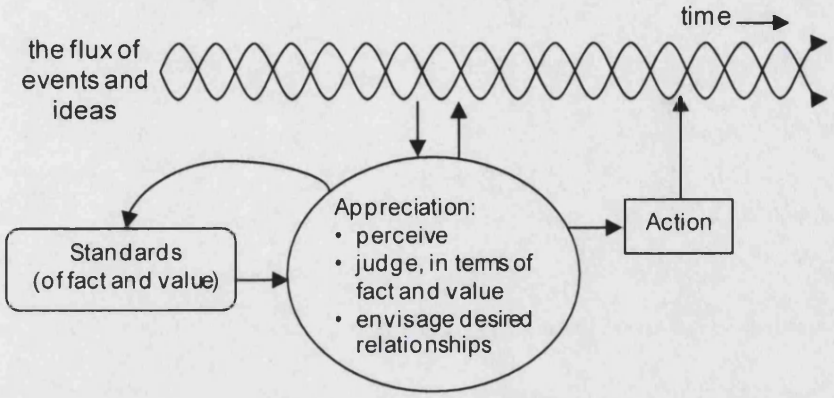

Figure 6: The structure of an appreciative system expanded. *Source Checkland, 1995, p.7*

The *standards* or criteria, by which the mix of courses to be followed will be judged, are not given from outside. They are themselves internally generated by the previous *history of the system itself* and its interactions with its environment (Checkland & Holwell, 1998). As shown in **Figure 6** these standards may be also modified by the very act of using them in the process of appreciation (Checkland & Casar, 1986). Therefore, the present operation of the system, influenced by its past operations, may in turn modify its future operations "through its effect on standards and consequently on the 'setting' of the appreciative system" (Checkland & Casar 1986, p.5).

While the form of the appreciative system remains the same over time, its contents (its setting) continually (but not necessarily continuously) change (Checkland & Casar, 1986, p.5). Therefore an additional feature of the model, as shown in **Figure 7**, is one that represents its dynamic nature. According to (Checkland, 1995, p.7) "there is a recursive loop in which the flux of events and ideas generates appreciation, and appreciation itself contributes to the flux". The appreciative system is, thus, always open to new inputs from the continuous flux of events and ideas and, through its actions, it reproduces a continually changed self (Checkland, 1995).

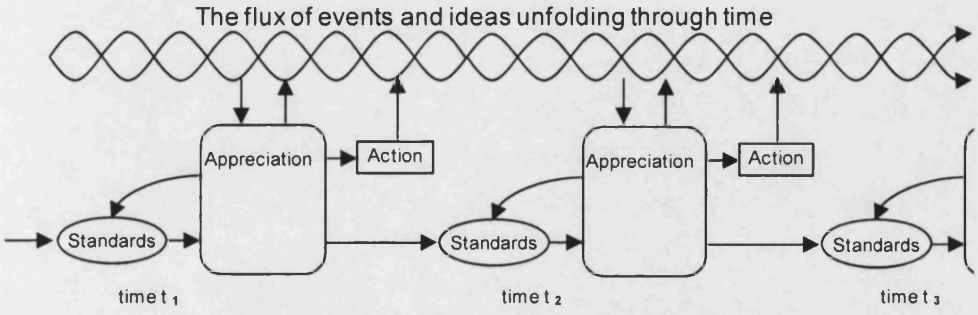

Figure 7: The dynamics of an appreciative system. *Source Checkland and Casar, 1986, p.8*

According to Checkland and Casar (1986) their model, presented in Figures 5, 6 and 7, is a systemic version of Vickers's theoretical approach, which analyses the process by which individuals and human groups perceive reality, appreciate a situation, make judgements about it and, if needed, act. The appreciative systems model is used in this thesis as a conceptual basis to analyse the process through which organisations or parts of them evaluate and respond to environmental disturbances. Taking into consideration the dynamic nature of an appreciative system, organisations are seen as continually reproducing themselves, or producing a changed self, through interactions with the environment. Therefore flexibility is also seen as a dynamic characteristic evolving over time, following and influencing the organisation's changes.

However, the analysis of the ability of an organisation to change would primarily require an analysis of the organisational context influencing it. Although the appreciative systems approach provides an understanding of the process of evolution and change occurring in organisations, it does not explain how the organisational context influences and is affected by the process of appreciation and its resulting action. Acknowledging this limitation Checkland and Holwell (1998) expanded Vickers's work to develop a model of organisational discourse.

3.4.4 A 'model' of organisational discourse

Vickers's analysis provides a process view of the organisation emphasizing the social aspects influencing the process of appreciation while overlooking the organisational, structural and technological factors. It is only in one of his books that Vickers briefly refers to the role of information technology, arguing that it has affected decision making in accepting effectiveness as the sole criterion by which to choose between alternative options (Vickers, 1972).

Recognising this weakness, Checkland and Holwell (1998) described organisational discourse as a process embedded in the organisational context and influenced by the external environment. They have, thus, proposed a "model" for the organisation (**Figure 8**), where people are deciding upon an action to take, based not only on external influences (partners or competitors), but also on contextual issues, such as technology, resources and organisational structure.

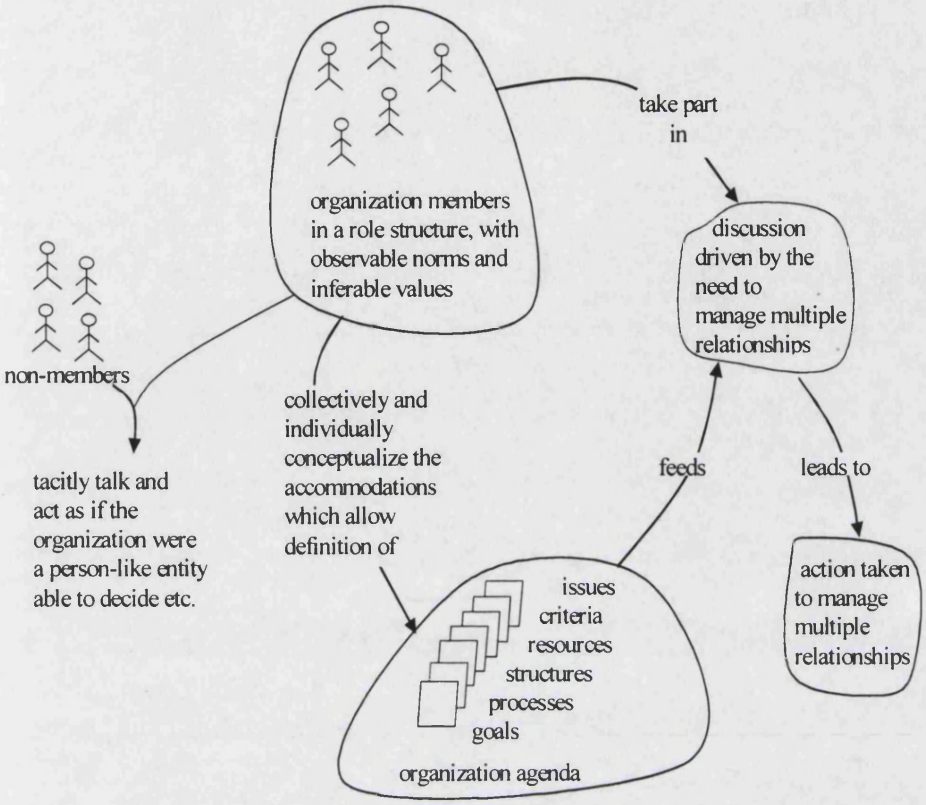

Figure 8: A richer model of the concept of an organisation. *Source Checkland and Holwell, 1998, p.83*

By developing this model, Checkland and Holwell (1998) tried to describe the process through which organisations are evolving and changing over time. They argue that changes are made by actions decided through organisational discourse and they identify the contextual issues that influence these decisions. Following Vickers's, ideas they provided a richer definition of action as "managing a (changing) set of relationships rather than just taking rational decisions to achieve goals" (Checkland & Holwell, 1998, p.84).

In this model, information technology is viewed as part of organisational resources and its impact on organisational discourse is not examined. Further exploring the impact of technology on organisations, Checkland and Holwell (1998) argue that information technology enables the creation of meaning, influences the identification of accommodations and supports the conduct of action. However, they do not discuss the potential constraining effects of information technology or the restrictions that organisational resources or structures may impose on its use. Moreover, they do not thoroughly analyse the social and political context that also directs decisions and influences actions taken in an organisation. Therefore, their conceptualisation of the organisational context is not detailed enough to analyse flexibility as a context-embedded notion. A more thorough examination of the

context is needed, not only to analyse the social and political environment that influences the process of appreciation, but also to examine the role of technology in the identification of available options and the conduct of action.

3.4.5 Discussing this approach

Vickers's contribution rests essentially on the development of the concept of the appreciative system, providing a way to analyse historical development and change over time (Blunden, 1994). His theory of appreciative judgement refers to the general processes of evaluating a situation, "fact finding and weighing of options" that an individual or a group of people are "bound to engage in once they recognize that a choice needs to be made in order to go in one direction rather than another" (Johnson, 1994, p.31). Therefore, it contributes to a better understanding of the process of decision making in organisations.

Vickers's theoretical approach can be seen as an attempt to set out the mental processes that individuals or groups of people employ when they are engaged in a process of evaluating and responding to events or ideas. The core of the activity concerns debate about possible courses that might be followed and the relationships they will affect. The standards or criteria by which the 'mix' of available courses and actions to be followed will be judged are themselves generated by previous cycles of appreciation[18]. They are developed through interaction with the environment and are changed not only by the outcome of action, but also by the very process of applying them.

As argued above, Vickers's theoretical approach (1968; 1983b; 1984), and especially Checkland and Casar's (1986) model of an appreciative system, are used in this study as a base from which to analyse the process through which people in organisations perceive and evaluate a situation (event or environmental disturbance), as well as to take decisions in order to respond to it. Therefore, this study focuses on the description of the process of appreciation and not on the analysis of its elements, constituting a 'system'.

Although Vickers's approach enables the understanding of the process of appreciation, it does not analyse the impact of organisational context on this process. Acknowledging this limitation, Checkland and Holwell (1998) developed a model of organisational discourse. To demonstrate the role of the context, they identified several organisational issues, such as resources, structures, processes and goals as factors influencing the process of decision

[18] According to Checkland and Holwell (1998) similar concepts are also developed in structuration theory (Giddens, 1984). The model of human agency in structuration theory views human beings as drawing on social structure, seen as rules and resources in human minds, and through interactions producing, reproducing and changing that structure. It also views human beings as monitoring their own conduct and its results in a reflexive way, which influences future interactions.

making in organisations. Nevertheless, the identification of abstract or general organisational criteria does not provide a thorough explanation of the organisational context. Therefore, to better analyse the organisational and interorganisational context, influencing both the process of appreciation and the conduct of action, an additional theoretical approach is incorporated within this study.

3.5 Analysing context

The argument that information systems research needs to associate the impact of technology with the context within which it is embedded has been increasingly supported by researchers (Avgerou, 2001; Ciborra & Lanzara, 1994; Ciborra, 2000). However, as mentioned at the beginning of this chapter, most researchers focus on the social and political context, treating technology as an independent variable, which they assume to be unproblematic. In the majority of studies, IT artefacts are either 'absent', 'black boxed' or 'abstracted from social life' (Orlikowski & Iacono, 2001). This study seeks to demonstrate the impact of technology on organisational flexibility by treating technology as part of the organisational context. Having technology as a focal factor, this study views the organisational context as comprising of the various social settings and structures within which information technology is embedded.

A valuable approach to the study of the context in information systems, which also emphasises the role of technology, is provided by 'web models' (Kling, 1987). They take an 'ensemble view' of technology, which does not perceive technology solely as a technical artefact but as a collection of additional resources, such as management practices, policies, organisational arrangements, training and the people associated with the technology's development and use (Orlikowski & Iacono, 2001). Even though the value of such an approach is recognised (Walsham, 1993; Avgerou, 2002; Checkland & Holwell, 1998), relatively few studies have actually used it. According to Orlikowski and Iacono (2001, p.130) "given the kind of emergent IS phenomena we are witnessing today (electronic commerce, open source software, virtual teams etc.) there clearly is scope for more work to be done from an ensemble view". The aim of this thesis is to build on these conceptualisations, elaborate and expand them. Thus, following the approach of web models, emphasis is given not only on the social context, but also on the technology that constrains or enables human action.

3.5.1 The context of technology

Web models (Kling & Scacchi, 1982; Kling, 1987) are a form of 'resource dependence' (Pfeffer & Salansik, 1978; Pfeffer, 1982) model. They expand upon resource dependence conceptions by emphasizing the history of commitments made in the course of computing

deployments, and the infrastructure that supports the implementation and use of computer-based systems. They make explicit connections between a focal IT and the social, historical and political contexts in which it is developed and used (Kling & Scacchi, 1982; Kling, 1987). Web models thus help to explain (Kling, 1987, p.307):

- The leverage provided by computing arrangements.
- The co-requisites for smoothly operating systems.
- The ways in which the social settings, in which computing arrangements are developed and used, shape their configurations and consequences.

The use of IT provides leverage of several sorts by increasing control, speeding up processes and facilitating work practices. It can also provide bargaining capabilities and satisfy users' interests (Kling, 1987). For instance, a decision support system, helping organisational actors to take a decision, can be also used as a support tool to convince colleagues regarding a specific decision (Kling, 1987). Similarly, an order management system can be used by sales managers as a tool to persuade their customers of the impact of sales promotions on future sales. Therefore, social leverage also depends upon the interactions between users of the focal technology and other parties with whom they negotiate.

However, the leverage provided by IT cannot be directly inferred from characteristics of the technology alone. Particular kinds of automation are often accompanied by altered work arrangements. Some of the resulting net payoffs or problems are more attributable to these related changes than to the technology *per se* (Kling, 1987). Sometimes, staff faces problems that cannot be resolved through improvements in the retrieval, manipulation and transmission of data. In other cases, staff may need to work even longer and harder after the implementation of a specific technology, in order to deal with issues such as increased work requirements, excessive data or even incompatibilities among the company's systems.

The implementation and use of IT may also provide unequal benefits to different employees. Although some may gain advantages, such as increased control, facilitation and speeding up of their operations, others may lose control of their activities, oppose particular computing arrangements and seek alternatives that better serve their interests (Kling, 1987). Occasionally staff may also be in conflict and their incentives to share data and cooperate may be limited.

Hence, large IT improvements may not often lead to proportionate gains in organisational action (Kling, 1987). The information processing leverage and benefits provided by a focal technology are closely related to the organisational arrangements and social settings in which the technology is developed and used. Kling and Scacchi (1982) developed this insight into what they called the 'web of computing' that includes commitments and additional infrastructural resources such as skilled staff, support services, organisational arrangements

and policies for the effective use of technology. Therefore, in web models "technology is neither an independent nor dependent variable but instead is seen to be enmeshed with the conditions of its use" (Orlikowski & Iacono, 2001, p.126). Technology is not solely perceived as a technical artefact and its conceptualisation also includes the socio-economic activity in which it is applied. To address these issues and better analyse the varied impact of IT on organisations, the web models approach proposes a set of assumptions presented in **Table 8.**

1. A computer system is best conceptualized as an ensemble of equipment, applications and techniques with identifiable information-processing capabilities.
   a. Each computing resource has costs and skill requirements which are only partially identifiable.
   b. In addition to its functional capabilities as an information processing tool, computer-based technologies may also be social objects which may be highly charged with meaning.
2. Role of infrastructure:
   a. The infrastructure supporting the focal computing resource and the organisational procedures by which it is organised and sustained are critical elements.
   b. Each computer-based service is provided through a set of structured computing resources and organised infrastructure. If this organisation of essential resources is large and complex, computer-based systems are a form of social organisation. Like any organisation or institution, it is not necessarily neutral.
   c. There is no "human factor" which is especially separable from the delivery of computer-based information services. Much of the development and many of the routine operations of computer-based technologies hinge on human judgements and actions carried out within complex, organised social settings.
3. Control over infrastructure:
   a. Organisations have limited resources to invest in any capital development such as computing. Not all necessary infrastructural resources are available (in adequate quality) as needed.
   b. Computer-using organisations rarely have complete administrative or political control over all their requisite infrastructure. Infrastructural resources may spread across several organisational units or nominally independent organisations.
4. The information processing leverage provided by a focal computing resource and its other costs and benefits, social and economic, are contingent upon:
   a. Its interactions with other computing resources;
   b. The social and organisational arrangements within which computer-based services are developed and provided (infrastructure and macrostructure)
5. Social action:
   a. Political interests, structural constraints, and participants' definition of their situations often influence organisational action. An organisational process model (Cyert & March, 1963) or a negotiated order model (Strauss, 1978) of social activities is used to analyse social relations.

Table 8: Main assumptions of web models. *Source Kling, 1987, p.312*

The first four assumptions have been also mentioned in the work of Kling and Scacchi (1982), whereas the fifth was added in Kling's (1987) later research. Based on these assumptions, web models treat computer-based systems, not only as information processing tools, but also as a form of social organisation with information processing, social and institutional properties. Kling (1987) argues that IT cannot be analysed solely according to

its discrete features and components. He states that viewing technology as "a particular piece of equipment, application or technique which provides specifiable information processing capabilities", conceives of technology independently of the social or organisational arrangements within which it is developed and used (Kling, 1987, p.309).

The second assumption emphasises the role of infrastructure on the impact and use of a focal technology. Infrastructure is seen as a set of organisational resources, arrangements, operations, commitment, policies and staff supporting the use of IT. However, as addressed in the third assumption, organisations do not always have the needed infrastructural resources to support a specific IT. Sometimes, they may also depend on third-party organisations for the maintenance and further development of this technology.

Kling (1987, p.313) argues that computer-based systems are developed, operated and used by independent networks of producers and consumers called 'production lattices'. The 'production lattice' of a particular system "is a social organisation, which is embedded in a larger matrix of social and economic relations" (Kling, 1987, p.313). These 'broader social relations' include:

1. The interdependencies between different groups who develop and use a computing resource and
2. Other social agents who depend upon the computing resource or upon whom the resource's users most depend.

As mentioned in the fourth assumption, these broader social relations and organisational arrangements further influence the information processing leverage and benefits provided by IT. Finally, the fifth assumption gives particular attention to the analysis of the social and organisational relations affecting and shaping the use of a focal technology. It states that political interests and structural constraints often influence organisational action and suggests two theoretical perspectives[19] for the analysis of social relations and action.

In general, web models provide a way to explain the impact of IT when it operates under different kinds of organisational arrangements or diverse situations of cooperation and conflict between key participants. The web models approach appears appropriate when the development or use of IT is socially complex, as well as when its "adoption or operation depends upon social relations that extend beyond the social setting in which the technology is developed and used" (Kling, 1987, p.307). In such situations, the way that technology is used, the leverage it provides and the interests it serves depend upon the interplay of stakeholders, work arrangements, resources and social 'games' within which technology is

[19] The organisational process model (Allison, 1971; Cyert & March, 1963) and the negotiated order perspective (Strauss, 1978) are briefly discussed in the following section. Their weaknesses are pinpointed and alternative approaches to analyse social action and relations proposed.

deployed. These may in turn be embedded in a larger web of social relations that also play a central role (Kling, 1987).

Therefore, to analyse the impact of technology, web models draw boundaries around the groups that influence its adoption or use. Boundaries can extend outside the immediate group of users to include broader workgroups and organisational units that also influence significantly the impact of IT (Kling, 1987). According to Kling and Scacchi (1982) the actions of staff in organisational units are also influenced and constrained by their parent organisations and 'organisational ecologies' in which they act. Furthermore, decisions regarding a specific technology can sometimes be made based on external influences, such as specific vendors or systems used by business partners or competitors. Therefore boundaries can spread beyond the organisation to include customers and competitors.

In summary, web models draw large boundaries around the focal IT by examining how its development and use shape, and are influenced by, the ***social context*** in which IT is embedded. 'Web models' define the social context of technology by taking into account:

- the previous history of commitments made in developing and operating related technologies,
- the infrastructure available for the support of the focal IT, and
- the social relations between the set of participants who influence the adoption, development and use of technology.

These three issues, influencing the implementation and use of technology, are further elaborated in the following paragraphs.

3.5.1.1 History of commitments made in the course of computing deployments

According to Kling (1987) the way that computing becomes integrated in organisational life depends upon many events and arrangements that take place before a system's implementation. To support his argument Kling (1987) uses an example from a case where the failure of a system was caused by the senior management's false assumptions. The managers thought that the company's technological infrastructure would be completed as soon as the hardware and software were acquired. But, they ignored their programmers' skillsets, the training of users, as well as the different type of support needed for these new computer-based systems.

Therefore, Kling (1987) argues that computing deployments are shaped by commitments to technologies and the social arrangements to support them. Web analysts view existing arrangements as embodying a complex set of previous commitments, such as contractual agreements with technology providers or trading partners, computer-based systems previously implemented and used in the organisation, and people already hired to support

specific operations. Some of these commitments may also be defined in larger settings within and outside the organisation (e.g. interactions with trading partners, procurement procedures).

Over time, organisations develop an array of infrastructural resources to support their computer applications. Key infrastructural resources are identified by following the chain of resources, equipment, consumers and providers that support a given computer-based system. As mentioned above, this network is called a 'production lattice' for the focal computing resource (Kling & Scacchi, 1982). According to Kling (1987) tracing the chain of social and technical interactions from the focal IT outward to various suppliers of basic resources and skills is imperative to identify the commitments to third party organisations, trading partners, related technologies and people made in the course of computing deployments. Identifying such broad boundaries is crucial since it may enable the identification of technological, social, spatial and temporal elements of context that may affect the actions of actors in the focal situation (Kling, 1987). Conversely, drawing narrow boundaries may miss critical relations with equipment vendors or outside consultants.

The history of commitments to technologies and people to support them leads to the formation of the infrastructure influencing the use and impact of the focal IT.

3.5.1.2 The role of infrastructure

Kling (1987) argues that computing arrangements depend upon the infrastructure, which comprises not only procedures and equipment, but also people. He emphasizes that the human factor is not separable from the delivery of computer-based information services and that many of a system's routine capabilities hinge on human judgements and actions carried out within complex social settings.

The array of infrastructural resources is developed incrementally, influencing and shaping the implementation and use of IT. The infrastructural resources for a given activity refer to resources, such as people, equipment, operations and contracts that help the activity to run smoothly (Kling, 1987). For example:

> Infrastructural resources for using reports from a computer-based information system include skilled staff, accurate and complete documents, sharp operations procedures, and enforceable equipment contracts. For software developers, infrastructure includes programming skills, information about systems, working hardware etc. (Kling, 1987, p.338)

The study and analysis of information infrastructures has become increasingly popular in IS research with numerous studies (Ciborra, 2000; Hanseth & Monteiro, 1998; Monteiro & Hanseth, 1996) providing definitions and extensive analyses. Even though different approaches have been used, a lot of similarities in definitions can be found. Hanseth and

Monteiro (1998, p.1126) describe an infrastructure as "a layered patchwork of components and associated routines which emerge historically" and argue that it does not have a clear-cut boundary with the "outside". Ciborra (2000) analyse infrastructure as comprising computer-based systems, applications and services, as well as people involved in their use, their interests and relations. Infrastructure is also seen as influenced by a history of events that disrupted or contributed to its development and "have an irreversible influence on its configuration at any given moment" (Ciborra, 2000, p.32).

Influenced by these approaches, infrastructure is analysed in this study as an ensemble of human and non-human resources. It is seen as consisting of elements, such as hardware, operating systems, software applications, standards, physical resources (e.g. space in the warehouse), organisational arrangements and human resources. However, based on the assumptions of web models, the interactions between people, influencing the development and use of a focal IT, are analysed independently.

According to Kling (1987), infrastructural resources are layered. He argues that a focal computer resource for one participant might be infrastructure for another. For instance, a retailer's warehouse management system, which provides data to purchase managers, is infrastructure for the analysts using the CRP system. He also argues that a focal computer-based system (e.g. a CRP system) is often tightly coupled with the various elements of infrastructure, both horizontally (through a particular production lattice incorporating VAN providers, software providers as well as trading partners using the CRP system) and vertically (e.g. a VAN and an EDI translator at a lower level and an ERP system, in the central offices, at a higher level). He finally states that infrastructural resources are not only tangible and physical, such as a VAN, specific software, contract or skilled employees, but also capabilities for producing these tangible elements (e.g. the ability to hire or train CRP analysts, the ability to purchase new software).

Finally, Kling (1987) raises the issue of control over infrastructure arguing that organisations do not always have all the infrastructural resources required for the deployment of a specific information system. He also argues that organisations may not have full administrative or political control over the requisite infrastructure, since it may be spread across several organisational units. Furthermore, control over IT may be limited when it is shared with trading partners or when its support and maintenance is conducted by third-party organisations.

As will be further discussed in the following section, this type of control is also influenced by the interactions between people or organisations sharing the technology under

examination. After all, it is through the negotiations of participants that computing developments are initiated, designed, altered, revised, expanded and used (Kling, 1987).

3.5.1.3 Social processes

Kling (1987) argues that web models enable the examination of dynamic social processes that influence patterns of computing development, adoption and use under changing organisational conditions. Social practices also mediate between computer-based information processing capabilities and some valued outcome, such as more accurate orders. In order to explain social processes, web models take into account "the lines of action in which people come to engage with computing, the going concerns of the organisations they inhabit and the patterns of incentives and constraints which influence them" (Kling, 1987, p.321). To explain social processes Kling (1987) proposes the use of the organisational process perspective.

This theoretical perspective (Cyert & March, 1963) views organisations "as noisy production systems composed of a network of work groups", which produce and exchange goods and services based on relatively standardised, formal or informal procedures (Kling, 1987, p.321). Information, services, material or products flow imperfectly along standard channels (from node to node). Transportation and communication through these channels is based on temporal regulation, since materials may be transported on fixed schedules and information exchanged at regular intervals (Kling, 1987). However, as these channels are imperfect, delays and losses are common. Finally, both the channels and nodes change over time (e.g. through staff changes) and their characteristics and structure form temporal patterns.

According to Kling (1992), this perspective sees organisations as open systems with activities and outcomes influenced by environmental factors. Organisational processes are seen as responses to inputs and the production of outputs. Organisations and their sub-units are characterised by their outputs and their average behaviour in providing goods and services to clients (Kling, 1987). Clients make demands and organisational participants develop formal or informal routines to deal with them.

This systemic perspective emphasizes the purposive side of organisations, without suggesting that organisational participants face clear problems and have specific goals that they pursue through explicit practices (Kling, 1992). It suggests that:

> Organisational goals are redefined by subunits that enact them... Organisational participants have limited capacities to process information; behaviour is characterised by many common routines and procedures... Organisations adapt slowly as a by-product of solving particular problems. Groups neither share common values nor do

they agree on common goals, but jointly cooperative outcomes are common (Kling, 1987, p.322).

However, this perspective has limitations since "larger organisational arrangements, the values of participants, the distribution of constraints, and the set of procedures and norms, which describe ongoing behaviour, are largely taken for granted" (Kling, 1987, p.322; 1992, p.392). This perspective focuses on the description of organisational activities without thoroughly explaining the social processes and interactions. Although it argues that organisations adapt slowly as by-products of problem solving, it does not analyse the process through which people evaluate a situation and engage in discourse to decide upon an action to take. Furthermore, it neither examines how social relations may affect organisational discourse and actions, nor explains how previous patterns of behaviour may influence future actions. Therefore, it fails to analyse thoroughly how organisations change and evolve over time.

In this research we circumvent the limitations of this perspective by using Vickers's appreciative systems approach. This approach provides a more thorough explanation of the social process as an iterative process of appreciation, judgment and action. It also explains social action by taking into account the influence of standards generated over time through subsequent processes of appreciation. Although it argues that people's decisions or actions may involve the management of relationships, it does not analyse thoroughly how personal interests or social relationships may influence both the process of appreciation and the decision upon an action.

3.5.1.4 Social relations

Kling (1987; 1992) suggests the adoption of a negotiated perspective to analyse the social relations of people influencing organisational outcomes. This perspective views the actions of organisations as by-products of ongoing negotiations (Strauss, 1978). It does not take the influence of a dominant coalition for granted and assumes that the coordination of complex organisations is problematic for participants (Kling, 1987). It thus focuses on the way that organisational practices or investments/changes of IT are decided or conducted by groups with differing interests (Kling, 1992). "Participants' strategies, the stakes they contend for, their options, relative power, and the bargains they strike in a negotiating context" are all central to this perspective (Kling, 1987, p.322). Organisational participants are also viewed as engaging in multiple and overlapping negotiating contexts in which their stakes and options may be reinforced or constrained. Their perception of situations is influenced by their interests, training, socialisation and the negotiating contexts in which they participate (Kling, 1987).

Rather than taking the influence of a dominant coalition for granted, analysts who adopt this perspective pay special attention to who is bargaining over what, and with what options in the different negotiating contexts (Kling, 1992). They accept conflict as an ordinary element of the ongoing interplay of groups and organisations and focus "on the creation of procedures and on how variations are negotiated" (Kling, 1987, p.322).

Although this approach puts emphasis on the bargaining capabilities of organisational participants, it does not thoroughly explain how the relations of participants may influence the outcome of the negotiation. Furthermore, although issues of conflict and power imbalance between negotiating parties are central to this perspective, the meaning of power is not elaborated by Kling.

However, the concept of power is examined in resource dependence theory (Pfeffer & Salansik, 1978; Pfeffer, 1982), which formed the basis for the development of web models. Besides explaining the distribution of power in organisations and its impact on the processes of decision making, this theory also focuses on the relationships of organisations with their environment and trading partners (Pfeffer, 1982). Based on Pfeffer's work, Lacity and Hirscheim (1993) argue that power is derived from *authority* (related to the position that a person has in the company), *resource acquisition*[20] (the one who controls the resources makes the rules), *dependency and low substitutability* (power comes from offering something of value that few other sources can provide, create dependencies and become irreplaceable) and *ability to absorb uncertainty*. Uncertainty may derive from competition (Pfeffer, 1982) lack of resources (Pfeffer & Salansik, 1978) or lack of information[21] (Lacity & Hirschheim, 1993). All these also apply to the interorganisational level. Organisations are seen as not internally self sufficient but requiring resources from the environment (Pfeffer, 1982). Therefore, an organisation needs to interact with others that control the resources and as a consequence have a measure of power over the organisation (Pfeffer & Salansik, 1978). In the case of the grocery retail supply chain, the power of an organisation over its partners may derive from its market share, range of products and market influence.

According to Starkey *et al.* (1991), power relations are likely to influence the level of strategic flexibility achieved in an organisation. Further elaborating this argument, Volberda (1996) argues that organisations can increase their strategic flexibility, through using their market power to deter entry and control competitors. The imbalance of power between

[20] Resources may involve money, budget allocations, availability of staff, products, market share etc.

[21] The one that has access to information absorbs uncertainty (Lacity & Hirsheim, 1993)

trading partners not only influences their interactions, but also the implementation and use of technology at the interorganisational level (Webster, 1995; Barry & Doyle, 2006).

At the organisational level, the analysis of power requires careful attention in contexts where individual interests diverge (Walsham, 1993), conflict is common and negotiations are imperative. It also needs an in-depth examination since "people often attempt to conceal their motives for political action in order to protect what they perceive as their self-interest" (Walsham, 1993, p.41). In such cases, researchers need to spend much time in organisations in order to gather and interpret field data, which might represent differing opinions or conflicting interests.

Although this study takes into consideration the potential impact of power imbalances on the interactions between people or organisations, both its focus and scope prevented such an in-depth analysis of power, especially at the organisational level. Even though this research recognises that power issues may affect both the process of appreciation and the conduct of action, it does not see conflict as fundamental and assumes that common interests are also shared between stakeholders. Therefore, it analyses social relations not only as involving politics and conflict, but also as characterised by issues of trust and close cooperation.

Kumar *et al.* (1998) developed an approach that focuses on interaction processes, based on collaboration and cooperation. They argue that like Kling's (1980) socio-political perspective, their perspective is also an interactionist[22] one. But, instead of focusing on politics and conflict, it introduces a rationality in which trust and collaborative relationships become the key concepts of analysis.

According to Kumar *et al.* (1998, pp.214-215), relationships "form the context in which the interactions take place". They are cumulative and may be long term in nature. They not only involve investments (made in the relationship), but also mutual orientation ("the inclination and expectation to interact with each other") and bonds. Kumar *et al.* (1998) put particular attention on the bonds developed between firms and see them as having various economic, social, technical, informational, logistical, administrative and legal dimensions. As they argue, these bonds may also have a social aspect, which may transcend economic bonds and significantly influence interorganisational relationships.

Further analysing the nature of social and organisational relationships, Kumar *et al.* (1998, p.215) argue that they evolve over time through "processes of adaptation". Through such

[22] Interactionist perspectives focus on interactions between organisational participants. Interactions comprise exchange and adaptation processes. They represent the "here and now of interfirm behaviour and constitute the dynamic nature of relationships" (Kumar *et al.*, 1998, p.215).

processes, involving adjustments or improvements in operations, services, products or mutual expectations, the bonds between firms or people may be strengthened and the resolution of conflict facilitated. As they state, adaptation presents "an ongoing process of investment in relationships" (Kumar *et al.*, 1998, p.215).

Even more important than improved relationships and close cooperation is the development of mutual trust between the interacting parties. According to Young-Ybarra and Wiersema (1999, p.443) the notion of trust is based on three main components: dependability ("expectations that the partner will act in the alliance's best interest"), predictability ("consistency of actions by the partner") and faith ("belief that the partner will not act opportunistically, even in novel situations"). As Kumar *et al.* (1998, p.215) argue:

> The trusting party develops mostly implicit assumptions regarding the trusted party's behaviour. Aware of the anticipation held by others, regarding its general conduct, the trusted party becomes "trust-worthy" if it fills the obligation to fulfil this anticipation. This bidirectional combination of mutual anticipation and obligation yields an effective mode of coordination.

As they further argue, trust is particularly important at an interorganisational level when higher levels of trust not only reduce the cost of monitoring performance but also facilitate interaction and reduce the need for detailed contracts.

The role of relationships in the flexibility achieved both at an organisational and interorganisational levels, is of focal interest to this research. Guided by the above discussion, social and organisational relationships are seen not only as based on power and politics, but also as characterised by collaboration, cooperation and trust.

3.5.2 Summary and discussion

Web models (Kling & Scacchi, 1982; Kling, 1987) provide a valuable approach to the study of organisational context by putting emphasis on a focal technology and analysing its impact by drawing boundaries around groups, which influence its adoption or use. Web models examine the development and use of IT within complex social settings by highlighting the technological infrastructure, human resources and previous investments or commitments to people and to related technologies. Therefore, the context of technology in web models is identified as a combination of the social relations of people involved with the implementation and use of this technology, the infrastructure available for its support and the history of commitments made before or during its deployment and use.

It can be argued that these elements constituting the context of technology are interrelated. Social relations can be considered as being part of the infrastructure, since the latter also

comprises people participating in the implementation and use of IT. Moreover, the history of commitments can also be considered as part of the infrastructure, since it is this history that specifies the current state of the infrastructure. These ideas are also elaborated in more recent studies (Ciborra, 2000) that analyse infrastructure as comprising computer-based systems, applications, services, people involved in their use, their interests and relations. In these studies infrastructure is also seen as being influenced by a history of unique events that contributed to its development.

Following web models' conceptions, this study views infrastructure as an ensemble of human and non-human resources. However, for analytical purposes it examines social relations and the history of events leading to the formation of infrastructure, independently. Examining issues of human communication and relations separately, facilitates the analysis and contributes to a better understanding of the political context that influences decisions and actions leading to changes of infrastructure. Moreover, taking into account the history of commitments to technologies and people enables a more thorough examination of the unique events contributing to the development of infrastructure. It also provides a deeper understanding of the way that previous decisions regarding human resources or implementations of computer-based systems can facilitate or constrain actions (or responses to environmental disturbances). Therefore, it can be argued that web models provide a solid theoretical basis to understand the context influencing the impact of technology on organisational flexibility.

Nevertheless, the use of web models is also associated with certain limitations. Kling (1987) argues that the context of technology is not static, since its constituting characteristics evolve over time. However, web models do not explain in detail the process under which changes occur in the organisational context and fail to present the dynamic interaction between the organisation and its environment. They also do not emphasize the process of creation and recreation occurring in the organisational context; nor do they explain how social interactions can influence relationships between social groups (Walsham, 1993). Therefore, they do not provide any model of the organisation (Checkland & Holwell, 1998) and fail to thoroughly analyse the social processes that take place over time. Acknowledging this limitation, Kling (1987; 1992, p.368) suggests the use of an "open-systems organisational model", involving an organisational order perspective and a negotiated order perspective, to better "describe the social relations among key participants".

In this thesis, Vickers's work on appreciative systems, which is also an open-systems perspective, and more specifically Checkland's model of organisational discourse, are used for the examination of social processes influencing change in an organisation. Vickers's approach provides a richer way to analyse the process of decision making and problem

solving in organisations, than the organisational process perspective suggested by Kling. This approach enables an analysis of the process of creation and re-creation occurring in an organisation, as well as of the interaction between the organisation and its environment. However, it does not thoroughly examine the social relations that may influence both the process of appreciation and the decision upon an action.

The negotiated order perspective suggested by Kling (1987) puts emphasis on issues of conflict, power imbalances and bargaining capabilities of organisational participants. However, it does not elaborate on the meaning of power and does not thoroughly explain how the relations of participants may influence the outcome of the negotiation. In this research, resource dependence conceptions are incorporated to provide a better understanding of power imbalances between organisational participants or different organisations. However, social relations are not only seen as involving conflict or power dependencies, but they are also examined as being based on trust, collaboration and cooperation. Taking into account the strengths and limitations of these perspectives, this thesis proposes a synthesised theoretical framework, combining web models and appreciative systems thinking ideas.

3.6 A framework for the analysis of flexibility

Influenced by Pettigrew's contextualist approach, the analysis of flexibility is based on a description of the *process* through which organisations respond to environmental changes as well as an examination of the organisational/interorganisational *context* that influences the process of response. As specified by Pettigrew (1985), the linkage between process and context is of key importance for understanding the impact of IT in organisations. Walsham (1993, p.5) demonstrates this linkage by arguing that "human actors draw upon elements of context, such as resources or perceived authority, to carry out actions and through this activity can reinforce or alter existing structures and contexts". Similarly, in this study the *linkage between the process and the context* is explored by examining how the process of response to environmental threats or opportunities can lead to changes of the context as well as how contextual elements influence or shape this process of response.

The process of response is analysed through the appreciative systems model (Checkland & Casar, 1986), which is based on Vickers's work on appreciative systems. This model provides a theoretical schema to understand how people in organisations evaluate and respond to environmental disturbances. The main elements of this model are the flux of events or ideas unfolding through time, the process of appreciation generated by these events/ideas and the action taken to respond to them. The model proposes that the process of appreciation is based on judgements of facts regarding a specific situation (event or idea).

Participants perceive and select facts influenced by their interests and concerns. They then decide upon an action to take, based on standards generated by previous history. According to Checkland and Holwell (1998) there is an iterative cycle in which appreciation is generated by the flux of events and ideas, appreciation itself contributes to the flux and through its action(s) reproduces a continually changed self.

Acknowledging the limitations of this approach to analyse the contextual issues that influence the process of appreciation and the decision upon an action to take, an additional theoretical approach is suggested in this study. Since one of the study's objectives is to examine the impact of technology on organisational flexibility, the approach selected is one that also gives emphasis to the role of technology. The analysis of the context is thus based on web models that define the social context of technology by taking into account the social relations between the set of participants responsible for its usage, the infrastructure available for its support and the history of commitments made in the course of computing deployments. Although web models provide a solid theoretical base to examine the context, they have certain limitations, since they do not explain how social interactions can lead to changes in the organisational context. Consequently, they are inadequate to analyse the process through which organisations change (temporarily or permanently) in response to environmental threats or opportunities.

Vickers's appreciative systems perspective complements web models, by explaining the process through which organisations, groups of people or individuals respond to events (or ideas) and through their actions lead to a continually changed organisational/interorganisational context. In turn, web models add to the appreciative systems approach by providing a thorough analysis of the organisational context influencing both the process of appreciation as well as the conduct of action. It also addresses the role of negotiations and social relations in the process of organisational discourse and decision making. Therefore, it can be argued that the combination of appreciative systems and web models, presented in **Figure 9**, provides a solid theoretical basis for the analysis of the context and process of change as well as for their linkage.

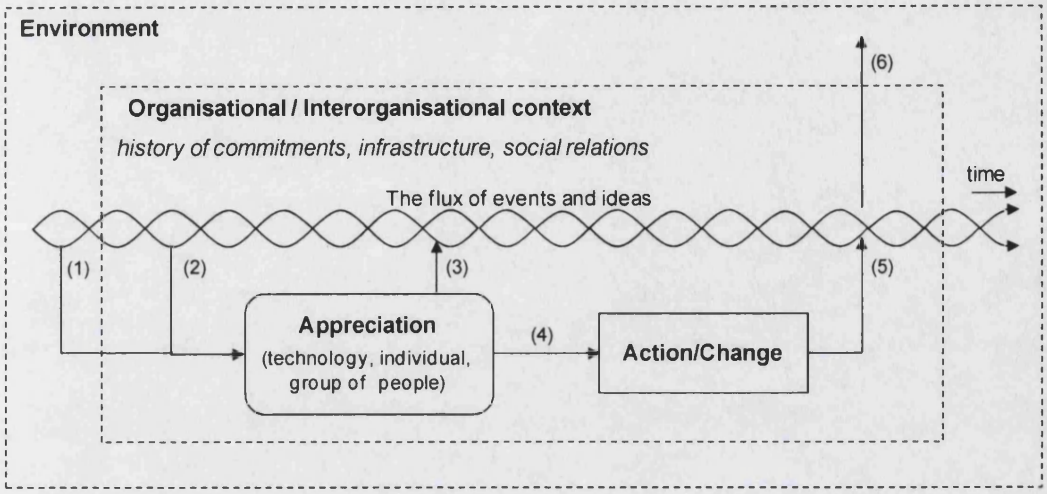

Figure 9: Linkage of the context and process of response

Based on this framework, the organisation/business network responds to events or ideas arising either from the environment (1) or from the organisation/business network itself (2). It reacts to the incoming events through the process of appreciation. Appreciation can be conducted by individuals or groups, belonging to the same or different organisations. It can also be conducted by software that has embedded business logic. For example, changes in demand can be handled by an intelligent computer-based system, which automatically adjusts the safety stock levels.

When an event occurs, through appreciation the participants make judgements, identify the possible options to respond and decide upon an action to take. This process is based on standards generated by previous history and is influenced by the interactions and relations of participants. Both the process of appreciation and the choice of action are enabled or constrained by the available infrastructure and the history of commitments to technologies and people. The outcome of the appreciation can be another idea (3) or an action/change (4) that may affect the organisational/interorganisational context.

There is a recursive loop in which the flux of events and ideas generates appreciation, while appreciation itself leads to action/change. This change can have an impact on the environment (6) or can affect the organisation/business network itself, by leading to changes in the context or by provoking another event or idea (5). Flexibility is thus seen not only as the ability to respond to environmental disturbances, but also as the capability to produce a continually changed self.

By combining these two theoretical perspectives I managed to acquire an understanding of the way that changes occur in an organisation as well as how these changes influence and are affected by the organisational context. However, understanding and explaining the process of

change is different to analysing the ability of an organisation to change. Therefore, the study's approach needs also to include an analysis of the concept of flexibility.

In an analysis of organisational flexibility, the temporal (efficiency, responsiveness), range (variety of options) and scope (operational, structural and strategic) dimensions of flexibility also need to be incorporated. Flexibility as a multidimensional concept has been described in the framework derived from the literature review. The combination of that framework (**Figure 4**) with the one presented above (**Figure 9**) leads to a synthesized framework of flexibility, presented in **Figure 10**.

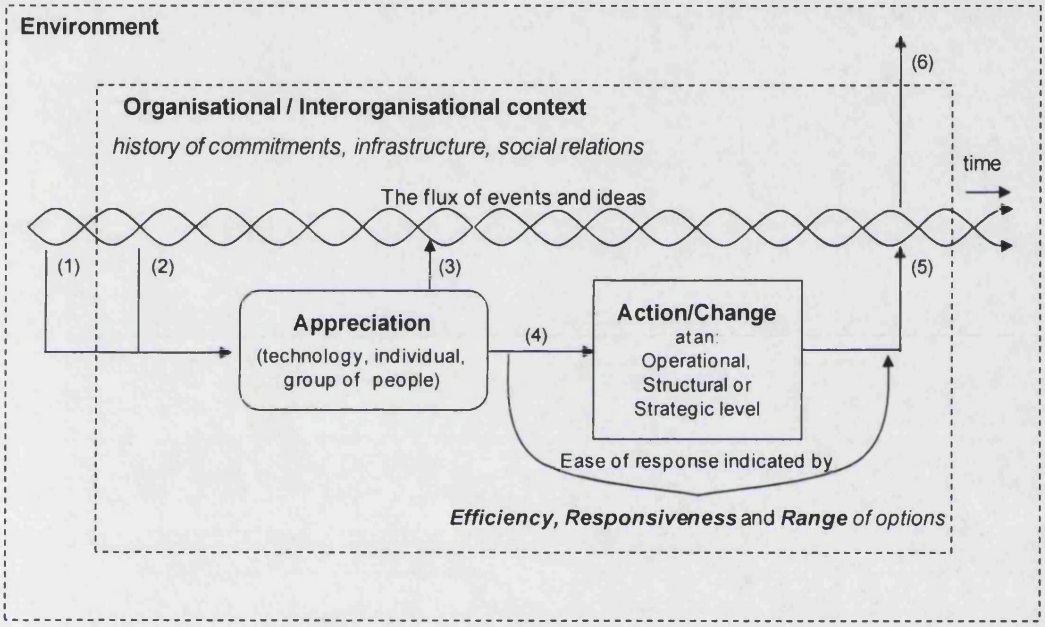

Figure 10: A synthesized framework of flexibility

Based on this framework, the temporal, range and scope dimensions demonstrate the ability of the organisation/business network to respond to an incoming event or idea. The action to respond is decided through the process of appreciation, whereas the ease of response is indicated by the efficiency and responsiveness in the conduct of action. The action can be conducted at operational, structural or strategic levels, revealing the scope of flexibility. The ability to change at each one of these levels is further indicated by the availability of options to respond at a specific level.

The set of themes incorporated in this theoretical framework are used as a basis for the analysis of the empirical data, leading to an improved understanding of the notion of flexibility as well as to further refinements of the framework.

3.7 Concluding remarks

Driven by the insight gained during the first stages of our empirical work, it was realised that the framework presented in the literature review could contribute to the explanation of flexibility as a multidimensional, but context-free, concept. Identifying the limitations of this approach, this study argues that flexibility needs to be perceived as a dynamic concept embedded in the organisational context. It further demonstrates that a better understanding of flexibility can be attained through the examination of the process through which organisations respond to environmental disturbances as well as the analysis of the context affected by and shaping the process of response.

The embedded meaning of flexibility in open systems thinking approaches, which view organisations as changing and evolving through interactions with their environment, contributed to the adoption of Vickers's appreciative systems for the analysis of the process of change. The appreciative systems approach enables the analysis of the process through which individuals or groups of people evaluate an environmental disturbance (threat or opportunity), make judgements about it, identify choices of response and select an action through which to respond.

Recognizing the limitations of this approach to analysing the context that shapes and is affected by the process of response, the web models perspective is incorporated in this study. The web models approach enables the examination of both the organisational and interorganisational contexts by considering a focal information technology and by explaining the social and organisational characteristics that surround it.

The limitations and strengths of these theoretical approaches have been discussed and their combination into a synthesized theoretical framework has been argued. The way in which the theories used have influenced the research methodology is discussed in the following chapter (Chapter 4). Chapter 4 also specifies the stages of the study that influenced the development, alteration and finalisation of the theoretical framework. It then describes how the theoretical ideas specified in the research framework shaped or affected the empirical work as well as how they were further developed through the analysis of the collected data.

CHAPTER 4 - RESEARCH APPROACH

4.1 Introduction

This chapter presents the research approach followed in the study. It discusses the research paradigm underlying the thesis and describes the research design: the case study strategy, the selection of organisations and the methods of data collection and analysis.

The choice of a research methodology involves making a number of implicit and explicit assumptions, which not only determine and guide the process of research, but also affect the subsequent presentation and interpretation of results. Different research paradigms may entail different ontological and epistemological assumptions and may be associated with diverse research techniques. Therefore, in order to justify the selection of a research approach, researchers need primarily to be explicit about the philosophical assumptions underlying their study (Orlikowski & Baroudi, 1991).

This chapter briefly presents the predominant research paradigms in the IS field and discusses their ontological assumptions and epistemological positions. It justifies the selection of an interpretive paradigm for the analysis of flexibility and presents the paradigm's linkage to appreciative systems thinking and web models theory. It further examines the role of the theory in an interpretive study and demonstrates how the theoretical framework of flexibility was designed, developed and further refined through the empirical work. It discusses the assumptions and characteristics of case studies, distinguishing between single and multiple case study approaches, and describes the multiple case design followed in this research. Further justifying the use of an interpretive case study approach, the chapter presents the seven principles of interpretive field research developed by Klein and Myers (1999). After discussing the application of these principles, the chapter describes the research design and the case study strategy. It presents the methods of inquiry and data collection as well as the design and conduct of the interviews. It also describes the steps followed in the analysis of the qualitative data, involving data preparation, coding and interpretation. It finally presents an overview of the research approach, demonstrates the interdependence between various stages of the research (literature review, theoretical development, empirical work, analysis and discussion) and concludes with a summary of the research methodology.

4.2 Research paradigms in information systems

Research paradigms entail assumptions about the social world and about the way that research should be conducted, as well as about what constitute legitimate problems, solutions and criteria of proof (Creswell, 1994). 'A paradigm is thus a construct that specifies a

general set of philosophical assumptions covering, ontology (what is assumed to exist), epistemology (the nature of valid knowledge) and methodology' (Mingers, 2001, p.242).

Ontology refers to the underlying assumptions made about the essence of phenomena under investigation –'theories of reality' (Cornford & Smithson, 2006, p.61). It is concerned with beliefs about *physical and social reality,* about *human rationality* and *social relations* (Orlikowski & Baroudi, 1991). Epistemology is concerned with the nature of knowledge claims. It 'refers to the type of knowledge that can be obtained about a phenomenon under study' (Cornford & Smithson, 2006, p.61) and is associated with beliefs about the origin and limits of human knowledge. It also refers to 'a set of assumptions about the mode of inquiry; that is how to obtain this knowledge and demonstrate that it is valid' (Klein & Hirschheim, 1987, p.285). Finally, methodology refers to the application of specific approaches enabling the acquisition of this knowledge. It is concerned with the research methods and techniques appropriate for gathering valid empirical evidence.

The term methodology is often confused with 'method'[23]. "A 'methodology' is more general and less prescriptive than a method. It is a structured set of guidelines or activities to assist in generating valid and reliable research results. It often consists of various methods or techniques, not all of which need be used every time." (Mingers, 2001, p.242).

This section discusses the methodological assumptions of different paradigms without specifying the research methods that they may entail. The research methods most commonly used in the information systems field and their classification as quantitative and qualitative methods are discussed later in this chapter.

The IS field incorporates a diversity of research paradigms[24], such as positivist, interpretivist and critical, which entail different philosophical positions and influence different streams of research in IS. Their ontological, epistemological and methodological assumptions are analysed only to the extent that allows us to justify the underpinning paradigm in this research.

The positivist paradigm entails the belief that reality is objective and independent of human experience (Chen & Hirschheim, 2004). It sees human action as being intentional and

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[23] 'It can be difficult to precisely delineate the boundaries between method and methodology at one end (e.g., which is administering and analyzing a survey?), or between methodology and a general research approach (e.g., "qualitative research methodology") at the other' (Mingers, 2001, p.242). Methodology is often used in a broad sense, to refer to any kind of advice given to analysts about how to analyze or intervene in the real world (Jackson & Keys, 1991).

[24] Most researchers distinguish between the positivist (empirical-analytic, objectivist, functionalist) and interpretive (subjectivist, constructivist) paradigms (Lee, 1991), while others add also the critical paradigm (Orlikowski & Baroudi, 1991). However, there are also researchers that refer to the following four paradigms: functionalism, social relativism, radical structuralism and neohumanism (Burrell & Morgan, 1979; Hirschheim & Klein, 1989).

rational (Orlikowski & Baroudi, 1991) and supports the view that there is 'one best way' to solve most problems, which in all like circumstances is the same (Mitev, 2001). In this paradigm, organisations are seen as structures of rational-economic activity, with their prime function being decision making in pursuit of goals and objectives (Checkland & Holwell, 1998).

Positivist researchers regard scientific knowledge as consisting of regularities and causal laws, as providing explanations of an objective world (Iivari, 1991) and as allowing for verification or falsification of predetermined hypotheses. Therefore, epistemologically, positivist researchers are concerned with the 'hypothetic-deductive testability of theories' (Chen & Hirschheim, 2004, p.201) and seek generalisability of their results (Lee & Baskerville, 2003).

Positivist methodologies are based on the view that 'the objective cause-effect relationships' existing in the world can be discovered by 'structured observation' (Walsham, 1993, p.4). They are thus associated 'with would-be scientific methods of investigation based on systematic collection' of data (Checkland & Holwell, 1998, p.40) and aimed at objective measurements (Chen & Hirschheim, 2004) and hypothesis testing. Typical positivist methods include simulation, laboratory experiments, field experiments and quantitative surveys (Galliers, 1991), enabling the drawing of inferences about a phenomenon from a representative sample to a stated population (Orlikowski & Baroudi, 1991).

However, due to the quest for universal laws, the positivist tradition disregards historical and contextual conditions as possible triggers of events or influences on human action. It also disregards conflict, which is seen as "dysfunctional to the social system and as something to be suppressed or overcome" (Orlikowski & Baroudi, 1991, p.10). Therefore, positivistic research is criticized as inadequate in explaining human, organisational, societal (Lee *et al.*, 1997) and political issues implicated in the implementation and use of information systems.

In contrast, interpretive research aims to understand social phenomena in their own social context, constructed and reproduced through social action. It also aims to understand human action through making sense of the meanings that social agents assign to it (Walsham, 1995a). Therefore, the interpretive paradigm enables the capture of complex and dynamic social phenomena that are both context and time dependent. It entails the ontological position that reality is subjective and that the social world is produced and reinforced by humans' thoughts, their actions and interaction (Mitev, 2001; Checkland & Holwell, 1998).

Interpretive research is based on the epistemological position that 'our knowledge of reality, including the domain of human action, is a social construction of human actors' (Walsham, 1993, p.4). It holds that knowledge is the result of everyday concepts and meanings and

emphasises human interpretation and understanding as constituents of scientific knowledge (Iivari, 1991). Therefore, in contrast to the assumptions of positivist science, in interpretive research, "there is no objective reality that can be discovered by researchers and replicated by others" (Checkland & Holwell, 1998, p.22; Walsham, 1993).

In an interpretive approach, knowledge is neither obtained by the employment of natural and causal laws, nor does it involve 'would-be-scientific' hypothesis testing (Checkland & Holwell, 1998). In order to understand the meaning embedded in human action and social interaction interpretive researchers believe that they need to closely investigate the social setting and learn from the participants' perspectives (Chen & Hirschheim, 2004). Knowledge is thus obtained through social discourse and seeks for a qualitative confirmation. An interpretive approach may embrace a hermeneutic methodology, which involves a continuing iteration, analysis and reiteration, leading to the gradual development of an understanding of the phenomenon under study.

The interpretive approach is weak in addressing structural conflicts and political disagreements within society and organisations, and might ignore contradictions that may be endemic to social systems (Orlikowski & Baroudi, 1991). In contrast, the critical research perspective is primarily concerned with critiquing existing social systems and revealing their inherent conflicts and contradictions (Mitev, 2001). It offers a different view not only from the positivist perspective, but also from the interpretive. Rather than focusing on descriptions, interpretation and understanding, it places strong emphasis on issues of power, conflict and the emancipation of the individual (Walsham, 1993).

The critical paradigm entails the ontological position that society is founded 'on certain deep-seated structural faults that need to be exposed' (Cornford & Smithson, 2006, p.60). Critical researchers see organisations as a locus of conflict (Knights & Murray, 1994) and argue that disagreements over technical changes are inevitable, as new technologies are designed and used to serve particular interests. They also argue that organisational change is a political process requiring the capacity to mobilise power resources (Mitev, 2001). The emphasis on the issue of power and on the analysis of coercive contexts, led critical researchers to embrace the philosophical positions of social theorists, such as Habermas (1987) and Foucault (1980).

The epistemology of critical theory requires approaches that 'question the ends that IS innovation serves, sense objectors' concerns, juxtapose the interests of different social groups and seek to foresee long-term consequences on the social fabric' (Avgerou, 2005, p.108). Therefore, critical researchers aim to critically evaluate the social reality under investigation (Orlikowski & Baroudi, 1991) and engage with questions of an overtly political

or moral nature (Avgerou, 2005). Their ultimate goal can also be an emancipatory one, intending to release people from intellectual and social domination (Lyytinen & Klein, 1985) by eliminating the causes of unjustifiable alienation and by enhancing the opportunities for realizing human potential (Hirschheim & Klein, 1994). This primarily involves understanding the 'oppressive regimes within societies and within the institutions that constitutes them' (McGrath, 2005, p.88). It also entails the critical testing of the validity and soundness of arguments in the creation of knowledge (Lyytinen & Klein, 1985).

This leads methodologically to interpretive research methods that go beyond the self-understanding of participants and include critical analyses by means of particular theoretical frameworks (Orlikowski & Baroudi, 1991). What distinguishes critical from interpretive research are: 'researcher motivation, choice of research focus, theory selection and active engagement with others to influence them, and ourselves of the value of results from critical IS research' (Walsham, 2005, p.116). However, work is still being conducted in order to clarify what researchers mean by 'being critical' as well as what research methods they use (McGrath, 2005). While interpretive methods would look for multiple interpretations and deep understanding of the often conflicting rationalities of the people involved in the study, critical researchers may see a particular conflict and focus on that, downplaying other interpretations (McGrath, 2005). Therefore, critical research has also been challenged in that it may tend to be totalising or deterministic (Mitev, 2001).

Each paradigm has its own strengths and weaknesses in explaining and generating an understanding of a phenomenon under investigation. Therefore, applying different paradigms can bring new and creative solutions and insights (Hirschheim & Klein, 1989; Benbasat & Weber, 1996). For instance, the positivist and interpretive approaches are not always irreconcilable but in some cases can prove to be mutually supportive rather than mutually exclusive (Lee, 1991). Further developing the argument for methodological pluralism, Mingers (2001, p.240) suggests that 'research results will be richer and more reliable if different research methods, preferably from different (existing) paradigms, are routinely combined together'. However, the mixture of different approaches may also entail risks, especially concerning the combination of fundamentally opposing philosophical assumptions.

The following section discusses the implications of these paradigms in this study of organisational flexibility and justifies the selection of an interpretive research approach. It examines the role of theory in an interpretive study and presents the linkage of appreciative systems thinking and web models theory to the interpretive paradigm.

4.3 The research paradigm underpinning this thesis

As noted in the literature review, most studies of flexibility have employed a positivist perspective aiming to 'measure' flexibility through the identification of various 'metrics'. Although some of these studies (De Leeuw & Volberda, 1996; Golden & Powell, 1997; Kumar, 1999) argue for the impact of organisational context on the level of organisational flexibility, they do not provide a thorough analysis of the context. Instead, they identify several contextual factors, such as an organisation's size, technology, technological awareness and structure, and discuss their positive or negative influence on flexibility.

In general, the positivist tradition believes that human action is intentional and rational and usually disregards historical and contextual conditions as possible triggers of events (Orlikowski & Baroudi, 1991). When contextual factors are identified they are seen as static characteristics, rather than as dynamic concepts changing over time, influencing and affected by human action. Therefore, it can be argued that a positivist approach is inadequate to thoroughly analyse flexibility as a dynamic and context embedded notion.

A more thorough examination of the context that shapes and is influenced by the process of organisational change can be provided by an interpretive or critical research approach (Mitev, 2001). However, the critical approach is equally inappropriate for this thesis, which does not emphasize political or moral issues. This study does not focus on coercive contexts and does not have an emancipatory objective. Although it examines issues of social relations and imbalance of power, it does not see conflict as fundamental and recognizes that common interest might also be shared between stakeholders.

Therefore, an interpretive approach is adopted in this thesis, aiming to analyse the process through which an organisation responds to environmental disturbances as well as the context that influences the process of response (Kopanaki & Smithson, 2003). This context/process type of analysis is well known in the information systems field through Pettigrew's contextualist approach. Contextualism 'is concerned with the event in its setting' (Pettigrew, 1985, p.53) and is traditionally associated with the interpretive paradigm. As noted in the previous chapter (Chapter 3), our analysis is conducted through two theoretical approaches that also belong to the interpretive tradition.

In this thesis, the analysis of the process of change is conducted through the use of Vickers's appreciative systems, belonging to the broader category of soft systems thinking. In general, soft systems thinking is situated within the interpretive paradigm since its guiding assumptions are 'subjective' (Jackson, 2001). Interpretive researchers view social reality 'as being continually constructed and re-constructed in a social process in which meanings are negotiated' (Checkland & Holwell, 1998, p.40). For them an organisation does not exist as

an independent entity, but is part of sense making by a group of people engaged in a social discourse, dialogue and conduct of action (Checkland & Holwell, 1998). Such a view is also expressed in appreciative systems thinking that explains how an organisation changes or produces a continually changed self through actions taken as outcomes of the process of appreciation (Checkland & Casar, 1986).

Acknowledging the limitations of appreciative systems thinking to examine the context of study, a web models theoretical approach is also incorporated in this study. This theory enables a more thorough analysis of the organisational/interorganisational context by also emphasising the role of technology. Situated in the interpretive tradition, the web models approach takes a wide view of technology and the surrounding social context. Technology is not perceived solely as a technical artefact, but as a collection of additional resources, such as management practices, policies, organisational arrangements and people associated with its use. Technology is also seen as a dynamic contextual element, changing over time through decisions and interactions of the people involved. Embracing an interpretive epistemology, web models guide researchers to closely examine the interplay between the technical and the social by taking into account the views of various stakeholders (Kling, 1987). By examining different organisational participants, web analysts seek to investigate the broader social relations, the current infrastructure and the history of commitments to technologies and people that shape the implementation and use of technology. Therefore, by employing web models, researchers are able not only to investigate the changes of technology and the social context surrounding it, but also to acquire a broader view of the evolution and change occurring in an organisation.

As specified in Pettigrew's contextualist approach (Pettigrew, 1985), the linkage between process and context is of key importance for understanding permanent or temporary organisational change. In this study the *linkage between the process and the context* is conducted through the combination of the aforementioned theoretical approaches into a synthesized conceptual framework. The framework provides the concepts to examine how the process of response to environmental threats or opportunities can lead to changes of the context as well as how contextual elements influence or shape the process of response. Human actors draw on elements of context, such as relationships, resources and information technology to carry out actions that may in turn reinforce or alter existing organisational contexts (Walsham, 1993). Therefore the relationship between process and context is of a dynamic nature and can be better captured through an interpretive approach.

As will be justified in the following chapters, the investigation of this dynamic interaction of action and context is fundamental to the understanding of organisational flexibility and will be conducted through the application of the theoretical framework to the study's empirical

data. In general, theory is used in this thesis both as a high-level lens for the conceptualisation of flexibility, and as a tool to analyse large amounts of complex qualitative data. The role of the theory in interpretive research is further discussed in the following section.

4.4 The role of theory in interpretive research

Theory plays an essential role in interpretive research and can be used in various ways. It can be challenged through the research revealing either its rightness or its weaknesses, it can be the outcome of the research or it can be used as a conceptual tool to view and analyse the data. Interpretive research is usually not intended to falsify theories, but to develop theories as 'sensitising devices' to view the world in a certain way (Klein & Myers, 1999). 'Theories concerning reality are ways of making sense of the world' (Checkland & Holwell, 1998, p.22) and shared meanings conveyed from theories present a form of inter-subjectivity rather than objectivity (Walsham, 1993). Therefore, there are not correct or incorrect theories, but just more or less interesting ways to view the subject of study (Walsham, 1993; Avgerou, 2002).

One of the main criticisms of a theory is that it provides both a way of seeing as well as a way of not seeing, as it 'blinds' researchers to other perspectives at the moment of its application (Avgerou, 2002). Therefore it is desirable in interpretive studies 'to preserve a considerable degree of openness to the field data, and a willingness to modify initial assumptions and theories' (Walsham, 1995b, p.76).

An additional criticism is that the use of a theoretical approach might be influenced by the researcher's personal experience and insight (Walsham, 1993). Nevertheless, as Walsham (1993, p.7) argues 'an appropriate blend of theory and practice may be more valuable to an individual practitioner than practice alone', since 'theories may aid the synthesis of implicit practical knowledge and, equally important, may provide a means to communicate this knowledge to others'. He further states that the exposition of research results through verbal and written discourse enables broader judgements of value to be made through the sharing and testing of the acquired insights with others.

In this study, appreciative systems thinking and web models theories were considered and challenged during the course of the empirical work. The selection of these approaches was influenced by the preliminary findings. These theories were then used as conceptual tools to view and analyse the data and were further challenged through their juxtaposition with the final results. Their weaknesses were identified and a research framework combining these two approaches was developed.

A framework defines and expresses what constitutes 'knowledge' about the situation researched. It should not be taken as a given, since the research might lead to the framework being modified or, in an extreme case, abandoned (Checkland & Holwell, 1998). However, 'without a declared-in-advance epistemological framework it is sometimes difficult to distinguish researching from novel writing' (Checkland & Holwell, 1998, p.23). Checkland (1991) distinguishes between the framework as a linking of ideas and the process (or methodology) of applying these ideas in an organised way to a particular area. As demonstrated in **Figure 11**, the way of applying the theoretical ideas in the area of study may lead to changes in the framework or in the methodology itself. It may also lead to an improved understanding or specification of the area of application.

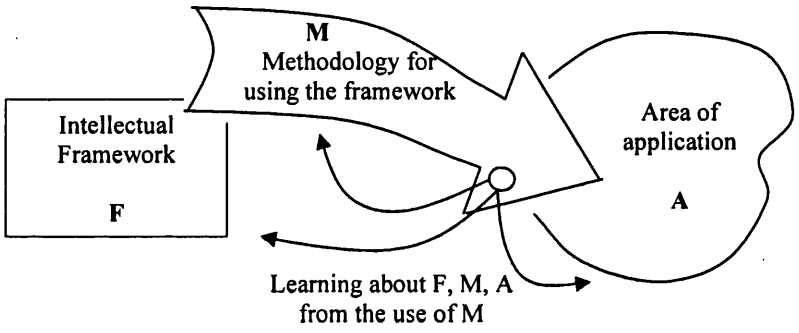

Figure 11: The organised use of rational thought. *Source Checkland, 1991*

In this study, the initial research framework (presented in Chapter 2 -**Figure 4**) was further developed through its application to the area of study. The incorporation of appreciative systems and web models approaches led to the development of a refined conceptual framework (**Figure 10**). This framework was used as a sensitising device to analyse the empirical data. The data and the area of study were then re-examined and patterns within the data set were revealed. The aim of this additional round of analysis was to identify weaknesses in the proposed theoretical framework, as well as to further theorize based on the existing empirical data.

The application of the theoretical framework to the area of study was dictated by the approach (or methodology)[25] followed in this research. In interpretive research, various methodologies can be used (Walsham, 1995b) to guide the process of theoretical

[25] Although the term methodology is often confused with that of research approach (Mingers, 2001), it refers to a more structured set of guidelines shaping the research and assisting the generation of valid research results. The term approach is preferred in this thesis, since only a part of this study was pre-planned, whereas most of it was improvised depending on emerging issues and data needs.

development and understanding of data. In this thesis emphasis is given to an approach that enables the understanding of the process of change as well as the context that influences it. According to Walsham (1993) a context/process type of analysis requires the use of a qualitative research method, since the context changes and knowledge needs to change as well (Pettigrew, 1985).

4.5 Qualitative research methods

'Qualitative research stands for a set of approaches to research informed by the various rationalities or partial world views brought to a problem rather than just a particular set of techniques' (Pettigrew, 1985, p.54). It involves the use of qualitative data, such as documentation, narratives, descriptions, interviews, as well as data gathered through participant observation to understand and explain social phenomena (Myers, 1997). Qualitative research is not always interpretive or critical, but it can also be positivist, depending on the underlying philosophical assumptions of the researcher.

A research method is a strategy of inquiry, influenced by the underlying philosophical assumptions and affecting various stages of the research - from its design to the collection of the data (Myers, 1997). Research methods can be classified in various ways, with the most common being the distinction between qualitative and quantitative research methods.

Quantitative research methods were originally developed in the natural sciences to study natural phenomena and are mostly associated with research of a positivist epistemology. Examples of quantitative methods include simulation, laboratory experiments, field experiments, quantitative surveys (Galliers, 1991) as well as formal methods (e.g. econometrics) and numerical methods such as mathematical modelling (Myers, 1997).

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena (Myers, 1997). Given that the types of problems investigated by qualitative researchers are likely to be indeterminate, the qualitative methods used are also imprecise (Pettigrew, 1985). Although qualitative methods are mostly associated with interpretive or critical research, they can be also employed by researchers following a positivist approach. However, they cannot be as easily turned into procedures as quantitative methods, 'which can be described, learnt and then practised' (Pettigrew, 1985, p.55). Rather than utilizing tools to quantify, correlate and test variables, qualitative methods enable researchers to develop a deeper understanding of the research environment (Walsham, 1993) as well as to closely investigate the context, content and process of organisational change (Pettigrew, 1985).

Within the social science tradition, qualitative methods that were developed for understanding human cognition and agency involve ethnography, case study research, action

research (Lee *et al.*, 1997) as well as grounded theory (Myers, 1997). In these methods, qualitative data sources are mainly collected through observation or participant observation, documentation, questionnaires, semi-structured interviews (Trauth & O' Connor, 1991), descriptions and narratives (Myers, 1997).

In this study, an interpretive case study method is adopted to examine flexibility as a dynamic characteristic, changing over time influenced by and affecting the changes of organisational/interorganisational context.

4.5.1 Case study research

Case study research is defined as an empirical enquiry that investigates a contemporary issue or event within its real-life context, especially where the boundary between such issues or events and its context is not clearly defined, and in which multiple sources of evidence are used (Yin, 1994). Case research can be conducted in many different ways. It can be carried out taking a positivist or interpretivist stance, can use qualitative and quantitative methods, and can investigate one or multiple cases (Cavaye, 1996).

According to Walsham (1993) a qualitative case study is one of the most appropriate methods for conducting empirical work in the interpretive tradition. It aims for in-depth understanding of the context of the phenomenon under study (Cavaye, 1996) and offers richer explanations than the specification of predefined factors or the testing of predetermined hypotheses. Case study research 'can describe phenomena, can build theory, or can test existing theoretical concepts and relationships' (Cavaye, 1996, p.236). As mentioned previously, the research followed in this thesis combined both building and testing of theory. When the predetermined theoretical constructs were found inadequate to explain the complexity of the data, additional theoretical approaches were incorporated and were further tested through their application to the data.

Besides differing on the use of theory, case studies also vary on the number of organisations examined. An important decision is whether to study a single case or a set of cases. A single case design enables the researcher to investigate a phenomenon in depth (Cavaye, 1996). It allows for 'thick' description, which gives the researcher access to the subtleties of changing and multiple interpretations, which otherwise would have been lost. Single or in-depth case studies are often carried out longitudinally, that is over a reasonably long period of time. They involve frequent visits to the field site (Walsham, 1995b) and are often supplemented by detailed historical reconstructions of earlier periods. Such case studies provide the opportunity to thoroughly analyse the context of study, enable the observation of events unfolding over time (Walsham, 1993), the examination of continuous processes, and the interconnection of various levels of contextual analysis (Pettigrew, 1990).

The interpretive approach gives more weight to a single case study, rather than multiple case studies, which are less detailed. While a single case study enables in-depth analysis and rich descriptions, a multiple case design enables analysis of data across cases (Cavaye, 1996) and may show that findings are not merely the result of idiosyncrasies of the research setting (Miles & Huberman, 1994).The conduct of multiple case studies should be justified analytically, that is to show the need for incorporating multiple cases or a distinction between the cases, rather than statistically (i.e. to demonstrate that results can be generalised statistically).

In this study, a multiple case design was used for the following reasons. The aim to examine flexibility both at the organisational and interorganisational levels required the inclusion of at least two organisations. Other organisations were added to better analyse the impact of interorganisational systems on varied organisational contexts as well as to acquire a more comprehensive view of flexibility. The number of cases examined was not predetermined and depended on how much knowledge was acquired after studying a case as well as on the additional information that was expected to emerge from studying further cases (Cavaye, 1996).

Weaknesses of qualitative case studies relate to the risk of bias from either researchers or interviewees (Fitzgerald & Russo, 2005). Further criticisms tend to focus on the lack of statistical generalisability of their results. As a response to these criticisms, Klein and Myers (1999) identify a set of principles for the conduct and evaluation of interpretive field research.

4.6 A set of principles for interpretive field research

The principles proposed by Klein and Myers (1999) were derived from the examination of studies (Walsham & Waema, 1994; Myers, 1994; Orlikowski, 1991) that are considered as classic contributions to interpretivism. They refer to interpretive research, mainly of a hermeneutic nature, and in particular to interpretive field studies, including case studies and ethnography[26]. In response to potential criticisms that the proposition of principles may violate the emergent nature of interpretive research, Klein and Myers (1999) argue that these principles are consistent with the philosophical base of the interpretive literature. They also argue that it is better to have some quality standards, 'since the absence of any criteria increases the risk that interpretive work will continue to be judged inappropriately' (Klein & Myers, 1999, p.68).

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[26] Although there is no explicit distinction between the two, their principles differ on the length of time that a researcher needs to spend in the field and the extent to which he immerses himself in the life of the social group under study (Klein & Myers, 1999).

The following sections are concerned with addressing the seven criteria for conducting and evaluating interpretive case study research. These are the principles of the hermeneutic circle, contextualisation, abstraction and generalisation, dialogical reasoning, multiple interpretation, suspicion and interaction between the researcher and the subjects of study. These principles and their interdependence are described and their application in this study is discussed.

4.6.1 The principle of the Hermeneutic Circle

Hermeneutics began as the study and interpretation of sacred texts and is now considered as the process of interpretation of any textual material (Myers, 1997). Hermeneutic research in information systems mostly draws on the work of Gadamer (1976), who argues that language is fundamental to our existence in the social world, and that every reading or hearing of a text constitutes a hermeneutic act of giving meaning to it through interpretation.

The idea of the hermeneutic circle suggests that we come to understand a complex whole from prior conceptions about the meanings of its parts. The process of understanding moves from a precursory understanding of the parts to the whole and from a global understanding of the whole context, back to an improved understanding of each part (Klein & Myers, 1999; Gadamer, 1976). In Gadamer's description of the hermeneutic circle the terms parts and whole should be given a broad interpretation.

In this study the (smaller) parts were the preliminary conceptualisations of flexibility both at organisational and interorganisational levels. These preliminary ideas were elaborated through the acquisition of views of various participants. These additional opinions led to an improved understanding of the flexibility of people involved with specific operations (parts) and contributed to the conceptualisation of flexibility at the level of a department (larger parts) and then at the level of the organisation (whole – part of broader whole). The improved understanding of organisational flexibility has further contributed to the conceptualisation of flexibility at the level of the dyad (whole) that is the interaction between two trading partners. The dyad is also considered as a part of a broader context comprising an extended supply chain (including manufacturers and distributors) or the market as a whole. In order to acquire a more complete view of flexibility, an understanding of this broader context was also required.

Therefore, in a number of iterations of the hermeneutic circle, the process of interpretation moved from a precursory understanding of the parts (flexibility of operations, departments, organisations) to an understanding of their respective wholes (departments, organisations, interaction between organisations) and from the global understanding of the whole

(flexibility at an organisational/interorganisational level) to an improved understanding of parts.

4.6.2 The principle of Contextualisation

The principle of contextualisation requires that the subject matter is studied in its social and historical context. It thus suggests critical reflection of the social and historical background of the research setting (Klein & Myers, 1999). Positivist researchers also study the way the organisation has been in the past but, they presume that 'patterns observed in the past will also repeat themselves in the future' (Orlikowski & Baroudi, 1991, p.5). In distinction to this, interpretive researchers believe that organisational patterns are constantly changing. Organisations and technology are not static and the relationships between people and organisations are evolving and changing over time (Ciborra, 2000; Klein & Myers, 1999). As a consequence, interpretive research seeks to understand dynamic phenomena, treating each instance as a unique historical occurrence, influenced by the total history of the organisation (Klein & Myers, 1999).

In this study we were particularly interested in revealing the social and historical background of the research setting in order to develop an understanding of flexibility as a context embedded concept. In order to explain the context of study thoroughly, without neglecting the role and impact of technology, we selected the web models perspective and based our analysis on its theoretical concepts. Web models make explicit connections between a focal technology and the social, historical and political context in which it is developed and used. Allowing the drawing of boundaries around groups or organisations associated with the use of technology, this approach enables the analytical separation between the inner (organisation/business network) and the outer context (broader political and economical environment - Greek or global market). It also enables the identification of higher (dyad, organisation) and lower (departments, processes) levels of contexts, facilitating a multilevel analysis (Pettigrew, 1987) of flexibility.

The principle of contextualisation also requires that the researcher sees people as producers and not just as products of history (Klein & Myers, 1999). This aspect is also taken into account in this study by seeing the changes of organisational context as results of the processes of appreciation and action conducted by participants and influenced by standards generated by previous history (Vickers, 1984).

4.6.3 The principle of Interaction between the Researcher and the Subjects

Whereas the principle of contextualisation places the object of study in context, this principle 'requires the researcher to place himself/herself and the subjects into a historical perspective'

(Klein & Myers, 1999, p.74). The study's participants may change their perspectives or affect their activities by the appropriation of concepts used by IS researchers. Therefore, this principle "requires critical reflection on how the research materials (or 'data') were socially constructed through the interaction between the researchers and the participants" (Klein & Myers, 1999, p.72).

Clearly, informal conversations, interviews and requests for specific documents may affect the way organisational participants view the subject of the study. This may in turn influence the empirical data collected. However, this effect is lessened if the influence and intervention of the researcher is limited. In this study, as will be elaborated in the data analysis section, data collection was mainly based on semi-structured interviews, guided only by some predetermined themes. Respondents were thus able to express their opinion without being constrained or directed by specific questions. Nevertheless, the interpretation of data may have been influenced by the general themes guiding data collection as well as by the predetermined theoretical constructs of the study. Acknowledging this constraint I tried to be as open as possible in embracing new ideas or perspectives of respondents as well as arranging for additional interviews when further information, clarifications and cross-checking were needed. It was through this continuous process that the understanding of the case improved and interpretation emerged.

4.6.4 The principle of Abstraction and Generalisation

While the previous two principles deal with the examination of an event in its setting and emphasise features unique to the event, this principle deals with the generalisation of the study's results. Since the results of interpretive research are influenced by the history and context of the organisation and represent a specific historical period, it has sometimes been concluded that interpretive research cannot generalize its findings. This argument is challenged by the principle of abstraction and generalisation, which requires that the idiographic details revealed by the interpretation of the data are related to theoretical and general concepts that describe the nature of human understanding and social action. Therefore, intrinsic to interpretive research is the attempt to relate particular results, emerging through the application of the principle of contextualization to very abstract categories, ideas and concepts that may apply to multiple situations (Klein & Myers, 1999).

From an interpretive position, 'the validity of an extrapolation from an individual case or cases depends not on the representativeness of such cases in a statistical sense, but on the plausibility and cogency of the logical reasoning used in describing the results from the cases and in drawing conclusions from them' (Walsham, 1993, p.15; 1995b). Therefore, case studies are useful for analytical generalisations, where the aim of the researcher is to

generalise a particular set of results to some broader theoretical propositions (Yin, 1994). According to Walsham (1995b) there are four types of generalisation for interpretive case studies: the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insight. Nevertheless it is important that theoretical abstractions and generalisations are carefully linked to the field study data so that the process of obtaining insight is clear (Klein & Myers, 1999).

A multiple case study approach was adopted in this study to examine flexibility as a dynamic characteristic changing over time influenced by and affecting the changes of organisational/interorganisational context. By analysing the impact of IOS on the flexibility of different organisations, I was able not only to examine how different organisational contexts affect the impact of technology on flexibility, but also to derive more generalisable conclusions through cross-data analysis. In order to reduce the risk of deriving conclusions that are strongly influenced by the local context of Greece, I included large multinational companies in the study. These organisations normally follow the management practices of their mother companies and belong to committees that set standard policies and specify strategies at a global level. It can therefore be argued that the results of this study are relevant beyond their local context.

However, in this study, generalisability is mostly attained by the theoretical insight gained through the analysis and understanding of flexibility as a context-embedded notion. The idiographic details revealed by the data interpretation were related to theoretical concepts drawn from web models and appreciative systems. The selection of these approaches was based on the examination of social and information systems theories and was particularly influenced by the empirical data and results obtained from the field study.

Influenced by these theoretical approaches and informed by the idiographic details of the case, the theoretical framework developed in this thesis is abstract enough to provide a generalisable understanding of flexibility. Although finalised towards the end of the fieldwork, the framework was used both as a "sensitising device" (providing understanding of the subject of study at a higher level) and as a base to guide and construct the analysis of the empirical data. The development of this framework and its further improvements were based on the principle of dialogical reasoning discussed next.

4.6.5 The principle of Dialogical Reasoning

The principle of dialogical reasoning "requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tells") with subsequent cycles of revision." (Klein & Myers, 1999, p.72). The researcher juxtaposes the preliminary theoretical assumptions or preconceptions guiding the

original research design with the data that emerge through the empirical work. This activity is part of the hermeneutic process. Hermeneutics recognizes that 'prejudice' or prior knowledge of a phenomenon is a necessary starting point of our understanding. However, a researcher needs to be able to confront these prejudices with the research results and if needed modify or abandon them altogether (Klein & Myers, 1999). This activity can be applied several times so that the improved understanding of one stage of research becomes a preconception for the next.

As will be further analysed in this chapter, I started the fieldwork by having formalised a preliminary conceptual framework for organisational flexibility. This framework was mainly derived through an extensive literature review and focused on the multidimensional nature of flexibility. It provided a base for the analysis and understanding of flexibility and guided the initial research design. However, the juxtaposition of the framework with the preliminary findings (dialogical reasoning) demonstrated that analysing flexibility solely as a multidimensional concept was not sufficient to capture its complex nature. Flexibility needed to be viewed as a dynamic and context embedded notion, changing and evolving over time, influenced by and influencing changes of the context. To analyse the process through which organisations respond to environmental threats, take decisions, handle and accommodate changes, I decided to incorporate theoretical ideas from appreciative systems thinking. Acknowledging the limitations of this approach in analysing the context, I added web models and a refined theoretical framework was developed. This framework was again juxtaposed with the research findings and further improvements were made. More details on how the principle of dialogical reasoning was used in this study are given below in the overview of our research approach.

4.6.6 The principle of Multiple Interpretations

While the principle of dialogical reasoning suggests the confrontation of the researcher's preconceptions with the empirical data, the principle of multiple interpretations suggests the confrontation of the differing views of the participants in the field. An interpretive researcher should not rely on findings from only one source, since human actions are conditioned by a social context involving multiple agents (Klein & Myers, 1999). Therefore, depending on the subject of study the researcher may need to take into consideration multiple viewpoints that may differ. This principle suggests that the researcher "identifies possible differences in opinions and interpretations among participants, as these are expressed among different narratives or stories regarding the same events or issues" (Klein & Myers, 1999, p.72). The researcher should confront these contradictions and revise his understanding accordingly.

To enable a more complete examination of the subject of study, I tried to take into account multiple viewpoints. Within the same organisation, interviews were conducted in various departments, and in some departments the views of more than one person were considered. Since the aim of the study was also to examine flexibility at an interorganisational level, information was collected both at the supplier's and at the retailer's side. To study flexibility in varied organisational contexts, as well as to more thoroughly examine the impact of technology, several suppliers and retailers were incorporated in the study.

Some differences in opinions were identified during the empirical work. These differences were expressed not only by people belonging to different departments, but also by people in the same department. People in different departments are engaged with varied activities and have different views of flexibility at operational and structural levels. They may also have diverse perceptions of the impact of technology on flexibility. Differences in opinions were also identified between suppliers and retailers. However this was expected since interorganisational systems and specifically the CRP system have a different impact on the suppliers' side than on the retailers' side. These diverse views were complementary rather than contradictory. They offered alternative perspectives and their confrontation contributed to a more balanced view of flexibility.

4.6.7 The principle of Suspicion

While the above principles are more concerned with the interpretation of meanings, the principle of suspicion is also concerned with the discovery of false preconceptions or socially created distortions (Klein & Myers, 1999). This principle requires "sensitivity to possible 'biases', 'omissions' and systematic 'distortions' in the narratives collected by participants" (Klein & Myers, 1999, p.72). This principle goes beyond the understanding of the meaning of data to the understanding of the meaning behind the words. It is the least developed principle in the IS literature and is mostly applied in critical research, which identifies vested interests, power structures and the limitation of resources as possible causes of socially created distortions.

Interpretive researchers usually take their informant's views at face value and do not always follow the principle of suspicion. Nevertheless, they may be able to deal with potential biases or distortions by taking into account multiple viewpoints. They may also better ensure the integrity of their results by collecting data from different sources (Yin, 1994).

The principle of suspicion is the least developed in this study. However, it was expected that certain views would be biased or influenced by personal or organisational interests. For instance, the IT managers would probably have a biased or more positive stance towards the use of interorganisational systems and their impact on the flexibility of certain operations or

of the organisation as a whole. To deal with this suspicion, I took into account documentation as well as views of additional stakeholders. Moreover, in the case of a retailer that had unsuccessfully implemented CRP, in order to counteract any possible bias of managers, the views of the suppliers were also considered.

4.7 Application and interdependence of principles in this thesis

Klein and Myers (1999, p.78) argue that the seven principles are interdependent, since the understanding and exploration of the context of study (principle two) depend on the generation of data through the researcher's interaction with the subjects (principle three); "the theory and concepts to which the researcher will be abstracting and generalising (principle four); the researcher's own intellectual history (principle five)"; the different views of the study's participants (principle six); and the aspects of "reality presented" that the researcher examines critically. They further argue that a certain degree of interdependence can also be identified between these six principles. For instance, the principle of multiple interpretations is closely related to the principle of suspicion since, to deal with possible biases or omissions, researchers often take into consideration the views of multiple participants. The principle of multiple interpretations may also relate to the principle of dialogical reasoning, since the confrontation of differing views can lead to a more thorough revision of preconceptions of the study.

The principle of the hermeneutic circle is considered as fundamental to all the other principles. This principle can guide the application of the other six in the interpretation of the case study data. All the other principles are not necessarily complete on their own. They may guide the researcher to examine and develop an understanding of specific parts of the case but need to be combined in order to contribute to an understanding of the field study as a whole. "During repeated cycles of the hermeneutic circle, all of the suggested principles can be applied iteratively, forming a complex web of interpretations" (Klein & Myers, 1999, p.73). The researcher moves back and forth between different interpretations of the field study material until a complete understanding of the phenomenon under study is reached.

As will be explained in the overview of the research approach (Section 4.9), an understanding of flexibility both at an organisational and interorganisational level was gradually reached through repeated cycles of the hermeneutic circle. During these cycles, the context of study was gradually explored (contextualisation), possible biases and differences in interpretations were handled (principles of suspicion and multiple interpretations), the idiographic details were related to general theoretical ideas (principle of abstraction and generalisation) and differences between my theoretical preconceptions and the actual findings were identified (principle of dialogical reasoning). This juxtaposition between

theoretical ideas and empirical data contributed to a gradual development of understanding leading to repeated improvements to the study's theoretical framework.

4.8 Research design

This study adopted a qualitative method of inquiry in order to develop an understanding of organisational flexibility as viewed and experienced by organisations and their stakeholders. The aim to examine flexibility both at an organisational and interorganisational level as well as the need to acquire a broad understanding of flexibility led to the adoption of a multiple case design. The fieldwork was conducted over a period of 28 months in 7 organisations, comprising 3 suppliers and 4 retailers. The selection of these organisations and the evolution of the multiple case design are further discussed in the following sections. These sections also present the methods of data collection and analysis applied in this study.

4.8.1 Case selection

As shown in Chapter 2, grocery retail supply chains need to deal with increased competition, progressively more demanding consumers and changing market needs. Aiming to increase both their efficiency and flexibility they implement IOS to support their business-to-business transactions. However, this was not the only reason influencing the selection of this industry in this study. While an extensive literature enumerated the benefits of IOS, research examining the impact of this type of technology on grocery retail-supply chains (Cunningham & Tynan, 1993; Webster, 1995), was revealing constraining and locking-in effects on organisations due to their involvement in hub-and-spoke arrangements (Kalakota & Whinston, 1996; Angeles & Nath, 2000) and closed business networks (Chan & Swatman, 1998). These conflicting views attracted me to examine flexibility in the context of the grocery retail supply chain.

The case study was conducted in Greece mainly due to connections through the University of Athens that facilitated access to both retailers and suppliers. The aim of the study was to acquire a general understanding of flexibility, while avoiding entirely context-specific results. Therefore the research focused on the examination of multinational companies that follow the management practices and technological initiatives of their mother companies in Europe and US. However, in order also to obtain a variety of results as well as a more thorough view of flexibility, empirical work was also conducted in a few local companies. To reveal how differences in the organisational context influence the impact of technology on organisational flexibility, the selection of sites was also based on specific organisational characteristics, such as size, competence, technological awareness and position of the companies in the Greek market.

Access was gained without difficulty in most organisations. Since the aim of the study was to examine the impact of technology on organisational flexibility, the first person contacted was normally the head of the IT department. A formal letter describing the aim and methodological approach of the research was also sent to the upper management of the organisations. Access to the first organisation was further supported by connections through the University of Athens, whereas access to subsequent organisations was facilitated through contacts and recommendations provided by interviewees.

The first organisation studied was Unilever, a large multinational supplier and one of the first companies to implement EDI and CRP systems in Greece. The conduct of fieldwork in this organisation contributed to the preliminary understanding of the context of study and guided subsequent research by identifying relevant and unrelated issues. Furthermore, information given by this supplier, regarding customers and competitors, combined with data collected through documentation led to the selection of the subsequent sites.

Aiming to examine the impact of the system at the retailer's side as well as to examine flexibility at the level of the interaction between suppliers and retailers, I selected AB Vassilopoulos as the second organisation to study. AB is a large and successful multinational retailer and was identified as one of the most efficient and competent trading partners of Unilever. It was chosen mainly because it is one of the pioneers in the in-house development of new technologies as well as one of the first retailers to fully implement CRP.

In contrast, Carrefour was a large retailer that used interorganisational systems but was having problems in realising their benefits. Carrefour is a large multinational group of companies with a big percentage of the Greek market. At the time of the study, the company was facing a lot of problems due to structural and operational changes. These changes as well as certain deficiencies in the technological infrastructure led to the incorporation of this company in this study.

To obtain a more balanced view of flexibility at the interorganisational level, it was decided also to include a second supplier's viewpoint. Since most suppliers that use interorganisational systems in Greece are large multinationals, the selection of the supplier was based on AB's and Carrefour's recommendations. They suggested Procter & Gamble as one of the most efficient and technologically aware suppliers. Procter & Gamble was also selected because it was the initiator of CRP implementation in Greece as well as one of the leading companies technologically in the field.

After conducting a preliminary analysis of findings in these organisations and having examined flexibility both at the level of the firm as well as at the level of the interaction between trading partners, supplementary empirical work was carried out in the organisations.

This additional fieldwork aimed at clarifying issues or investigating supplementary subjects raised during the course of the research.

To further investigate the impact of technology on organisational flexibility, a CRP implementation failure was also incorporated in this study. It is the case of a local retailer (Atlantic S.A.) that implemented CRP and was trying for a year to use it in its interaction with Procter & Gamble and Unilever. After spending money and effort in the implementation of CRP, the company decided to abandon the whole project. The empirical work conducted with the aforementioned suppliers contributed to gaining access to Atlantic. However, only a relatively small number of interviews were conducted in this company, not only due to the limited number of employees affected by the incomplete implementation of CRP, but also due to the unwillingness of people in charge to talk about the failure of the project.

In order to acquire a wider view of flexibility, the study was also conducted in two local organisations that were not using EDI systems for their business-to-business transactions. These comprised a local retailer (Sklavenitis S.A.) and a small local supplier (Selecta S.A.), both of which were relatively successful in the Greek market, although lagging behind many technological advances.

Further details regarding the conduct of fieldwork and the methods of data collection are provided in the following sections, while more detailed descriptions of the companies are given in the subsequent chapter (Chapter 5).

4.8.2 Data collection

Acknowledging the fact that field research is dynamic and that it demands both 'intuition' and 'improvisation' (Scott, 2000), the fieldwork conducted in this study was partly planned and partly improvised. The original plan was to conduct fieldwork in at least four organisations (two suppliers and two retailers) in order to discover the impact of technology in varied organisational contexts, as well as to analyse flexibility both at the organisational and interorganisational levels. However, neither the specific organisations nor the exact number were predefined. Besides Unilever and AB Vassilopoulos that were specified as potential cases at early stages of the research, the others were selected during the course of the empirical work. Their selection was not only based on ease of access, but also on characteristics of these cases, revealed during the course of the empirical work.

When access to an organisation was gained, the primary objective was to develop an initial understanding of the organisational environment, through documentation involving the company's website and articles in specialised magazines. This information was further

enriched during the conduct of interviews in the company. To a certain extent the sequence of interviews in each organisation was planned in advance. However, the course of the study was also guided by the unfolding of the data, by recommendations and contacts provided by the interviewees as well as by the opportunity to approach additional people to interview. Therefore, it can be argued that the fieldwork conducted in this study was designed dynamically and was partly planned and partly improvised.

Empirical evidence was gathered using multiple methods of data collection, including semi-structured interviews, documentation and limited observation. As will be further explained in the data analysis section, such a combination of research techniques also allows for data triangulation (Jick, 1979), reinforcing the validity (Yin, 1994) and completeness of case study findings.

The main source of data was semi-structured interviews, carried out in the various organisations. Interviews are considered as the primary data source for interpretive case studies, since they enable researchers to access better the interpretations of participants regarding their actions and the events that took place (Walsham, 1995b). Semi-structured interviews lie between structured interviews, where the researcher predetermines a list of questions to be asked, and unstructured interviews, where the interviewees freely express their view regarding the subject of study. Semi-structured interviews are based on particular themes, designed to collect common information allowing the interviewees to tell their own story, in their own words.

In this study, a list of themes and questions were specified prior to each interview. The respondents were provided with an initial overview of themes, but interviews were not structured and did not follow strict guidelines. They were more open and specific questions were raised only when the collection of additional information was required. This flexibility allowed for reflexivity and refocusing on the data (Trauth & O' Connor, 1991). By following such a reflexive approach, it was possible to change and adapt the direction of the interviews as the research progressed.

The main part of the empirical work was carried out during a period of 28 months (from May of 2000 to July of 2002). The study involved repeated visits to field sites and repetition of interviews with several persons. The predetermined themes and questions depended on the company and the position of the interviewee in it. The content of interviews changed as the study progressed and knowledge evolved. Supplementary interviews were conducted to clarify issues mentioned in previous discussions, as well as to shed light or give additional information on issues arising during the study.

The total number of interviews was not predetermined. In order to ensure integrity of data, I interviewed people that represented a variety of managerial, operational and user perceptions. Interviewees were selected based on their position in the companies as well as their involvement in the implementation and use of the CRP system. Therefore, the respondents worked in functional areas such as IT, marketing, sales or purchasing, logistics and warehouse management. Besides the potential provision of insight in the study, the selection of respondents was also influenced by recommendations from other interviewees. When the gathered data was believed to be sufficient for a thorough analysis and no new insight was gained by additional interviews, it was decided to stop adding respondents.

The number of interviews conducted in each organisation is presented in **Table 9**. The table shows the position of respondents in the companies without specifying their names. The main reason for this is that some of the interviewees requested anonymity.

Organisation	*Number of Interviews*
Suppliers	
Unilever Hellas	***15***
IT manager (now in marketing department)	*3*
Head of the sales department	*1*
CRP analyst for Carrefour	*3*
CRP analyst for AB	*1*
Sales Manager for Carrefour	*2*
Sales Manager for AB	*1*
Warehouse manager	*1*
Warehouse employer	*1*
Sales Manager for Sklavenitis	*2*
Procter & Gamble	***9***
IT manager	*1*
CRP analyst	*2*
Sales manager of central Greece	*1*
Key account manager for AB	*1*
Key account manager for Carrefour	*1*
Warehouse manager	*1*
Logistics outbound manager	*1*
Warehouse employer	*1*
Retailers	
AB Vassilopoulos	***6***
IT manager (EDP stores manager)	*2*
EDP user (EDI and CRP user)	*1*
Systems analyst	*1*
Purchase manager (Dry Grocery and Liquids)	*1*
Warehouse manager	*1*

Carrefour	***5***
ECR responsible	*2*
CRP user	*1*
Warehouse manager	*1*
IT manager (Warehouse)	*1*
Atlantic	***2***
CRP and EDI responsible	*2*
Organisations that are not using IOS	
***Selecta S.A.** (local supplier)*	***3***
Owner and general manager	*2*
Sales manager	*1*
***Sklavenitis** (local retailer)*	***2***
Accounting manager	*1*
IT manager	*1*
Number of Interviews	***42***

Table 9: List of interviews

The majority of interviews were carried out in Unilever, mainly because it was the first organisation accessed. The conduct of fieldwork in Unilever enabled a better understanding of the subject of study, demonstrated relevant and unrelated issues and pinpointed other suppliers or retailers that could contribute to this study. The number of interviews in the other organisations was smaller, since as the study evolved the scope of research became more specific. Moreover, the empirical work conducted on the suppliers' side was more extensive than that conducted with the retailers, since the implementation and use of CRP has a larger impact on suppliers. Finally, it should be remarked that in the last three organisations the interviews were very limited, since these cases were considered as supplementary to our study. The objective of adding them in the research was mainly to incorporate views of organisations that have never or have unsuccessfully implemented CRP or EDI systems.

Most of the interviews lasted for about 2 hours and nearly 90% of them were tape recorded and transcribed shortly after the interview. Short notes were taken during the interviews that were not tape-recorded. The interviews in the different organisations were carried out in three main time periods as demonstrated in **Figure 12**.

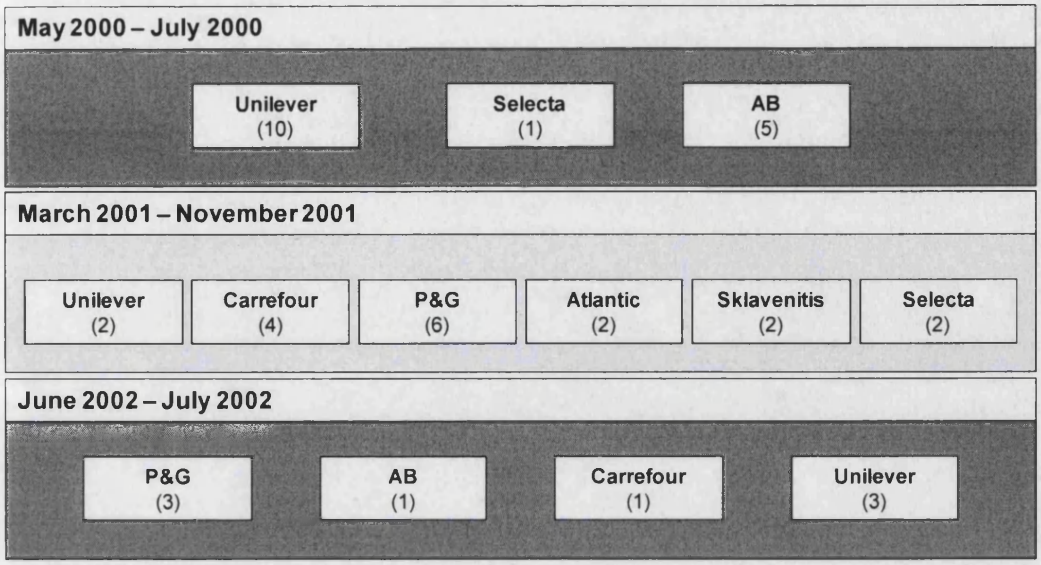

Figure 12: Conduct of interviews in the case study organisations

The first round of interviews was carried out from May to July 2000 and mainly involved one supplier (Unilever) and one retailer (AB). An interview was also conducted in a small local supplier (Selecta), through personal connections and ease of access to this company. This interview was not only to discuss the inability of this company to implement CRP, but also to acquire a better general knowledge of the Greek market and of the key players. Both suppliers identified Carrefour as an interesting case to examine, since the organisation was undergoing changes at a structural, operational and technological level at the time.

After conducting a preliminary analysis of the findings of these organisations, the second round of interviews started in March 2001. Before proceeding with the fieldwork in Carrefour, a few supplementary interviews were carried out in Unilever. These aimed at examining the implications of CRP in the interaction between Unilever and Carrefour. They also revealed information regarding Carrefour's context and operations and contributed to the better planning of fieldwork in the company. After completing research in Carrefour, it was decided to start empirical work in Procter & Gamble (P&G), which was one of the initiators of the CRP project. The interviews conducted in this company provided valuable information regarding the characteristics and usage of this technology, its advantages as well as the constraints that it imposes both at an organisational and interorganisational level. They also provided information regarding the case of Atlantic that faced several problems in the implementation and use of the CRP system. To gather additional data regarding the failure of the CRP project in Atlantic a couple of interviews with the IT manager of the company were also conducted.

A small number of interviews were also carried out in a local retailer (Sklavenitis), while two supplementary interviews were conducted in the small supplier (Selecta). Sklavenitis has a big percentage of the Greek market and Selecta is considered as a successful local supplier. However both companies use less advanced technologies and have not yet implemented IOS to support their business-to-business transactions. The flexibility of these companies was examined and the reasons for their limited investments in technologies were discussed.

After completing a first or second round of interviews in all the organisations, the data gathered was examined and roughly analysed. The study of the findings demonstrated the need to gather additional data, mainly involving the interactions of P&G with Carrefour and AB. Therefore, supplementary interviews were conducted in P&G with the IT manager and the key account managers of the two supermarkets. This extra data showed changes in the interaction of the company with AB, mainly due to a recent acquisition of a smaller local retailer (TROFO). To examine better the changes of operations, an additional discussion regarding this acquisition was held with AB's IT manager. A supplementary interview was also carried out with Carrefour's IT manager in order to examine the technological advances and structural changes in the company, as well as to reveal the impact of these changes on the company's flexibility and cooperation with suppliers. The last part of the empirical work was conducted in Unilever, where discussions with the CRP analysts for AB and Carrefour enabled cross-checking of the information gathered in this third round of interviews.

More information regarding these companies was collected through secondary resources such as the companies' websites, newspapers and specialised magazines. Power-point presentations and outputs from CRP and EDI systems were also reviewed to understand better the use and potential impact of technology on these organisations. These documents provided a primary understanding of the organisational characteristics, context and use of technology, further built up during the conduct of interviews. Documentation reviewed in this study also included newsletters, reports and deliverables of projects issued by ECR-Hellas. This information supplemented data from the interviews, providing a broader view of the context of study and further insight from an official perspective. Acknowledging the fact that documents may be written for specific reasons (e.g. marketing purposes) and may refer to specific audiences, they were not considered as literal recording of events or as unmitigated truths (Yin, 1994). Rather, they were carefully reviewed as sources of supplementary information, strengthening or invalidating evidence from other sources (Yin, 1994).

Data was also gathered through limited observation. Direct observation, as opposed to participant observation refers to noticing (monitoring) a phenomenon without intervening in it. Observation is criticised for having limited validity, since it is influenced by the

researcher's own perception and interpretations. However, observational evidence may be useful in providing additional and sometimes richer information regarding the phenomenon under study. In this study, direct observation was limited and was mainly conducted to develop a better understanding of the flexibility of operations as well as the impact of technology on it. Therefore, it involved observation of operations in the central warehouses of the main organisations (Unilever, Procter & Gamble, AB and Carrefour) as well as observations of the usage of the CRP system in the central offices (the work of the CRP analysts on the supplier's side and of CRP users on the retailer's side). Observational evidence was also gathered through visits to warehouses and supermarkets with sales managers, enabling me to compare their traditional way of working with the new one supported by EDI and CRP systems.

Finally, more insight was gained through my participation in the following two conferences: the 2nd National ECR Conference, Athens, Greece, June 2001 and the 3rd International ECR Research Symposium, 11-12 September 2003, Athens, Greece. Attendance at presentations and panels, as well as informal conversations with the conference's participants, enriched my knowledge and understanding of both the global and local context of the grocery retail supply chain.

Since the completion of the main part of the empirical work, in July 2002, until the completion of this thesis, additional documentation involving articles from specialised magazines and newsletters of ECR-Hellas has been reviewed. Furthermore, occasional correspondence has been kept with some of the study's interviewees. This infrequent correspondence, conducted mainly through telephone calls, enabled the clarification of certain issues and kept me updated regarding the technological advances and changes in the case study.

4.8.3 Data analysis and interpretation

As justified in the previous section, initial data collection was followed by some preliminary analysis leading to and affecting the collection and analysis of supplementary data. The analysis of qualitative data is probably the most contested issue within interpretive research (Yin, 1994). The distinction between the stage of data collection and that of analysis is not as marked as in positivist research, since the data affects the analysis and the analysis may influence subsequent collection of data (Myers, 1997). Therefore the collection of qualitative data, its analysis (coding) and interpretation are usually ongoing and iterative processes (Miles & Huberman, 1994) throughout an interpretive study.

Acknowledging the problematic distinction between data collection and analysis in an interpretive research, Myers (1997) suggests that we should speak of 'modes of analysis'

rather than of data analysis. He states that modes of analysis are different approaches to interpret or analyse qualitative data and refer to approaches that focus on narrative and metaphor, hermeneutics, semiotics and grounded theory.

The mode of analysis used in this study is hermeneutics, which refers to knowledge building through an interpretation process where the understanding of the phenomena is continually refined (Boland, 1985). As a mode of analysis hermeneutics suggests a way of understanding textual data (whether verbal or written). It is concerned with making sense of the object of study, which can be a text or a text analogue (Myers, 1997). A text-analogue can be an organisation, which the researcher comes to understand through the analysis of documentation or views expressed by organisational participants. However, different stakeholders may often have incomplete or contradictory views about a phenomenon. Therefore, the aim of a hermeneutic analysis is one of trying to make sense of the whole that is the organisation, through the examination of differing or complementary views and the consideration of the relationships between the people involved (Myers, 1997).

As discussed in Section 4.6, following the idea of the hermeneutic circle, in this study the process of understanding moved from the interpretation of the whole to the understanding of its parts and back to the whole. As the main part of the theoretical development took place in parallel to our empirical work, an interesting interplay emerged between understanding the theory and analysing and interpreting the data. An early understanding of organisational flexibility (as a whole), mainly based on ideas from the literature, guided the initial analysis of interviews, documents and observation data. This hermeneutic process led to an understanding of parts (departments, operations, technology, people involved etc) and to an improved theoretical conception of the whole. This iterative process between theory building and understanding of data continued throughout the case study.

The data collection produced a large amount of data, comprising transcripts of interviews, documents and observational notes. As mentioned in the previous section, the combination of different techniques of data gathering allowed for triangulation of data. Data triangulation is generally used to deal with partial views or biases as well as with potential differences in findings so as to strengthen the validity and reliability of a case study (Yin, 1994). In this study triangulation enabled the juxtaposition of data derived from different sources (e.g. different interviews, documents and observational data). It also allowed the identification of opposing views within the same interview, through different forms of questions. Triangulation was not only used to examine the same phenomenon from multiple perspectives, but also to enrich the understanding and capture a more complete view of the phenomenon under study (Jick, 1979).

In order to manage better the large amount of data collected, a categorisation and classification of these data, based on specific research themes, was required prior to its analysis. All interviews were transcribed in full and were prepared for coding. In this study, coding was not applied in a strict methodological sense and was rather used as a means of gaining insight into the subject of study. The concepts identified during coding, emerged from the data itself. However, they were also partly influenced by themes from the organisational flexibility literature as well as by the objectives and theoretical conceptions of the study.

At the first stage of analysis, the transcripts were sorted according to each organisation and each group of transcripts was examined separately. Coding was mainly used as a data labelling device and was carried out as a means to organise, categorise and facilitate the retrieval of data. Data was initially categorised based on whether it referred to organisational issues or to the interaction of the organisation with its trading partners. The text was further 'segmented and concepts (or codes) within it were identified by examining the text in detail' (Cornford & Smithson, 2006, p.186). The categories (groups of concepts) formed involved the impact of CRP on ordering, deliveries, inventory management, out of stocks, promotions, product releases and the handling of changes both at an organisational and interorganisational level. The relationships between these categories were examined and the findings involving the organisational level were associated with those involving the interaction with trading partners.

At the second stage of analysis, the findings were re-examined and compared across organisations. The results of each organisation were juxtaposed with those of the other organisation and a more general understanding of the impact of CRP on the operational, structural and strategic types of flexibility of both suppliers and retailers emerged. The differences between the organisations were associated with differences in their contexts and further coding involving the technological infrastructure, the management practice and the people involved in the focal operations was conducted.

The coding schema was repeatedly revised as the analysis evolved. The successive reading and reflective revisiting of data, concepts, themes and codes formed the basis of the data analysis (Scott, 2000). It was essential to 'step back' from the data and try to gain an understanding of the broader picture (interorganisational, organisational, technological and social issues influencing flexibility), in order to refine these concepts, their categories and relations. At this higher level of abstraction it was also possible to contrast the emerging themes with the research questions and the study's theoretical ideas. Throughout this process, multiple notes were taken to summarise thoughts and ideas generated as the study of

the transcripts progressed. These notes facilitated the evolution and generation of concepts and formed the basis for the development of the theoretical framework.

The writing up of the interim analysis was also helpful in reducing the amount of data already collected (Miles & Huberman, 1994) as well as in refining the major themes, theoretical concepts and issues emerging from the data. Therefore, the process of writing itself contributed to the development of ideas and revealed connections between events, previously assumed to be separate (Scott, 2000).

4.9 Overview of research approach and structure of thesis

This thesis evolved based on an interpretive stance and was particularly informed by the hermeneutic process of interpretation. This section refers to a research approach rather than to a research strategy or methodology, since this research was partly designed and planned in advance and partly improvised. The argument and theoretical approach underlying this study gradually evolved based on the principles suggested by Klein and Myers (1999). In a hermeneutic circle, the understanding of flexibility as a property of the interaction between organisations (whole) contributed to and was influenced by the understanding of flexibility as a property of the organisation (whole – part of a broader whole), of different organisational departments (parts) and of their specific operations (smaller parts). Therefore in a hermeneutic circle a multilevel analysis was conducted and interdependencies between higher (market, dyad, organisation) and lower (departments, processes of response) levels of context were examined.

Through repeated cycles of the hermeneutic circle, multiple interpretations were handled, interconnectedness among some phenomena in historical and present time[27] was identified and an understanding of different levels of context was gradually developed (contextualisation). Idiographic details were related to general theoretical ideas (principle of abstraction and generalisation) and a conceptual framework of flexibility was developed and changed at various stages of the research. The juxtaposition of these theoretical conceptions of flexibility, at subsequent cycles of revision, with the data that emerged through the empirical work (principle of dialogical reasoning), deepened our understanding of flexibility and contributed to the refinement of our theoretical framework.

As shown in **Figure 13**, the study started by an extensive literature review (arrow 1), resulting in the development of an initial research framework of flexibility (presented in Chapter 2 - **Figure 4**). But, this was only a prior understanding of flexibility, acquired by

[27] This refers to the horizontal level of analysis of a contextualist approach (Pettigrew, 1987).

previous research and theories studied, and it was further elaborated through its application to the case study data (arrow 2). The empirical data collected at the first stage of the fieldwork demonstrated that the preconception of flexibility, as a static and context free concept, was inadequate to address the plurality of issues emerging from the results of the empirical work. The process through which the organisation/business network responds to environmental disturbances or changes needed to be analysed more thoroughly (arrow 3). Recognizing the embedded meaning of flexibility in open systems thinking approaches, appreciative systems was selected as the theoretical base to examine the process through which groups of people or individuals appreciate a situation, make judgements about it and decide upon an action to take. The juxtaposition of this approach with the research data (arrow 4) revealed weaknesses of the theory to analyse the social context affecting the process of response (arrow 5). To analyse better the organisational/interorganisational context by also putting emphasis on the role of technology, web models were also incorporated into the study. The combination of web models' concepts with notions of appreciative systems thinking led to the development of a refined conceptual framework (presented in Chapter 3- **Figure 10**). This theoretical framework, which was gradually developed through an iterative process between theory and empirical work, driven by the principle of dialogical reasoning, was then used as a basis for the analysis of the empirical data (arrows 6 and 7). The set of themes incorporated in the framework, influenced the coding of data and formed the basis of the analysis. This was a fairly detailed analysis that formed the foundations for a discussion and understanding of the concept of flexibility and of the case study results at a higher level of abstraction. This led to a further refinement of the conceptual framework (arrow 8) and initiated the deriving of concluding remarks in the study (arrow 9).

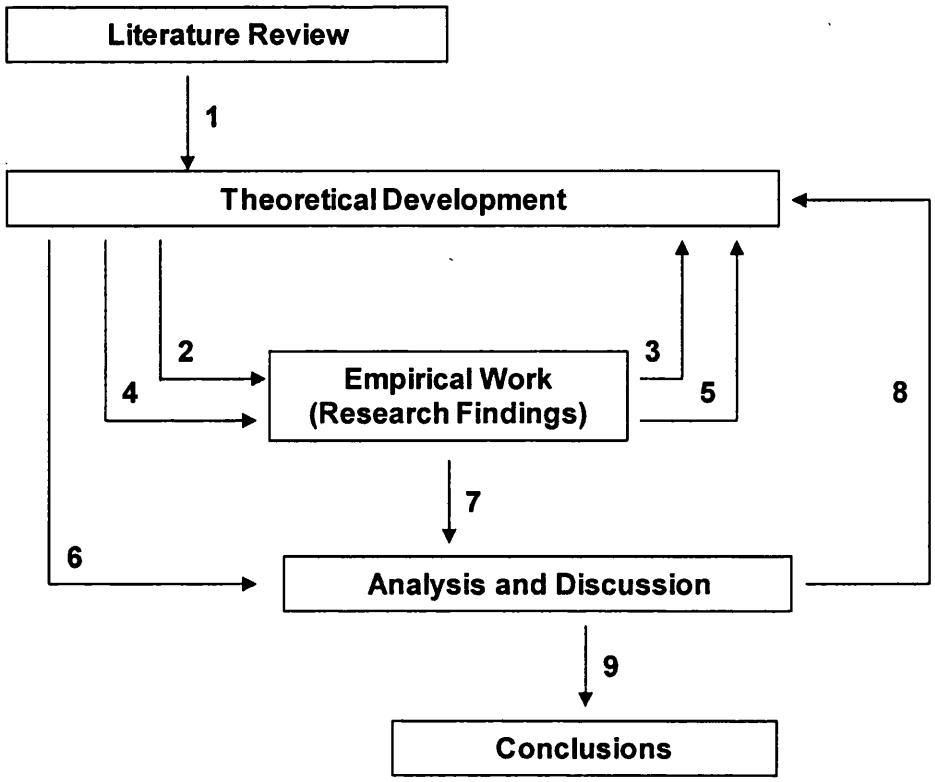

Figure 13: Research approach

In this section I provided the historicity and evolution of the intellectual base of the research. Since there is not a one-to-one correspondence between the stages of the research and the different chapters of this thesis, this section also demonstrates their association. The literature review and the first part of the theoretical development, concerning the building of the initial framework of flexibility, are presented in Chapter 2. The rest of the theoretical development including the theories used for the analysis of the process and context of response are described in Chapter 3. This chapter also discusses the theories' weaknesses and proposes their synthesis into a theoretical framework. The way that the empirical work was conducted in this study as well as the methods of data collection and modes of analysis are presented in this chapter. The organisations examined are described in the following chapter (Chapter 4), while the research findings are presented in Chapters 5 and 6. The findings are analysed based on themes derived from the organisational flexibility literature as well as from the appreciative systems and web models approaches. This set of themes also forms the basis for the writing of the analysis. The data analysis is presented in the first part of Chapter 7, followed by a discussion and presentation of the refined conceptual framework of flexibility. Finally, Chapter 8 presents the concluding remarks of the research.

4.10 Summary and conclusions

This chapter presented the research methodology followed in this thesis. As justified in the above sections the methodology was designed based on the research questions and objectives of the study. The aim to develop an understanding of the complex concept of flexibility by thoroughly examining the organisational and interorganisational contexts surrounding it, led to the adoption of an interpretive approach - entailing a subjective epistemology and the ontological belief that reality is socially constructed. It also led to the adoption of a case study approach and specifically of a multiple case design.

A case study, in a grocery retail-supply chain in Greece, provided the empirical data needed to support our argument. In order to understand how different organisational/interorganisational contexts influence the impact of technology on organisational flexibility I followed a multiple case design. The companies were selected based on characteristics, such as size, position in the market, relationships with trading partners, technological awareness and infrastructure. The study was conducted in 7 organisations (3 suppliers and 4 retailers). The empirical work was carried out over a period of 28 months and the empirical data was collected through repeated visits to the field sites, semi-structured interviews, documents and limited observation.

The use of different sources of data, as well as the conduct of multiple and repeated interviews, enabled cross-checking of data and aimed at eliminating potential biases or inconsistencies of interviewees (principle of suspicion). In order to ensure integrity of findings and eliminate influences from preconceived notions, I interviewed people representing a broad range of managerial and operational positions and took into consideration possible differences in opinions and interpretations (principle of multiple interpretations).

The interpretive field research was also influenced by the principles of contextualisation, hermeneutic circle and dialogical reasoning. Flexibility was examined as a context-embedded notion and its conceptualisation evolved through repeated cycles of hermeneutic circle. The interaction between the whole (flexibility of the retail-supply chain) and its parts (wholes-parts of broader wholes) (organisations, departments, operations) provided a feedback loop through which comprehension of flexibility was developed. Furthermore, through the application of dialogical reasoning in subsequent cycles of revision, the understanding and conceptual framework of flexibility was reviewed and further developed through the incorporation of additional theoretical ideas.

The broader context, that is the global and the Greek market in which flexibility is examined, is described in the following chapter (Chapter 5). The chapter provides further details of the

case study as well as briefly describes the profiles and contextual characteristics of the organisations examined. It additionally presents the findings regarding the impact of EDI and CRP on both suppliers and retailers.

CHAPTER 5 - RESEARCH FINDINGS AT THE ORGANISATIONAL LEVEL

5.1 Introduction

As mentioned in the previous chapter, the empirical study was conducted in 7 organisations, 5 of which (2 suppliers - Unilever and Procter & Gamble - and 3 retailers - AB Vassilopoulos, Carrefour and Atlantic) had implemented and used EDI and CRP. Data was also gathered in one local retailer (Sklavenitis S.A.) and one local supplier (Selecta S.A.) that had not yet implemented these systems. The objective of adding them to the research was to acquire a wider view of organisational flexibility in the industry.

After providing general information regarding the ECR initiative and the role of ECR-Hellas, this chapter describes the implementation of EDI and CRP systems in the fast moving consumer goods (FMCG) sector in Greece. It then presents the profiles of the organisations studied and describes the findings in each one.

The implementation of EDI and CRP in the two suppliers (Unilever and Procter & Gamble) is presented first, followed by a description of the impact of these systems on their operations. As the implementation affects various departments, including IT, sales and warehouse management, the findings lack a conventional narrative, but comprise snapshots from different parts of the companies.

This section is followed by the presentation of data from Selecta, the smaller supplier that has not yet implemented CRP. The juxtaposition of the findings from the two multinationals with those of the local supplier provides a more complete view of the impact of EDI-based technology on the replenishment process.

The chapter also examines the impact of EDI and CRP on the retailers. It first describes issues concerning their implementation and use in AB Vassilopoulos and Carrefour and then discusses the CRP failure in Atlantic. It also examines the ordering process in Sklavenitis, which has not yet implemented EDI.

5.2 The role of ECR-Hellas in the Greek market

As mentioned in the second chapter, ECR has been employed internationally by organizations as an attempt to respond effectively and efficiently to changing market conditions (Loebbecke & Powell, 1998). At the beginning of 1995, the leading manufacturers and retailers operating in Europe took the initiative to create the ECR Europe Committee, as followed by the establishment of similar committees in most European countries. The Greek committee was formed in May 1995 under the name of ECR Hellas. The aim of these committees was to promote the Efficient Consumer Response concept, to increase awareness about ECR practices, to launch projects and to coordinate their

implementation. The various projects mainly focused on the standardisation and optimisation of processes, both at the supply and demand sides. Their objective was to increase the efficiency of business processes and improve cooperation between trading partners, to achieve a responsive, consumer-driven replenishment system, in which customer satisfaction is maximized and costs are minimized.

Most large retailers and suppliers in Greece have been working together since 1996 under the umbrella of ECR Hellas to standardise management practices and technology implementation as well as to facilitate their operations and cooperation. Following the directives of ECR-Europe, ECR Hellas launched projects on centralisation, product coding, pallet standardisation, efficient replenishment and implementation of EDI and CRP. Currently, the efforts of ECR-Hellas are centred on the implementation of cross-docking and CPFR (Collaborative Planning Forecasting and Replenishment).

The aim of the centralisation project was the creation of central warehouses by retailers to provide single delivery points for suppliers. Although some retailers still do not have a fully centralised system, the benefits and cost savings for suppliers are considerable. By delivering their products to a central warehouse rather than door-to-door they lose less time and can be more efficient and responsive to their customers. However, direct deliveries to stores may still be needed to handle product shortages or special promotions. But, as retailers open more small stores in town centres, this is becoming increasingly infeasible.

To further increase the efficiency of deliveries the members (and non-members) of ECR-Hellas have put considerable effort into product coding, one of the first projects of ECR-Hellas. It involved the creation of rules for the formation of unique product codes, based on the EAN/ITF standard. It also involved the specification of the exceptional conditions under which changes of product codes were allowed.

Besides the coding of individual products, the members of ECR-Hellas were also engaged in the coding of product cases and pallets. The objective was again the specification of rules for issuing unique pallet codes, again based on the EAN/ITF standard. Even though pallet coding was not implemented by all organisations, in general the project brought many benefits, including improved ordering and inventory management, as well as increased efficiency in the preparation of deliveries, and the loading and unloading of trucks.

Further benefits resulted from the unit load and pallet standardisation project, aiming at standardising the packaging of products in pallets, plastic cases or paper cases. This aimed at further improving inventory management through standardisation of pallet size and better exploitation of storage space. It also led to a reduction of the time needed for picking and packaging and consequently to a reduction of warehouse staff. Although the benefits are

considerable, some organisations still do not use the same standard (euro-pallet). Implementation of this initiative is difficult as it also requires the involvement of foreign companies that supply Greek suppliers and retailers.

These efforts facilitated the implementation of the efficient replenishment project, which addressed all the issues involved in the movement of products from the manufacturer to the retailer's point of sale (Pramataris *et al.*, 1997). This project aimed at maximising the efficiency of product replenishment along the value chain, reducing the cost of ordering as well as matching production to consumer demand. It was achieved through the close cooperation of both suppliers and retailers and was supported by technologies, such as computer assisted ordering, EDI and CRP.

Realising the potential benefits of EDI-based systems, ECR-Hellas put considerable effort into their implementation. Besides using them for the exchange of orders, invoices and payment information, the aim of ECR-Hellas was also to use them for the exchange of inventory information, needed for the application of CRP (Pramataris *et al.*, 1997). However, as will be described below, the lack of resources and technological awareness has impeded most companies, even members of ECR-Hellas, from proceeding with the implementation of EDI and CRP.

5.3 Implementation of EDI and CRP in the Greek market

The EDI-based systems implemented in Greece involve EDI orders, electronic invoices, PRICAT messages and CRP. Learning from the difficulties that other European countries faced, Greek companies, under the lead of ECR-Hellas, cooperated closely in implementing EDI. To avoid the problems of incompatibility as well as the proliferation of standards, they decided upon a common standard (EDIFACT) and a VAN provider (IBM). Nevertheless, they still faced difficulties due to the implementation of different versions of EDI and CRP.

> When we changed the version of CRP nothing was working, because we added new fields in the messages [Unilever – IT manager].

To increase the benefits gained by the use of EDI and CRP the members of ECR-Hellas have also tried to use the Internet, instead of a VAN, as the underlying means of communication. The main advantage expected by the use of the Internet was the decreased cost that would enable smaller companies to participate. However, it was soon realised that the establishment of a secure communication environment required the implementation of VAN services over the Internet. Acknowledging the limited added value of the Internet as well as the extra effort needed, Greek companies have, until recently, continued to implement and use VAN-based EDI and CRP.

At the time of the study, the companies that had implemented EDI in Greece comprised 12 suppliers and 4 retailers, while only a subset of these had also invested in CRP. The first company to implement CRP was Procter & Gamble (P&G), which also initiated CRP globally[28]. Influenced by their European parent companies as well as by trading partners and competitors, other companies have followed. These CRP implementations have either been outsourced or purchased from software companies[29].

As described in the previous chapter, CRP shifts the responsibility of ordering from the retailer to the supplier. In its most common form, the retailer's central warehouse sends an inventory report to the supplier, including stock availability, stores' orders and products in-transit. Based on this, and on an extensive history of product demand, the system at the supplier's side proposes an order. This order is checked by a CRP analyst who may make changes based on product promotions or other potential demand changes. The main objective is to minimise 'out of stocks' while keeping stock levels as low as possible. Ideally the flow of products is matched to the consumers' actual demand, yielding considerable improvements in production, logistics and inventory management. However, like all EDI-based systems, CRP also imposes constraints, especially for smaller organisations.

According to Unilever's IT manager, while the implementation of EDI takes approximately a month[30], the implementation of CRP requires much longer, including up to six months to build the necessary product demand history, as well as a month for additional testing.

> This period of time also depends on the competence and technological awareness of the customer [Unilever - CRP Analyst dealing with Carrefour].

Besides the time and effort needed for implementation, additional reasons were also mentioned as discouraging smaller companies from investing in CRP. These included the high cost of implementation and maintenance, problems of incompatibility with internal information systems, lack of technological awareness, and inability to perform the required business process reengineering, as well as inability to recruit CRP analysts (or users).

As the IT manager of Unilever stated "besides the companies that have not implemented CRP due to the lack of an appropriate infrastructure, there are also a few companies, especially retailers that have not invested in CRP either due to other priorities or due to reluctance to cede control of their orders". He further argued that "if a critical mass of

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[28] P&G designed CRP for its specific needs and then outsourced its implementation to IBM.

[29] However, the incompatibilities created were only restricted to problems of different versioning, since the same VAN provider and standard of electronic messages (EDIFACT) were used.

[30] This time includes the installation of VAN, the installation of EDI software, the setting of the message and the testing of the system.

companies implements the system, the ones that are still hesitant might probably reconsider. It is indicative that those that implemented CRP, after realizing its benefits, have not only accepted it, but also tried to implement it for all their products".

It should be additionally noted that CRP cannot provide benefits to all types of organisations.

> Macro[31] for example faces difficulties in the use of CRP system. This company is directed to merchants and does a kind of wholesaling, generating strange statistical data regarding product demand. In this case the order that the system suggests is not always optimal [Unilever-IT manager].

Therefore, the organisations that have implemented CRP comprise a limited number of large multinational suppliers and retailers, having the necessary technological awareness and resources. As will be demonstrated in the following section, these companies have gained efficiency, cost savings and improved cooperation with their trading partners.

5.4 Research findings

Influenced by their parent companies or ECR-Hellas, the four large multinational organisations (Unilever, P&G, AB and Carrefour) have implemented EDI and CRP since 1996. Following the suggestions of other members of ECR-Hellas, Atlantic also tried to implement CRP but, after several months of testing, the whole project was abandoned. From the organisations examined, only Selecta and Sklavenitis were not using IOS for their B2B transactions. However, as they were both successful organisations, they were also considered in this study of flexibility.

The findings concerning the impact of EDI and CRP technologies on the suppliers are presented first, followed by those concerning the retailers. In both cases the findings are juxtaposed with those of the organisations that are not using IT for their business to business transactions.

5.4.1 The impact of EDI and CRP on the suppliers

This section presents the findings involving the impact of EDI and CRP systems on the operations of Unilever and Procter & Gamble. It also considers the process of replenishment in Selecta S.A.

5.4.1.1 Unilever

Unilever is a large multinational company and one of the world's leading suppliers of fast-moving consumer goods. It was created in 1930 by the merger of the British soap maker Lever Brothers (founded in 1885 by William Hesketh Lever) and the Dutch margarine

[31] Macro is a retailer targeted towards merchants.

producer, Margarine Unie. The business has grown considerably since and the company prides itself on combining the entrepreneurial spirit of the founders with a caring approach to its employees and communities it serves.

Unilever has two parent companies - Unilever NV and Unilever PLC – which, despite being separate businesses, operate as a single unit with the same board of directors. Unilever operates in 150 countries with corporate centres in London and Rotterdam. It has an annual turnover of 47 billion euros and it employs 265,000 people, with 90% of managers locally recruited and trained. It has a large portfolio of popular brands, many of which are market leaders, including:

- Bertolli, Healthy Heart, Knorr, Lipton, and Ben & Jerry's (food)
- Axe, Dove, Lux, Pond's, Rexona and Sunsilk (personal care)
- Brilhante, Cif, Comfort, Domestos, Omo, Skip and Snuggle (home care).

Like its competitors in the highly dynamic FMCG market, Unilever needs to constantly develop new products, through research and development, and manage its brand portfolio carefully. It also has to balance the development of both global and local markets and has attempted to develop strong roots in these markets and first-hand knowledge of the local culture. This means tailoring products to different markets and anticipating the demand of different consumers.

In an industry characterised by low margins Unilever also has to focus on performance and productivity, implying searching for operational excellence, increased efficiency and reduced costs through innovation in process management and the implementation of new technologies. However, despite pruning its brand portfolio from 1600 brands to around 400, Unilever's financial performance has been lacklustre for many years and compares unfavourably with its arch-rival, Procter & Gamble.

Being part of a multinational, Unilever Hellas follows the policies regarding management practices and technological investments of the European Headquarters. However, as observed during the empirical work, instead of a highly competitive and stressful environment of a multinational, the company was characterized by a more sociable and collaborative working atmosphere.

Unilever Hellas is one of the leading companies in Greece as well as an early and important member of ECR-Hellas. As such, it contributed to most ECR projects, including product coding, pallet standardisation, efficient replenishment, implementation of EDI and CRP.

Issues of implementation and use of EDI and CRP in Unilever

Unilever was one of the first companies in Greece to implement EDI and CRP. As its IT manager argued, EDI was seen not only as a tool to support interorganisational operations, but also as a strategic initiative. Unilever was using two message types, PRICAT and electronic invoices. EDI orders were not implemented, because they were superseded by CRP.

Aiming at cost reduction and increased order efficiency, Unilever Europe urged its Greek subsidiary to implement CRP. The system, bought from a software company, was implemented in 1996. At that time, logistics and inventory management were supported by SMS (Space Management System), which was running in the company's central warehouse. A couple of years later, the company decided to implement a SAP R3 system to support forecasting, ordering and invoicing. The fact that these two systems were not integrated and did not interoperate with CRP necessitated human intervention and generated extra workload. The orders issued in CRP had to be re-keyed into SAP, while the orders issued in SAP were inserted in SMS through a batch process, the next morning.

The implementation of CRP did not lead to extensive organisational restructuring. Although the sales managers continued to be responsible for the same customers, their job was facilitated, since some of their activities were handled by CRP. The CRP implementation has also led to the creation of the new role of CRP analyst, based in the sales department. Besides technical skills, CRP analysts also needed to have market and logistics expertise. They were responsible for operating the system, checking the automatically produced orders and changing them when necessary. They worked closely with sales managers to optimise orders with regard to unusual demand, promotional activities and seasonal products. Due to their specialised skills and knowledge they were valuable to the company and difficult to replace. As the IT manager of Unilever stated, the structure of the sales department would further change, if many of their customers decided to implement CRP.

> If this happens, the new structure will be more efficient, since sales managers will not need to spend time in taking orders. They will have better control of orders and will be better able to manage the distribution and actual sales of products. A common policy for all customers will then also be facilitated [Unilever – Head of Sales Dept.].

Although, at the time of the study, Unilever was using CRP with just four large retailers (AB, Carrefour, Veropoulos and Macro), benefits were still noticeable, especially in the interaction of the company with these customers.

> All benefits of CRP will not be realised until there is a widespread adoption of the practices by our most powerful customers. However, we can still talk about improvements in our processes and cooperation with retailers that already use this technology [Unilever-IT manager]

Impact on the company

The usage of CRP starts with an agreement between Unilever and each customer, regarding the products that are going to be incorporated, the safety stock level of each product and the time in which an order should be delivered. Considering a detailed history of product demand and taking into account the retailer's inventory report (including the available stock, the stores' orders and the products in transit), the CRP system issues a suggested order. This order is then checked and, if needed, changed by a CRP analyst.

Although CRP has brought considerable benefits by optimising the process of ordering, it did not support all of the company's needs. The software itself had certain deficiencies, mainly because the system was not built in-house.

> CRP was not designed based on our specific requirements. Therefore, to be able to use it properly, we had to adjust some of our activities and practices [Unilever - CRP Analyst].

One limitation was that CRP did not identify potential mistakes in the customer's inventory report. This weakness was overcome by extra effort and time spent by CRP analysts in checking inventory data and detecting mistakes, such as omitted store orders or products in transit.

An additional limitation was that it could not retain a history of changes to CRP orders. Therefore, to keep track of their changes, the CRP analysts used Excel files, specifically developed for this purpose.

> We also use these Excel files, copies of CRP messages, to inform the sales managers regarding orders and product demand. The sales managers cannot be informed directly from CRP, since once the order is finalised it is automatically sent (through EDI) to our customer. Therefore, data is exported and saved under a different more easily processed format [Unilever - CRP Analyst for Carrefour].

Once finalised the Excel file was sent to the sales managers, who once again checked the order and typed it into the central office system (SAP R3). The finalised order was also changed in CRP (by the CRP analysts) and automatically sent to the customer.

> The fact that CRP is not integrated with SAP R3 facilitates the creation and exchange of the auxiliary excel file and allows for more possibilities of intervention [Unilever – CRP Analyst for AB].

However, the lack of integration between CRP and SAP R3 meant that the finalised order needed to be retyped into both systems.

> Since SAP R3 is not automatically updated by this electronic order, our sales managers have to do the required data entry, based on the Excel file. [Unilever - CRP Analyst for AB]
>
> The data entry conducted, both in SAP and CRP, does not only involve the risk of generating mistakes, but it also requires additional time and effort to be spent [Unilever – CRP Analyst for AB].

Even though the order process was not fully automated, CRP has still provided benefits, through considerable cost and time savings. By optimising ordering and reducing the time taken, CRP enabled Unilever to respond more efficiently to everyday situations. This improved responsiveness was also facilitated by an increase in the frequency of deliveries.

> By using CRP we became more responsive to our retailers' needs. Orders are optimized and handled more quickly, while, depending on the customer, products are delivered within 1 or 2 days, after the issuing of the CRP order [Unilever- IT manager].
>
> With CRP, the process of replenishment has become more efficient. As soon as we see that the stock of a product is decreased we replenish it so that a safety stock level is always kept [Unilever – CRP Analyst for Carrefour].

Besides the frequency of deliveries, CRP has also affected their management in general. Through the standardisation of ordering, products are always ordered in pallets or layers, while individual cases are added only when supplementary products are required. This has increased the efficiency of deliveries, leading to a considerable decrease in the cost and time needed not only for loading, but also for despatch.

> The standardisation of ordering has speeded up greatly the loading of trucks. We deliver full pallets and not many separate cases anymore [Unilever - Sales Manager for AB].
>
> The loading of individual cases and the creation of mixed pallets by our pickers require a lot of time, use much space in the warehouse and involve labour cost. This practice is still applied with customers that are not using CRP [Unilever - Sales Manager for Carrefour].

Through increasing the efficiency and frequency of deliveries as well as improving the monitoring of product demand, CRP has also contributed to the reduction of out of stocks.

> Prior to the system's implementation our customers or their stores could be left out of stock more often and for more days [Unilever-IT manager].

While reducing out of stocks, CRP has also enabled the lowering of safety stock levels.

> With CRP we managed to decrease the stock of our products in our customers by 15 days or more [Unilever- CRP Analyst for Carrefour].
>
> By keeping the stock low we have more flexibility to deliver extra products, e.g. for a promotional activity [Unilever – Head of Sales Dept.].

The decrease of safety stock levels and the exploitation of CRP's historical data regarding product demand have additionally improved Unilever's forecasting, planning and production management.

> With the detailed data regarding demand, provided by CRP throughout the year, we can improve our forecasts. For example, the data that we have regarding the sales in April, demonstrate the type and amount of products required to satisfy our customer needs in this specific month. Therefore, our production is rationalised, since we no longer need to produce products that we do not sell [Unilever-Head of Sales Dept.].

> The orders sent to our manufacturers are thus the result of an estimation based on the planning of sales combined with historical data taken from CRP [Unilever - Head of Sales Dept.].

As a consequence, Unilever's inventory was considerably decreased, leading to further cost savings (both due to the freeing of storage and cutting of the excessive stock) and contributing to improved inventory management.

> Through better stock management and utilisation of storage we can deal with unusual situations, like unexpected deliveries from manufacturers [Unilever-Warehouse manager].
>
> The money saved can be used for other activities, such as promotions [Unilever - Head of Sales Dept.].

Improvements in inventory management also resulted from the minimization of product returns from retailers. Under the CRP contract, retailers have to accept deliveries and product returns occur only in exceptional circumstances.

> Most of our customers have an upper limit on the number of products that they can accept daily in their warehouse, but this does not apply to CRP. Even if they exceed the number of products they still need to receive deliveries from CRP. Therefore, return of products is now rare [Unilever - Sales Manager for AB].

The handling of product returns is not always easy. If a delivery of these products is planned for the next day, they can stay in the truck or be temporarily put into a specific space in the warehouse. If not, they have to be unloaded and stored again. This is not only time consuming, but also complicated especially when the previous storage space is now occupied.

Nevertheless, the aforementioned improvements in inventory management would not have been accomplished without the SMS system, which has supported and automated most warehouse operations, such as the handling of incoming and outgoing goods, the storage of products, the preparation of deliveries and the picking.

> Before implementing SMS, we were wasting much more time in the loading of trucks and we could more easily lose pallets. There were once 220 cases of a specific product missing. We searched everywhere for many hours, because these products were already ordered and needed to be delivered. The cases were found a year later when all products were moved to a new warehouse. Even if you have CRP, in such cases, there is nothing that you can do [Unilever –Warehouse Manager].
>
> Without an efficient warehouse management system the benefits of CRP would not have been realised [Unilever- IT manger].

An additional and significant benefit of CRP is related to its impact on the work of sales managers. Prior to the system's implementation, they had to go to their customer's central warehouse to take orders. A warehouse middle manager (or a purchase manager) gave them a list with the stock of each product, based on which sales managers calculated the order quantity. They needed to consider consumer demand, offers, promotions and seasonal

variations, after which they issued a suggested order, based mainly on experience[32]. This order was then examined by the customer's warehouse (or purchase) manager, who could ask for an increase or most probably decrease the proposed quantities. Thus, a considerable amount of time was spent on these negotiations and the whole process could last for more than 2 hours.

This way of ordering is still used with customers that do not use CRP. In contrast, sales managers responsible for CRP customers no longer need to go to the retailers' warehouses to take orders. This process is now handled, more efficiently, by CRP analysts, while sales managers intervene only to add new products, organise promotional activities or handle unusual or urgent situations, such as the recall of problematic products. Although, in the beginning, sales managers thought that they would lose responsibilities, it turned out that their job has been not only facilitated, but also enhanced.

> When we heard that the process of ordering is going to be automated we thought that we will not be needed anymore [Unilever - Sales Manager for AB].
>
> The system cannot handle all situations and the intervention of the CRP analyst under the instructions of the sales managers is imperative. There is a dynamic in the market, new promotions, new product and changing consumer needs that the system cannot know or manage [Unilever –IT manager].
>
> Therefore, sometimes we still intervene to optimise the order generated by the system. For example, in case of a product's inflation, we know that the demand will increase disproportionately, since consumers buy more products while the price is still low. We thus suggest to our CRP analyst to increase the stock of this product e.g. from 10 to 30 days [Unilever - Sales Manager for AB].

Although CRP has automated part of the sales managers' job, it has brought considerable benefits to them. One of their main responsibilities prior to CRP's implementation was never to leave the market out of stock, while also keeping stock levels as low as possible. This was one of their main worries since, in order to prevent out of stocks, they preferred to increase the safety stock levels. However, in the case of excessive stock, they were not only accountable to their customer, but also constrained in distributing new products or launching new promotions.

> Some of our customers may not accept a new products or promotions, unless the stock of the older one is reduced [Unilever –Sales Manager for Carrefour].

With CRP they do need to worry about such issues anymore, since ordering is optimised. Furthermore, being less involved with the ordering process, their job became much more interesting. They now have more free time to deal with more important and intriguing sales issues.

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[32] Since 1999, this process was also supported by software installed in the sales manager's laptop. Although this software was generating more accurate orders, it has not decreased the amount of negotiations.

> Without CRP, we needed approximately 2.5 hours to prepare an order. We do not need to spend time on negotiations anymore [Unilever - Sales Manager for AB].
>
> These two hours that used to be spent in orders can now be spent in visiting 3 stores, building relationships with the people working there and negotiating issues such as better positioning for our products on the shelves [Unilever - Sales Manager for Carrefour].
>
> We also have time to work closely with our customer's purchase managers. The improved cooperation with them enables us to negotiate various issues and work better for the benefit of both companies [Unilever - Sales Manager for AB].

As the dynamics of the market change, their job becomes more demanding and spending less time on ordering is imperative to be able to handle their increased responsibilities. For instance, they have knowledge of the consumer but not of the shopper. They need to study in depth the role of the shopper and for this they need to spend more time in the stores.

> We are now able to stay more inside our customer's stores; we can concentrate in learning the habits and behaviour of the shopper, create attractive shelves and arrange promotions [Unilever - Sales Manager for AB].
>
> Sales managers can thus spend more time on "growth" perspectives rather than on the process of ordering, which is more mechanistic. Their job has evolved, and the part of their work that has to do with the demand side has become more sophisticated [Unilever - Head of Sales Dept.].

One of the main weaknesses of CRP is that it does not provide sales information from the stores but only from the customer's central warehouse.

> This can lead to a potential decrease in sales, since the system does not allow us to see if a product is out of stock in a specific store. Therefore, it is only through our merchandisers or at the bigger stores through our sales managers that we can notice such problems [Unilever- CRP Analyst for Carrefour].
>
> The benefits of CRP would be maximised if it gave information regarding product demand per store [Unilever - Sales Manager for Carrefour].
>
> Having this additional information we could even better identify mistakes, consider product shelving, plan promotional activities per store and increase sales [Unilever - Sales Manager for AB].

Even so, CRP still provides useful data for sales managers. The history of product demand data, built into CRP, provides valuable information regarding actual sales, seasonal products and fluctuation of sales during and after a promotional activity. Another useful source of information for sales managers is the inventory report sent every one or two days by the customer as well as the suggested order issued by the system.

> By using the inventory report and order data we can more easily deal with issues, such as the recall of problematic products [Unilever- Sales Manager of AB].
>
> Furthermore, the history of product demand facilitates our decision making regarding marketing of products, discount stickers and promotional activities [Unilever- Sales Manager of Carrefour].

The acknowledged benefits of CRP also improved cooperation between Unilever and its customers. By having the control of orders and gaining the trust of its customers, Unilever could also better handle changes in products or promotions.

> By having almost full control of orders we can deal with changes of products, discount stickers or promotions, without spending time on negotiations [Unilever - Head of Sales Department].
>
> Our customers' trust has increased. We cooperate better with them and follow a common policy regarding sales and promotions [Unilever - IT manager].

Although the benefits of CRP were considerable, some weaknesses in the interaction with retailers were still pinpointed. Unilever's CRP analysts still needed to deal with mistakes, which mainly occurred in inventory reports, either because the retailers' processes were not automated or because their information systems were not integrated.

> If there is a mistake in the customer's inventory report - e.g. if instead of typing 40 units they type 40 cases - we send the wrong quantity of products without being able to identify the error [Unilever - CRP Analyst for Carrefour].
>
> Every store sends product needs to the customer's central warehouse. In the case that the shop's information system is not connected to the one of the central warehouse, mistakes can be made. E.g. if a store's manager forgets to inform the warehouse regarding a product's shortage, the inventory report that Unilever gets is incomplete [Unilever- IT Manager].

Since the CRP software did not identify potential mistakes, CRP analysts had to spend much time checking the inventory report and order. Usually, these problems were dealt with through close cooperation with the customer.

An additional limitation of the CRP software, mainly because it was not built in house, was the lack of flexibility in the management of promotions.

> One of the system's weaknesses is that it does not allow us to temporarily replace a product code with that of a promotion and then change it back to the one of the product again. Each time we need to change the codes manually (e.g. from a product to that of the promotion) while also being very careful to adjust the safety stock levels accordingly [Unilever – CRP Analyst for AB].

The system itself was inflexible and restricted not only the sequence of activities but also the time when a specific activity needed to be performed.

> Based on a mutual agreement the customer knows when it has to send the inventory report and Unilever knows when it has to replenish the missing stock [Unilever - IT manager].

CRP's predefined workflow required that an EDI message containing the suggested order was sent back to the retailer so that both parties could agree on the order. Although this process was not necessary, since the customers normally agreed, it needed to be carried out for various reasons (e.g. for purposes of non-repudiation). Acknowledging the extra time needed for the delivery of this intermediary message, Unilever's CRP analysts preferred to

send a copy of the order in Excel format by fax. It was only when the customer agreed that they sent the final order by EDI.

> More advanced technology would mean less flexibility, since we would lose much time to send the EDI message, wait until the customer sees it and wait for him to send it back...By using the fax we spend less time on this typical but obligatory process [Unilever - CRP Analyst for Carrefour].

Another limitation was that once a proposed order was submitted, the system did not allow for any changes (e.g. add a forgotten promotional activity). In order to deal with such problems the CRP analysts either created a supplementary order (directly in SAP R3) or waited for the next CRP order to incorporate the missing products. In urgent situations they could also bypass the predefined workflow by cooperating with the customer.

5.4.1.2 Procter & Gamble

Procter & Gamble is the leading FMCG manufacturer worldwide. Established in 1837, the company began as a small, family operated soap and candle company in Cincinnati, Ohio, USA. Today, P&G sells approximately 300 brands to more than five billion consumers in 140 countries. The company employs 135,000 people worldwide, with its main headquarters still in Cincinnati and a regional headquarters in Europe.

Faced with similar challenges to those of Unilever, P&G has been more successful in terms of improving shareholder value and market capitalisation. Its success has been attributed to improved innovation, the scrapping of unsuccessful brands, its acquisitions and a reduction in bureaucracy.

Representing P&G in Greece, Procter & Gamble Hellas Ltd. was founded in 1960 and has grown to become one of the biggest consumer goods companies with more than 35 brands in similar categories to those of Unilever. These brands include Tide, Pampers, Ariel, Crest Always, Pantene, Wash & Go, Head & Shoulders, Oil of Olaz, Vicks and Pringles.

Procter & Gamble Hellas is also a leading member of ECR-Hellas, following the policies of its parent company regarding the establishment of new business practices and the implementation of new technologies. Procter & Gamble was the pioneer in developing CRP and the system, primarily designed and built in-house, was later outsourced to IBM.

Based on my empirical observations, the company seems to be characterised by a highly competitive and demanding working environment, where long working hours are commonplace. The company's policy is to employ people from different backgrounds and endow them with the company culture through training. Aiming for continuous staff development, the company requires that employees change position and even departments

every two or three years. Furthermore, most employees seem to be relatively young (early thirties) even middle and senior managers.

Issues of implementation and use of EDI and CRP in Procter & Gamble

P&G was the initiator of the CRP project globally. The system was at the beginning built in-house and later purchased and further exploited by IBM. Knowing the potential benefits, P&G persuaded other companies in the Greek market to invest in this system. Being the initiator of CRP, P&G not only had a good knowledge of the system, but also the requisite infrastructure and organisational structure to use it properly.

When CRP was implemented, most of the company's operations were supported by an information system built in-house on an AS 400. The other European branches of P&G were already using CRP and, to save time and money, the company in Greece decided to exploit the existing EDI infrastructure. As a result, the EDI messages containing customers' inventory reports were forwarded through gateways to the main EDI application in the central offices of P&G in France. After being decoded and translated these messages were sent via a leased line to the CRP system of P&G in Greece. The decoded EDI message was translated into an order, which was then checked by the CRP Analysts. When the order was finalised two messages were created: the first was sent to the customer and the second automatically inserted into the AS 400, where the order was queued for delivery. Therefore, the CRP system was fully integrated with the company's AS 400 information system.

In 1999 senior management decided to implement SAP R3 to support finance, materials management and warehouse management. However, due to a problem displaying Greek fonts, the ordering, billing and shipping of orders continued to be supported by AS 400. To resolve data inconsistencies in the two systems, in-house developed batch programs were run every night.

As in the case of Unilever, the use of the CRP system was operated by CRP analysts, who were not only trained to use the system, but also had knowledge of the market. These analysts assessed product orders and, if needed, made changes to include new products, promotional activities and unusual demand fluctuations.

For this new role, a different job description and an additional department were created. Although CRP Analysts were responsible for the customers' orders and therefore were part of the sales force, they were not based in the sales department, but in Customer Service, which was under the umbrella of logistics.

> Our aim and agreement with our customers is to keep their stock as low as possible and not to sell more products than the ones needed. We need to have a different

> philosophy than the one traditionally associated with a sales department [P&G- CRP analyst].

The sales department had also a slightly different orientation. It was called customer business development department, having as its main objective the close cooperation with customers in order to support their development. Believing that a company could be developed through meeting changing market needs and issuing new products, key account or sales managers worked closely with their customers developing mirror teams. As they argued, the development of customers was also contributing to the development of P&G.

Impact on the company

The use of CRP has facilitated and optimised the ordering process. It not only estimated accurately the quantity of products needed to cover demand, but it also provided valuable information to CRP analysts, who checked the proposed order and intervened to incorporate new products or promotions.

The positive impact on ordering was constrained by the technological infrastructure, consisting of two different systems (AS 400 and SAP R3) that did not interoperate. When a CRP order was finalised it was forwarded to the AS 400 (in the central offices) for billing the order. The order was also handled by the SAP R3 (in the central warehouse) to prepare the delivery. The fact that these two systems had inventory data, that differed during the day[33], sometimes limited the efficiency of ordering.

> While the AS 400 may show availability of products, we might not have them in the warehouse. As a result, we either delay the preparation of the order for delivery, or we send it without the missing products. Luckily, such problems do not occur often [P&G-IT manager].

Other problems or mistakes were rare and were usually caused by omissions of the persons engaged in ordering.

> Mistakes can be made not only from our part, but from that of our customers. For example, if an inventory report is sent without the inclusion of products in-transit, the quantity of products suggested in the CRP order will be larger than the one needed [P&G-CRP Analyst].

Such problems were usually resolved by the CRP analysts, who checked the order, before sending it to the customer. In P&G this was supported by the advanced CRP software, which had an additional feature that could highlight possible mistakes in the retailers' inventory report.

> For example, the system demonstrates product codes, which are missing from the retailer's inventory report. It also marks with a different colour either products that are

[33] It is only during the night that a batch process brings the two systems to an agreement.

> out of stock, without any products in transit, or products that have an excessive stock without any stores' orders pending. By pinpointing such unusual incidents, it enables us to quickly identify potential mistakes, such as product codes that are accidentally deactivated in the retailer's information system. [P&G – CRP Analyst].
>
> It also identifies unusual fluctuations in demand. For example, it marks products that show a considerable decrease of stock, corresponding to a larger demand than expected. By having this type of information we can think of ways to react. If the increased demand is attributed to a promotional activity, the safety stock of products may need to be increased. In contrast, if this difference in demand is caused by a mistake (e.g. products in transit are omitted), the stock of products may need to be left as is [P&G – CRP Analyst].

This extra feature was very important for CRP analysts to pinpoint potential problems in product codes, omissions or unusual changes in product demand. As they argued, without the system it was very difficult to find all possible errors.

By accumulating experience, CRP analysts could more effectively resolve problems or deal with abrupt changes in demand, even without the support of the CRP application. Therefore, the satisfactory handling of orders as well as the proper use of CRP required the involvement of well trained and experienced people.

> I wouldn't expect a company with an advanced CRP system to achieve all the desired benefits without the involvement of properly trained users (or analysts). CRP analysts need to develop an understanding of market needs, seasonal products, the causes that may affect product demand and the impact of promotional activities. This knowledge is accumulated by experience and requires time [P&G – Key account manager for Carrefour].
>
> As the IT manager of P&G argued, the benefits associated with the use of CRP were multiple and led to a considerable reduction of the time and cost needed for issuing and processing orders. Time was saved by the standardisation and automation of ordering as well as the exchange of electronic messages. Further time savings were also imposed by the contractual agreement between the retailer and the supplier, which stipulated the time that a CRP order needed to be issued, processed and delivered. Some orders are issued in the morning and need to be delivered to the retailer by 6 o'clock in the afternoon. In order to meet this requirement, we always give priority to CRP orders [P&G- Outbound logistics manager].

Besides considerable savings in the time spent on ordering, CRP has also brought significant cost savings. The ordering process was simplified and the costs related to administration, the issuing of the order, and the exchange of electronic messages, as well as the analysis of product demand, were decreased. In addition to the costs related to ordering, CRP has reduced the cost of inventory and storage.

> The cost savings are remarkable. It has been estimated that they correspond to the 0.5% of the average price of a case of products [P&G – CRP Analyst].

The standardisation and optimisation of ordering achieved by CRP have also affected logistics and delivery management. CRP retained logistics information for each product; that is whether a product was delivered in pallets or layers or cases, and calculated the quantity accordingly. It also corrected potential data input mistakes by CRP analysts.

> For example, Ariel (a fast moving product) is always delivered in pallets of 84 cases. Even if we type 1, the system will automatically change it to 84. This feature optimises ordering and decreases the risk of making mistakes when changing an order [P&G-CRP analyst].
>
> The optimisation of ordering and the conversion of product quantity to cases, layers and pallets decreases the time needed for the preparation and delivery of orders [P&G – IT manager].
>
> It also provides additional cost savings by facilitating and speeding up the loading and unloading of trucks and consequently decreasing the number of people needed [P&G –CRP analyst].

However, as the outbound logistics managers argued, all these benefits would only be maximised if all customers could use CRP and accept deliveries of products in Euro-pallets.

Besides increasing the efficiency of deliveries, CRP has also increased their frequency. The frequent and regular replenishment of products has led to a considerable reduction of out of stocks and a consequent increase of sales. This was also accomplished through the support of the CRP application, which identified potential shortages or out of stocks, based on the customer's inventory report.

> Our objective is to decrease the percentage of shortages per month to 0.5%. If out of stocks are avoided and there are always products on the shelves, our sales increase, since we do not lose potential buyers [P&G-CRP analyst].

Although the rate of out of stocks was diminished, the amount of products per delivery was reduced and the stock levels in customers' warehouses were lowered.

> With the use of CRP our annual turnover is increased not only because we avoid out of stocks, but also because we can ensure the right quantity of products at the right time [P&G – Head of sales in central Greece].

The reduction of safety stock levels has in turn allowed for a decrease of stock in P&G's central warehouse through the exploitation of the detailed history of product demand, provided by CRP, leading to improved forecasting, planning and rationalization of production.

> By being able to estimate product demand we do not need to produce more products than required [P&G – Head of sales in central Greece].
>
> The money that is no longer spent on excessive stock can be now used for other needs of the company [P&G-IT manager].

The freeing of storage has not only reduced costs, but has also improved the capability of P&G to deal with unexpected deliveries from manufacturers and to temporarily store any excess stock. Improvements in inventory management were also realised through the optimisation of ordering, leading to fewer product returns from customers.

An additional benefit of CRP was that it assisted the jobs of sales and key account managers, while providing them with valuable planning information.

> Before CRP, we were taking decisions regarding the amount of products to replenish based on the stock that we saw[34] in the customer's warehouse. We also had a rough idea about the quantities needed at the stores as well as the ones in transit, but we could not determine them precisely [P&G – Key account manager for AB].
>
> To prepare an order, sales managers had to spend a considerable amount of time in the customer's warehouse [P&G – Head of sales in central Greece].
>
> With CRP we save a considerable amount of time. We do not intervene in the ordering process and we only inform CRP analysts of new products or promotions [P&G – Key account manager for AB].
>
> CRP enables us to gather data regarding product demand from our customers. It thus enables us to monitor the distribution and sales of products over a long period of time [P&G - Key account manager for Carrefour].

The successful results of CRP have also improved P&G's relationships with its customers. The increased trust has allowed for a complete shift of the responsibility for ordering to the supplier. Having full control of orders, CRP analysts could adjust stock so as to better deal with changes in demand, the release of new products and promotional activities.

> By gradually reducing the stock of a product in order to replace it with a new one or a special promotion, we handle product changes more efficiently [P&G –CRP analyst].
>
> With the use of CRP, the distribution of new products in the market has speeded up [P&G – Head of sales in central Greece].

The handling of changes in products and promotions was also facilitated by the detailed history of product demand.

> Each time we need to organise a promotion, we look at the CRP's history to determine the potential change in demand [P&G –CRP analyst].

However, the use of CRP also imposed constraints, mainly related to the rigid workflow. Since the messages needed to be downloaded and processed by the CRP analysts, the day and time that they needed to be exchanged were predefined. In fact, the time that the retailer would send the stock availability, as well as the time and day that the supplier would replace the missing stock, were specified by contract. Therefore, in the case of last minute changes, CRP did not particularly help.

> After finalising and sending an order, we cannot make any corrections or changes, such as adding forgotten products or promotions [P&G-CRP analyst].
>
> The use of CRP does not help us to handle such situations, since it imposes constraints regarding the day and time of ordering and requires that an inventory report is sent before the order is issued [P&G –IT manager].

However, it was not argued that CRP constrained such changes, since it could be easily sidestepped. Situations like the one described above, were usually handled through human

[34] In this case misplaced products were difficult to identify and were not counted for the determination of the order.

intervention and close cooperation between the interested parties. As a CRP analyst argued, the actions taken differed depending on the situation.

> For example, after an order is sent, a purchase manager may call to ask for extra cases of one or more products. Our reaction may differ depending on the time that this change is requested. We don't usually cancel the CRP order to create and resend a new one, since this is very time consuming. We prefer to make changes to the order stored in the AS400, since this is the one that is actually going to be delivered. In this case, the customer is advised to change the order in their information system [P&G – CRP analyst].
>
> All these changes are not conducted by CRP, but through our internal information systems. I cannot argue that the CRP system is flexible, but instead we are flexible [P&G – CRP analyst].
>
> For instance, extra orders issued from the central offices are considered as urgent. They are given a higher priority and are processed quicker [P&G – Outbound logistics manager].

Through experience, CRP analysts learnt to deal with last minute changes and urgent situations. Mostly they ignored the predefined workflow of CRP and worked closely with customers to overcome problems. However, in certain situations, e.g. when the order was already prepared or when there were no extra trucks available, it was impossible to make any changes. In such cases, they usually had to wait for the next CRP order, and consequently the next delivery, to incorporate the extra products. As they argued, sometimes their slow response was not due to the rigidity of CRP, but to other factors, such as delivery delays.

> If one of our products goes out of stock, even if we issue a supplementary order right away, it will take at least two days until this product is delivered to the customer's stores[35] [P&G - CRP analyst].

5.4.1.3 Selecta

The company started as a small commercial store in central Athens, with the name of Hatziathanassiou Brothers Ltd, which imported spices from Turkey and other Asian countries. During the 60s, the store grew, developed commercial relations with Greek food producers and was transformed to a wholesaler of spices and other food products. With the vertical and horizontal expansion of retail business in the early 80's, the partner and current CEO, Mr. Hatziathanasiou foresaw the need to change the company's orientation. Since large supermarket chains had started to dominate the Greek market, forcing small local shops to close, there was no space for wholesalers of domestic products, whose profit margin was gradually falling. This triggered the reorientation from a wholesaler to a representative of large foreign food companies, offering high quality products. Offering high profit margins to its foreign partners compared to other Greek importers, the company has grown fast.

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[35] One day for the delivery of products from P&G to the customer's warehouse and a second day for the delivery from the customer's warehouse to the stores.

Since the 1980s, the company has quickly developed to a group of three food importing companies: Selecta S.A, Hatziathanassiou Brothers Ltd and Hatziathanassiou Ltd. They import packed and branded foods from many European, American and Asian food companies and distribute them to retail stores, restaurants and catering outlets. The most well known brands are Bali rice, Geisha tuna fish and Holco mushrooms, but they also import a variety of cheeses and other delicatessen products such as caviar substitutes. These products are sold through a wide sales network to customers in Athens and other large cities, and via two retail associations ELOMAS and ELOMIN to the rest of Greece. Customers include large supermarket chains, such as AB Vassilopoulos, Carrefour, Sklavenitis and Veropoulos, as well as fast food outlets like Goody's and Everest. The group's annual revenue reaches approximately 13.000.000 euros.

Although Selecta S.A. is a family owned local company it has managed to become an important supplier in the Greek market. The driving force seems to be the owner's (Mr. Hatziathanassiou) passion for commerce and marketing. As he argued, his success above all depended on "his ear to the market". He stayed continuously in touch with his customers exchanging valuable information, regarding market trends and new products. His prime intension was to find which products the market needed, search for high quality products, import them and sell them.

Being a relatively small company, Selecta lagged behind technological advances. The company lacked the resources to implement EDI-based or CRP technology and followed traditional ordering and replenishment. However, the lack of technology was counterbalanced by the hard work of employees as well as the establishment of close relationships with customers.

Processes of replenishment in Selecta

The company's operations were mostly supported by an information system handling finance and supply management. EDI-based technology was not used, since as the CEO argued, such an investment was never among their priorities. He further stated that the implementation of EDI, especially for sending PRICAT messages, was never considered to be beneficial.

> At the moment, when an agreement regarding the release of a product is reached, a fax containing the product's characteristics (such as barcode, invoicing code, weight, packaging, number of items per case and number of cases per pallet) is sent to the retailer. This fax contains similar information to the PRICAT message, except that it is not automatically inserted in the retailer's information system [Selecta –CEO].

He argued that such a system would bring more benefits to the retailers by reducing data entry and speeding up the update of their systems.

In contrast, he considered CRP to be much more useful in providing information regarding product demand as well as stock in their customers' warehouses. It would also give the company full control of the ordering process.

Since CRP was not implemented, sales managers had to visit the customers' warehouses to prepare the orders, usually on a weekly basis.

> In the case of AB our sales manager visits the central offices and arranges the order with four purchase managers responsible for specific product types. Each purchase manager presents his stock, based on which he has prepared an order. Our sales manager is responsible to check the order and, if needed, make changes. Usually changes involve either a small increase of the quantity ordered (often by ten percent) or a larger increase to incorporate a special promotion. The agreed order is written and brought to our central offices by our sales manager [Selecta –CEO].
>
> In the case of Carrefour the sales manager visits the central warehouse in Athens, while two of our representatives visit the warehouses in Thessaloniki and Crete. In the Athens warehouse an employee responsible for our products has already prepared an order. The sales manager again checks the available stock and the order and if required makes changes. In this case, changes may also occasionally involve incorporation of new products that have been forgotten. The agreed order is then sent to us by fax. Since their operations are not totally centralised, as in the case of AB, each warehouse sends its own order independently. The sending of faxes from the three warehouses helps us to keep control of the orders [Selecta –CEO].

Therefore, sales managers had to apply different practices depending on the needs of each customer. They spent a lot of time on the ordering process, regardless of how the orders were taken. Without any support system, it was their responsibility to prevent out of stocks, typically by increasing safety stocks in the customer's warehouse, which involved further negotiations with purchase managers. The only advantage of not using an advanced ordering system was that they could handle changes in orders, simply by making arrangements with purchase managers.

As the CEO stated, a system like CRP would standardise and automate ordering. It would also facilitate the work of sales managers, since it would enable them to control the orders better, preventing out of stocks, and giving them more time for marketing and promotions. CRP could also bring benefits from the history of product demand as well as information regarding orders and deliveries, which could improve forecasting and planning for imports, which were currently based on experience. They would also be able to handle issues, such as product recall better.

> By keeping a history of deliveries, we could easily find out to which supermarkets the defective products had been delivered and recall them as soon as possible [Selecta – CEO].

The CEO concluded by saying that the adoption of CRP would be in the company's interest, provided that its implementation and maintenance was not very expensive and did not require major changes in the company's structure. As he said, "the company at the moment

lacks the resources to implement such a technology". He not only pinpointed weaknesses in their technological infrastructure, but also the inability to train existing personnel to become CRP analysts. Therefore, although CRP seemed to be beneficial in the long run, the company had still to examine whether the investment was worthwhile.

None of his customers (retailers) had requested the implementation of EDI orders or CRP, although a few years earlier, Marinopoulos (before its acquisition by Carrefour) had asked for EDI invoices. Although this would have reduced the cost of invoicing significantly, nothing happened and it was never discussed again.

Instead, large retailers had asked for the coding of products and their delivery in pallets. Without the support of an information system, it was the responsibility of sales managers to convert the product quantities into pallets, layers and cases. Nevertheless, this project, implemented several years ago, had brought remarkable results in terms of cost savings and efficiency both in warehouse management and deliveries.

Regarding the frequency of deliveries, he mentioned that they did not have any flexibility, since they could only deliver to each customer on a specific day of the week. If something went wrong (e.g. a broken down truck) it was very difficult to change the delivery day.

> The prearrangement of a specific date for delivery has increased the efficiency of retailers' warehouse management, but has constrained our ability to send additional products or, if needed, delay or change the date of the delivery [Selecta-CEO].

In general, being a small company, they had to meet the requirements of their larger customers. One restriction they faced involved the number and nature of promotional activities that they could run.

> Promotional activities are agreed at the beginning of each year. They are planned based on the turnover of a specific product and usually correspond to 9% of it. We are obliged to run these promotions and sometimes that is not of an advantage to us, but we have no flexibility to change what is already planned [Selecta-CEO].

However, planning promotions in advance resulted in the more effective management of product ordering and deliveries.

> A few days before the promotion starts, the retailers order an increased quantity of products to cover the promotion [Selecta-CEO].

An additional restriction, pinpointed by the CEO, involved the distribution of new products. This depended on the relationships with the foreign suppliers but, even more so, on the relationships with the Greek retailers. He argued that:

> Larger suppliers (such as Unilever and P&G) have more flexibility in issuing new products, while smaller companies like us have to argue for the quality and potential demand for these products in order to place them in a supermarket chain [Selecta-CEO].

When a new product is released they notified customers by visiting their central offices. In larger supermarket chains it was usually the Commercial Director who presented the product, informed the retailers and persuaded them to accept it. The Commercial Director was chosen not only due to his status, but also due to the good relations that he had developed over time with the customers. The retailers usually needed a few days to evaluate the product in terms of quality, potential sales and profit margin.

If the product was accepted detailed negotiations began. The first stage involved the listing fee to be paid to the supermarket for accepting the product and this depended on the supermarket chain. This varied depending on the size of the retailer, as well as on the relationship with them.

> Although Sklavenitis is considered as a large chain, because we have been working with them for many years we have achieved relatively low listing fees. With AB Vassilopoulos we can make different arrangements, since they also accept free products instead of cash. This is to the advantage of both companies, since we lose less and the retailer gains more by selling the products. But Carrefour is more rigid, they only accept money and they usually ask for high listing fees. [Selecta-CEO]

However, sometimes good relations were not enough as various market factors determined whether a particular product would be accepted, continued or stopped. For instance,

> Although we cooperate really well with AB, after their acquisition of TROFO, we have been asked to stop supplying them with a specific product. The reason was that TROFO was already getting a similar product elsewhere [Selecta-Sales manager].

By being a small supplier, they had to comply with restrictions imposed by their larger customers. As they argued, the only way to cope with this was by importing high quality products and by having a flexible product portfolio. Each new product had a trial period, after which, if sales did not meet expectations, it was immediately withdrawn. Additionally, as the CEO argued, to justify a premium profit margin, they had to import products that did not compete directly with domestic ones.

The CEO stated that good relationships with clients were a key factor in Selecta's success. Being present when the contemporary giant stores and restaurants had begun to dominate the market had enabled him to build strong relationships with most of them. For example, his professional and personal relationship with Mr. Sklavenitis (owner of Sklavenitis S.A.) could be traced back twenty years, when that chain had just begun to expand. The same close relationships were maintained with the foreign suppliers. The CEO finally added that he was personally involved in the maintenance and further development of these contacts, since keeping such good relationships was vital for success.

5.4.1.4 Overview of findings for suppliers

The issues concerning the implementation, use and impact of CRP in Unilever and P&G are summarised in **Table 10**. This table presents the technological infrastructure of the companies, the interoperability between the different information systems, the use of CRP, the workflow of ordering as well as the operational constraints of the system. It refers to the standardisation and optimisation of ordering and mentions the time and cost savings provided by CRP. It presents the benefits of CRP in the management of deliveries, out-of-stocks and inventory, as well as showing its impact on the work of sales managers, relationships with retailers, release of new products, handling of promotions and changes in orders. It also juxtaposes these findings with those of Selecta S.A. that does not use CRP.

Unilever	**Procter & Gamble**	**Selecta**
Development of the CRP system.		
Bought from a software company. Had to adjust business processes to fit the system.	Designed and partly built in-house. Outsourced & further developed by IBM.	N/A
Implementations of other EDI-based systems		
PRICAT		None
Electronic Invoices		
Company's technological infrastructure		
SMS Warehouse System implemented in 1995 for inventory & delivery management. SAP R3 system supports forecasting, ordering, financial management and invoicing.	Ordering, billing & shipping supported by an AS 400-based system, built in-house. Financial, material & warehouse management by SAP R3 system implemented in 1999.	An information system in the central offices supporting finance & ordering.
Issues of interoperability		
SMS & SAP R3 do not interoperate. The SMS system is updated regarding new orders from customers or orders to manufacturers issued in SAP, the next morning. Inventory figures in the 2 systems need to be reconciled weekly. CRP is not integrated with SAP R3 or SMS. CRP orders have to be re-keyed into SAP.	SAP R3 and AS 400 systems do not interoperate. Data inconsistencies resolved by overnight batch run. CRP system fully integrated with AS 400.	N/A
The use of CRP		
CRP analysts, with market & logistics expertise, control/amend automatic orders.		N/A

<table>
<tr><th>Unilever</th><th>Procter & Gamble</th><th>Selecta</th></tr>
<tr><td>CRP analysts are based in the Sales Department</td><td>Based in Customer Service under Logistics.</td><td>N/A</td></tr>
<tr><td colspan="3">Workflow of ordering</td></tr>
<tr><td colspan="2">CRP issues a proposed order based on the inventory report sent by the customer.</td><td rowspan="2">The sales managers visit the customer's central offices or warehouse (depending on the retailer) and spend much time on negotiations to create the order.</td></tr>
<tr><td>CRP analysts produce an Excel copy of proposed CRP order to make any changes.
The Excel copy is sent to sales managers and typed in the SAP system.</td><td>The CRP analysts make changes in the CRP system.
The finalised order is automatically inserted into the AS400 system.</td></tr>
<tr><td colspan="2">The finalised CRP order is sent to the customer
CRP orders are given a higher priority than normal orders</td><td></td></tr>
<tr><td colspan="3">Operational constraints</td></tr>
<tr><td colspan="2">CRP system generally inflexible, based on a predefined workflow, restricting the day & time for specific operations (e.g. sending/receiving messages).
CRP requires the exchange of many electronic messages (proposed order, retailer response and finalised order). Some are omitted or sent by fax, e.g. Unilever's proposed order to be accepted by customer.
The CRP order depends on inventory data from the customer. If these contain mistakes, which are not discovered, the proposed order may be inadequate.
CRP requires specialised staff, difficult to replace.</td><td>N/A</td></tr>
<tr><td colspan="2">CRP does not provide information regarding the sales of individual stores. Out of stocks or sales problems at this level can be identified only by sales managers or merchandisers.</td><td>Merchandisers responsible for observing sales at store level.</td></tr>
<tr><td colspan="3">Optimisation and standardisation of ordering</td></tr>
<tr><td>CRP analysts check retailers' inventory reports for errors, omissions or odd demand patterns. The system does not facilitate this time consuming and difficult process.</td><td>CRP software helps to identify inventory errors, speeding up the work of the CRP analysts & improving order quality.</td><td>N/A</td></tr>
<tr><td colspan="2">The orders are standardised and the quantities rounded up in pallets or layers</td><td rowspan="2">The sales managers, in cooperation with the customer's purchase managers do the rounding up of products in cases, layers and pallets.</td></tr>
<tr><td></td><td>The system automatically corrects mistakes in the number of cases; for palletised products, this must correspond to full pallets.</td></tr>
</table>

Unilever	Procter & Gamble	Selecta
Time savings		
Reduction in the time needed to create & issue an order. Time savings from automation and exchange of electronic messages. Time savings by avoiding exchange of certain electronic messages (e.g. acceptance of order).		N/A
Time spent by CRP analysts on checking the inventory report sent by the retailers. Time needed for creating the Excel copy of CRP order, and entry into SAP R3.	Time savings from the capability of the CRP software to identify mistakes. More savings from integration of CRP with internal IS. Full automation of processes.	
Cost savings		
Decreased cost of ordering, inventory, storage and delivery. Savings can be used for other activities, such as promotions.		N/A
Delivery management		
Increased frequency of deliveries. They deliver 1 or 2 days after the CRP order is issued. The quantity per delivery is considerably decreased. Increased efficiency of deliveries. Standardisation of ordering (rounding up into pallets) has eliminated picking and speeded loading and unloading.		They deliver once a week, on a specific day that cannot be changed. They try to deliver in full pallets to save time and money.
Out of stocks		
CRP shows out-of-stocks in the customers' central warehouses. CRP has decreased 'out of stocks' considerably, contributing indirectly to an increase in sales		It is the responsibility of sales managers to prevent the occurrence of out of stocks in the customers' central warehouses.
	The system colour codes products that are out of stock or that show a sharp increase in demand, thus warning of potential shortages.	
Stock in customers' warehouses		
Decrease of stock levels in customers' central warehouses. Preservation of storage space and more flexibility for extra products and promotions.		They have to maintain higher safety stock levels, just in case.
Forecasting, planning and production management		
Product demand history, from CRP, contributes to improved forecasting, planning & production management. They do not need to produce products that are not needed.		Based on experience.

<table>
<tr><th>Unilever</th><th>Procter & Gamble</th><th>Selecta</th></tr>
<tr><td colspan="3">Inventory management</td></tr>
<tr><td colspan="2">Reduction of stock levels.
Freeing-up storage space to cope with unexpected deliveries from manufacturers.
Considerable decrease of product returns.</td><td>N/A</td></tr>
<tr><td colspan="3">Impact on sales managers</td></tr>
<tr><td colspan="2">They no longer need to go to the retailers' central warehouses to take orders.
Their responsibilities for eliminating 'out of stocks' and minimising stock levels in customers' warehouses is handled by the CRP system.
They have more time to spend in the stores, developing a better understanding of the market & initiating new sales ideas.
They are provided with valuable information for decision making and sales planning.</td><td>Sales managers spend more than two hours to take an order. They are responsible to control out of stocks and monitor product demand. They are responsible for converting quantities into pallets, layers or cases.</td></tr>
<tr><td>They still intervene with the CRP orders with regard to new products and promotions.</td><td>They do not intervene in the issuing of orders but inform CRP analysts of promotions.</td><td></td></tr>
<tr><td colspan="3">Relationships with retailers</td></tr>
<tr><td colspan="2">Better cooperation with retailers.
Increased trust. VMI leads to better handling of product changes and promotions.</td><td>The company had longstanding good relationships with traditional retailers, facilitated by personal efforts of the owner.</td></tr>
<tr><td colspan="3">Release of new products</td></tr>
<tr><td colspan="2">Better handling of product changes.
They have full control of orders and can adjust stocks to deal with the generated demand.
Through CRP they gradually decrease the older product stock & send the new one when ready.</td><td>Product release depends on customer relationships & market factors. If accepted, they negotiate a listing fee for the product.</td></tr>
<tr><td colspan="3">Management of promotions</td></tr>
<tr><td colspan="2">CRP facilitates promotion management by demonstrating the changes in demand.
It also provides valuable information regarding the results of previous promotions.</td><td rowspan="2">At the beginning of each year the customers specify the number and kind of promotions.
Advance planning encourages more effective management of ordering and deliveries.</td></tr>
<tr><td>CRP does not allow automatic changes for promotions. The CRP analyst has to change the code and specify potential demand. This takes time and allows mistakes.</td><td></td></tr>
</table>

<table>
<tr><th>Unilever</th><th>Procter & Gamble</th><th>Selecta</th></tr>
<tr><td colspan="3">Handling of changes</td></tr>
<tr><td colspan="2">CRP contributes to the understanding of changing market needs.
It facilitates product recall.</td><td>Since they are not using any specific system, they can conduct changes in orders by simply making arrangements with purchase managers. Nevertheless, they deliver products on a specific day within the week which is very difficult to change.</td></tr>
<tr><td colspan="2">CRP does not always help in handling changes or urgent situations but it can be easily sidestepped.
From experience CRP analysts/sales managers can identify mistakes/problems, as well as dealing with urgent situations.</td><td></td></tr>
<tr><td>Once a proposed order is submitted, the system does not allow for changes. The CRP analysts need either to create a supplementary order (in SAP R3) and send it by fax or wait for the next CRP order to incorporate the changes.</td><td>The handling of changes depends on the specific situation.
They can replace the CRP order with a new one, but it is time consuming.
They usually make order changes in the AS400 & notify the customer, or they wait for the next CRP order.</td><td></td></tr>
<tr><td colspan="2">The CRP system is not flexible, but people are.
Mostly they ignore the predefined CRP workflow and cooperate closely with the retailer.</td><td></td></tr>
</table>

Table 10: Summary of findings for suppliers

5.4.2 The impact of EDI and CRP on the retailers

Although the use of CRP has had a greater effect on suppliers, by shifting the responsibility for ordering to them, it has also had an impact on retailers. This section demonstrates the findings involving the implementation and use of CRP in AB Vassilopoulos and Carrefour. It also presents a case of CRP implementation failure in Atlantic S.A. The section concludes by describing the ordering process in Sklavenitis, a successful supermarket chain that did not use EDI-based technology.

5.4.2.1 AB Vassilopoulos

Alfa-Beta Vassilopoulos S.A. was established in 1969 by the Vassilopoulos brothers. Gerasimos Vassilopoulos, the main shareholder, started in 1939 in Athens with a traditional delicatessen in the centre of Athens. In 1950, a second store was opened and in 1970, the company built its first supermarket, considered at the time as the most modern in the Balkans. Since then, the company has developed quickly and expanded its market share through opening new stores throughout Greece. In 1990, the company's shares were listed on the Athens Stock Exchange and in the same year the company received an award from A.I.D.A. (International Organisation of Retailers) as the best super market in Europe for its new MEGA store.

In 1991, a majority share in the company was taken by the Belgian Delhaize Group. The company expanded further in October 2000, with the acquisition of Trofo S.A. and Ena Cash & Carry. This resulted in the creation of the second largest supermarket chain in Greece with 104 stores. Up until 2003, the company focused its attention on integrating the Trofo stores into its main chain and bringing the Trofo stores up to the level of AB.

Like its competitors, AB attempts to increase its competitiveness through improved service levels, an increased variety of high quality products at competitive prices, improved operational efficiency and increased responsiveness to consumers through the use of IT. Therefore, AB has a strong IT department and an advanced technological infrastructure, with most information systems built in-house. Being an active member of ECR-Hellas, AB was one of the first retailers to implement EDI and CRP.

Issues of implementation and use of EDI and CRP in AB

The company implemented EDI in 1995. Although most systems were produced in-house, the EDI software was bought from EDI-Hellas and the VAN of IBM was used to ensure compatibility with the suppliers' systems. The company implemented various EDI messages including orders, invoices and PRICAT messages. They approached several suppliers and tried to persuade them to use EDI-based systems. At first, only multinationals implemented EDI, with 15 suppliers using it by 2000.

One of the first EDI messages was PRICAT, by which suppliers efficiently informed AB's purchase department and warehouse of the characteristics of a new product. The exchange of these messages speeded up the issuing of products, reduced mistakes and affected the work of purchase managers. For example, one of their responsibilities was the administration of a

very large number of product codes[36]. This fairly complicated and time-consuming activity was partly supported by PRICAT messages.

> The use of PRICAT messages has speeded up the replacement or issuing of new products, has facilitated the management of product codes and has considerably reduced mistakes [AB-Purchase manager].

Another EDI message used by AB was the electronic invoice, which produced benefits, even though a paper based invoice had also to be issued for legal reasons.

> The electronic invoice is always received before the suppliers' trucks arrive at our warehouse. The warehouse's information system is automatically updated regarding the expected products (data entry is not required and mistakes are avoided). Therefore the checking of deliveries is speeded up and our productivity increases [AB-IT manager].

As AB staff argued, these benefits would be maximised if PRICAT and electronic invoices were implemented with a large number of suppliers. This would not only lead to increased efficiency of operations, but also to a saving in time spent in data entry and checking of data.

CRP was implemented a year or two after the implementation of EDI, with a few multinational suppliers. CRP was used by specialists in the EDP (Electronic Data Processing) department, who were responsible to send the inventory report to the suppliers and to download the final order[37], which was automatically inserted into AB's IS.

The effective use of CRP was also supported by the technological infrastructure, which enabled efficient product replenishment from AB's central warehouse to the stores. Most operations were automated through information systems built in-house. For instance, when products were scanned by the POS systems of stores, their stock level was automatically reduced. When stock reached a safety level, an order was automatically issued and sent to the retailer's central warehouse. Finally, when a number of orders from a specific store were collected, the warehouse's information system issued a picking list and a shipping invoice for the delivery to the store. It also automatically reduced the stock level in the central warehouse.

> The benefits of the efficient information system of AB are more important than those of CRP. Through our system we are able to monitor product stock and sales in all our stores. Our ability to see this information on the spot is more vital than the ability to inspect the orders to our suppliers [AB-Purchase manager].

Thanks to the technological awareness of the IT department, CRP was fully integrated with the company's internal IS. Although at first, AB's managers were afraid that they would lose

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[36] Purchase managers in AB are responsible for more that 1200 product codes each.

[37] Once created the supplier's proposed order was sent by fax to purchase managers to approve it. Since purchase managers did not usually disagree with suppliers' suggestions, this process was often omitted and the final order was sent without further delays.

control of orders, they soon realised the benefits of the system. CRP further increased the efficiency of ordering from suppliers, while also allowing for human intervention. Purchase managers could still adjust orders when needed but this happened rarely, since ordering was optimised and mistakes were eliminated.

> I believe that the process of ordering would not have been optimised without the use of a system, such as CRP. Human experience cannot replace the calculative capacity and efficient operations of an advanced information system [AB –IT manager].

CRP also led to considerable cost and time savings, enabling AB to decrease out of stocks, reduce stock levels, preserve storage space and improve inventory management.

> CRP has reduced the occurrence of out of stocks. By always keeping a safety stock level of products in our central warehouse we increased our ability to respond to changing stores' needs [AB – IT manager].
>
> By eliminating out of stocks, CRP decreased the risk of losing customers due to shortage of products in our stores. It thus increased our competitive advantage [AB-Purchase manager].
>
> While enabling us to meet consumers' needs, CRP helps us to keep the levels of stock low. The freeing of storage enables us to better handle situations like a sudden decrease in consumer demand or unexpected deliveries from suppliers [AB-Warehouse manager].
>
> The decrease of stock also gives us more flexibility due to the money saved. The money that was previously locked up in excessive stock can be now used for further investments, promotional activities and our own-label products [AB- IT manager].

Improvements in inventory management resulted, not only from the decrease of stock, but also from the standardisation of ordering, which forced suppliers to deliver all products in pallets. This brought further time savings by speeding up the unloading of trucks as well as facilitating the storage of products in the warehouse.

However, the efficiency in the reception and storage of goods also depended on the warehouse's information system as well as on the management practices followed. In order to provide better services to the end consumer the company followed a FIFO (First in First out) arrangement in the central warehouse. Based on this policy, AB never accepted products with a more recent expiry date than those already in the warehouse. As this feature was not supported by CRP, this meant checking the expiry dates when products were delivered to the warehouse.

CRP provided additional benefits to purchase managers, who no longer needed to spend time negotiating orders[38]. This responsibility was shifted to suppliers, allowing purchase managers more time to work on promotions and in-store management.

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[38] In contrast, the use of EDI-based orders does not offer any substantial changes in the work of purchase managers. It reduces mistakes and increases the efficiency of ordering, without affecting purchase managers' responsibilities.

> We do not have to worry about product ordering anymore. Before the use of CRP we needed to be able to determine orders for all products and all suppliers. This was a time consuming and difficult task. This activity is now conducted by suppliers' sales managers who are now responsible for managing the orders or checking the availability of products in the stores. After all, the sales of specific products are mostly for the benefit of suppliers [AB-Purchase manager].
>
> Before CRP, we were getting involved with ordering at least twice a week. Now everything is automated and data entry is eliminated. However, we can still intervene, for instance to add a promotional activity, but this happens rarely (once every two months) [AB-Purchase manager].

Therefore, the implementation and use of CRP considerably decreased the time that purchase managers spent on ordering. This time could then be used for more important activities, such as monitoring sales, handling promotions and negotiating contractual agreements with suppliers. Purchase managers were also able to put more effort into the sales and promotion of their own-label products, thus differentiating AB from other supermarkets.

> Luckily, it is very difficult for CRP or any other type of technology to replace all aspects of our job [AB-Purchase manager].

However, CRP imposed few constraints on purchase managers. These were mainly related to the handling of changes in product quantities or promotional activities.

> Sometimes we feel that we are constrained by CRP, when we need to make last minute or unscheduled changes to product quantities (e.g. to cover a special offer in specific stores). Luckily this may happen only twice a month [AB –Purchase manager].

In general, the constraints were limited and were mainly caused by the need to exchange messages at a prescheduled time and day. Additional problems were rare and were usually due to human error.

> For example, suppliers' CRP analysts may forget to include products for a promotional activity or people from retailers may fail to send their inventory report on time [AB-IT manager].
>
> In unusual or urgent situations the CRP system may need to be sidestepped and problems are usually solved through human intervention [AB-IT manager].

Problems with CRP have only arisen after the acquisition of TROFO and ENA. These problems were not related to system integration, since AB's IT staff quickly upgraded the information systems of the stores acquired, as well as incorporating them into the CRP order.

> We had the experience and know-how to deal with the expansion of the company. Being very well organised, we managed to set up the information systems of four stores per week. People working in these stores accepted the new technology and adapted to the different conditions of work very quickly. This was attributed not only to their training, but also to their personal motivation and willingness [AB-IT manager].

The new problems were mainly caused by the different business model of ENA, which decreased the ordering efficiency. This company performed a type of wholesaling,

generating a varied and uncertain demand, which was difficult for CRP to handle. Furthermore, due to their unfamiliarity with this market AB's purchase managers needed to spend a lot of time adjusting to the new business.

An additional problem arising after TROFO's acquisition was an increased difficulty in distributing new products. This complication mainly emerged due to the different layout and organisation of TROFO's stores. These changes, associated with the growth of AB through acquisitions, also affected the company's interaction with suppliers.

5.4.2.2 Carrefour

The Carrefour group was founded in 1963, when the first store opened in France, and it has grown over the past 40 years to become the second largest retailer in the world and the largest in Europe with more than 12,000 stores in 29 countries. The group's policy is to encourage the recruitment and training of local staff and management as well as the support of local suppliers.

Carrefour arrived in Greece in 1999, merging with Promodes and Marinopoulos[39]. In less than 2 years, Carrefour became the largest supermarket chain in Greece, with 140 stores. The hypermarkets have adopted Carrefour's trade name, including the older Continent hypermarkets, while most of the supermarkets have been renamed as Champion-Marinopoulos stores.

At the time of the study the company was striving to change from a group under Greek administration, to a larger multinational group, under French management, facing different management practices and different cultures. It was a transitional period during which the company had to cope with major organisational changes, a problematic technological infrastructure and a cumbersome organisational structure.

Issues of implementation and use of EDI and CRP in Carrefour

CRP was implemented during the first year of Carrefour's operation in Greece. At that time, the company's main operations were supported by four different information systems: the central offices, the central warehouse, Carrefour stores, and the older Marinopoulos stores. Most systems did not interoperate and updating of data was performed either manually or through exchanging electronic messages.

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[39] Since 1962, when the first supermarket was opened, Marinopoulos was one of the biggest supermarket chains in Greece. The French company Promodes entered the Greek market in 1991 with the opening of the first hypermarket (Continent) in Athens. The cooperation between Promodes and Marinopoulos started in 1993 and until 1999 numerous Continent hypermarkets have been opened in various different parts of Greece (Athens, Thessaloniki, Larissa and Krete).

> Being one company we shouldn't use all these different information systems. But, their acquisition and implementation were based on choices and decisions taken at various points in time [Carrefour – Warehouse IT manager].

The company implemented CRP without previously implementing EDI orders or PRICAT messages. They had tested the exchange of electronic invoices but this has not worked properly, mainly due to the lack of interoperability between the different systems.

CRP was also implemented as an independent system, without being integrated into the system of the central warehouse or that of the central offices. It was used by an employee responsible for the ordering process with Unilever and P&G. This CRP user checked the inventory report from the warehouse system, typed it into CRP, sent it to the supplier and waited for the proposed order. Once this was received, she mapped the product codes from the barcodes (specified in CRP order) to internal Carrefour codes. Additionally, she had to process the orders already delivered to the warehouse in order to update the inventory report regarding stock and products in transit.

Although not fully automated, CRP contributed to a reduction in the time spent on ordering. Since the responsibility was shifted to suppliers, purchase managers did not need to spend time in this process anymore. Additionally, by ceasing to be responsible for excessive stock or out of stocks, they could spend more time on the management of own-label and seasonal products. However, due to the different systems and the potential data inconsistencies, they still had to monitor changes of product codes (e.g. new products or replacements of product (mother) codes with those of promotions (sticker codes)). They also needed to check stores' orders for mistakes or accidental deactivation of products.

By increasing the frequency of deliveries from suppliers, CRP led to a reduction of out of stocks, at least in the central warehouse. It additionally led to a reduction of safety stock levels, bringing cost savings and contributing to an improved utilisation of storage.

> The decrease of safety stock levels was vital for our company, since we are suffering from limitations of space in our warehouse [Carrefour-CRP user].

Benefits in inventory management also resulted from the standardisation of ordering and delivery of full pallets, which speeded up unloading and storage. However, these benefits were constrained by the limited space of Carrefour's warehouse.

> Due to the limited storage space, we cannot always accept products delivered by our suppliers. Even when we accept them (usually products of suppliers that use CRP) we cannot always store them in the correct place and because of that we sometimes tend to lose them [Carrefour-Warehouse manager].

To circumvent these problems, certain products had to be delivered directly to stores but this could not work with the centralised CRP process. Nevertheless, after enlarging the central

warehouse Carrefour gradually increased the number of products that were again delivered centrally.

The benefits provided by CRP were also constrained by the inefficient technological infrastructure of Carrefour. The four incompatible information systems, supporting operations in various parts of the company, led to delays, data inconsistencies and mistakes in updating data. During the day, the different information systems exhibited differences in their data, since many tasks were conducted in each one system, while none was automatically updated from the others. It was only late at night, through sending electronic messages, or the next morning through human intervention that data was harmonised.

The data inconsistencies as well as the mistakes from manual updates also affected the use of CRP. For example, since PRICAT was not used, data regarding a new product or promotion had to be typed into the system of the central offices. The central warehouse system was updated the next day, followed by the systems in the stores a day later. Some stores' systems were updated through electronic messages late at night, while others were updated manually the next day. An additional complication related to product changes, was that the new Carrefour stores were informed by the central warehouse, whereas the old Marinopoulos stores were informed through the central offices.

> Due to this distribution of tasks as well as due to the required data entry in various parts of the company, mistakes can be made... Data inconsistencies in the different systems can further delay the release of new products [Carrefour – Warehouse IT manager].
>
> If all systems are not correctly updated with the code of a new product we cannot accept it in the warehouse [Carrefour-CRP user].
>
> Therefore, a CRP order containing a new product can only be sent at least 2 or 3 days after the issuing of its code [Carrefour- Warehouse IT manager].

Delays were also experienced because of the inefficient ordering of certain stores. Due to a shortage of staff, a person could be responsible for the orders of many stores, without being able to quickly respond to all their needs. Furthermore, certain stores did not have an automated ordering system and staff had to check the shelves in order to prepare the order. Again the order was typed in the stores' information systems and sent to the central warehouse the next day. This type of ordering could cause delays, omissions and mistakes (e.g. an unusually large amount of products accidentally typed or misplaced products not counted in stock) and could result in inaccuracies in the inventory report sent to the suppliers.

> Besides mistakes in stores' orders, additional reasons that may generate mistakes in the inventory report or may cause problems in the use of CRP, can be the following: pallets of products that have arrived in the warehouse but have not yet been scanned; an already delivered order that is still marked as pending; a new product code that has not been issued in all systems; a product code that accidentally gets deactivated in one

> of the systems (e.g. in Champion-Marinopoulos stores) and finally a confusion between mother and sticker codes [Carrefour-CRP user].

Mostly, such problems or mistakes were noticed from the unusual changes in demand, demonstrated by the inventory report (e.g. one day showing an increased product stock, whereas the next no stock at all). However, sometimes they remained unnoticed, causing inefficiencies in inventory management and product distribution.

> If in one of our stores' systems a product code is accidentally deactivated, the stores run gradually out of stock, without sending orders for this product. The excessive stock is thus assembled in our warehouse [Carrefour – CRP user].

As the CRP user argued, it was not the warehouse management system that caused these problems/inefficiencies, but rather the incompatibilities between the various systems, the increased workload and the limitations of warehouse space.

> We have changes in products, promotional activities and stickers on a daily basis from our suppliers. Trying to manage all these changes with an inefficient technological infrastructure, and without having sufficient storage space in the warehouse, creates difficulties, misunderstandings and mistakes that are sometimes hard to detect [Carrefour – Warehouse IT manager].

Further delays and mistakes arose because the ordering process was not fully automated, since CRP was not integrated with the warehouse system.

> Data entry was required both to update CRP regarding our inventory data and to update the warehouse system regarding the final order [Carrefour-CRP user].
>
> Our goal is to integrate CRP with the system of our central warehouse, to reduce the mistakes due to data entry, as well as to save time [Carrefour – Warehouse IT manager].

Even though many problems were encountered in the use of CRP, Carrefour wanted to implement it with as many suppliers as possible.

> We want to try it with other suppliers as well. We realise the potential benefits of CRP and we are thinking not only to further invest in it, but also in EDI and Web-EDI [Carrefour – Warehouse IT manager].

At the time of the study, Carrefour was in a continuous process of evolution and technological development. The central warehouse had been expanded and was about to start operations. The warehouse system was also due to be replaced by one used by Carrefour in Europe. Furthermore, a new system was implemented in Carrefour stores, while also tested in a few Champion - Marinopoulos stores. This system was expected to facilitate issuing product codes, improve promotion handling and automate the ordering process from the stores to the central warehouse. However, until all the different systems are integrated, many of the problems mentioned above will remain.

> Even though these changes are going to improve the efficiency of many operations in our company, problems occurring from the existence of different systems will still exist [Carrefour – Warehouse IT manager].

5.4.2.3 Atlantic

Atlantic was founded in 1980 by Panayiotis Apostolou and gradually expanded to 10 stores by 1990, when the number doubled with the acquisition of a small supermarket chain in Piraeus. Between 1992 and 1996 the company invested 44 million euros in new stores, the refurbishment of old ones and the reorganisation of its internal structure. It also expanded through acquisitions of smaller local supermarket chains, including Kypseli SA, Christopoulos SA, and Farma Tetras SA. By the end of 1997, Atlantic had integrated all its subsidiaries and by 2000 it was operating 118 stores with a turnover of 235 million euros and was also listed in the Parallel Market of the Athens Stock Exchange.

Since then, in the face of heavy competition from Carrefour, Atlantic continued growing through small acquisitions, plus an alliance with the French Intermarché, such that it now operates 183 stores, with assets of 454 million euros, and is recognised as one of the top five retailers in Greece.

Atlantic tried to increase its competitiveness through improving internal operations and enhancing services to consumers. Being a member of ECR-Hellas, Atlantic tried to follow the new management practices and technological initiatives, but these required an advanced supporting infrastructure, in terms of IT and well-trained staff.

At the time of the study the company's technological infrastructure was weak and the employees lacked the technological awareness to support the implementation and use of new systems. The company was striving to adjust to its increased size and significant emphasis was being laid on the development of IT and logistics. Much effort was also being put on the reorganisation of the central warehouse and the implementation of a warehouse management system.

Issues of implementation and use of EDI and CRP in Atlantic

Following Procter & Gamble's suggestion Atlantic implemented CRP and also attempted to implement EDI in order to exchange PRICAT messages with its trading partners. The fear of being left behind motivated Atlantic to invest a lot of money and effort in these implementations.

However, the lack of technological awareness, as well as the lack of an advanced infrastructure, precluded them from realising the benefits of EDI-based technologies. Since PRICAT was not integrated with the information system of the central offices, the data entry task remained, and thus PRICAT did not produce any added value compared to fax messages.

The first attempt to implement CRP was conducted in cooperation with P&G. This started in 1999 but 'training' the software to produce optimised orders and testing lasted almost eighteen months due to problems in collecting product demand data. At first, CRP was used on a weekly basis to gather a detailed history of demand but, despite considerable effort, many problems arose during this training.

The second attempt to implement CRP was conducted, a few years later, with Unilever. However, after a month spent on meetings for setting up the application, the CRP project was called off.

The problems associated with the use of CRP were mostly attributed to the lack of an advanced information system in the central warehouse. Without accurate data regarding stocks and orders from the stores, it was impossible to determine demand or issue a correct inventory report.

> Trying to implement CRP was a mistake, since there were many other things that needed to be handled first [Atlantic- employee responsible for CRP and EDI].

Further problems resulted because the inventory report was neither automatically issued nor produced from a single source of information. The CRP users had to combine information, including product stock, stores' orders and products in transit, in order to create the inventory report and then type it into the CRP. Data entry was also required for updating the company's information system with the final CRP order sent by the supplier. These processes not only caused delays, but also invited errors.

An additional problem was the need to recruit and train staff to use the system, create the messages (e.g. the inventory report) and do the required data entry. Lacking the resources to employ new staff, they had to engage existing employees to become CRP users.

> For them it proved to be very difficult to handle two different types of orders, the traditional ones and the ones that were supported by CRP. As a result in the beginning they resisted to use CRP [Atlantic- employee responsible for CRP and EDI].

Besides their increased workload, they also needed to spend time solving problems and correcting mistakes in CRP inventory data and orders.

Even though the use of CRP was problematic, some benefits were still realised. These were mainly related to cost savings from the limited reduction of out of stocks and the decrease in safety stock levels. The standardisation of ordering, and the delivery of products in pallets, also increased the efficiency of unloading and storing products in the warehouse. Nevertheless, all these benefits were still constrained by the lack of a warehouse management system.

Acknowledging that CRP's benefits could not be realised without improvement in their technological infrastructure, Atlantic decided to postpone all CRP activities until the implementation of their new warehouse management system.

> This is a very big and crucial project for our company. Therefore, we need to put all of our effort on it so that it succeeds [Atlantic- employee responsible for CRP and EDI].

5.4.2.4 Sklavenitis

Sklavenitis is a local family-owned company, considered to be one of the most popular supermarkets with Greek consumers. At the time of the study the company had 38 stores, most of them hypermarkets, in Athens.

The company's prime aim is not to increase profitability through cost-savings and improved inventory management, but rather through increased sales by attracting as many customers as possible. Therefore, rather than investing in new technologies in order to automate operations, gain efficiency, reduce staff and cut costs, it invests in improved customer service, while maintaining high product quality and low prices. The company pays considerable attention to creating attractive stores and providing high quality services to customers. While other supermarket chains cut costs through reduction of personnel in stores, the Sklavenitis philosophy is to employ people responsible for supervising and managing products' shelving, checking out of stocks, but most importantly assisting and facilitating customers in their shopping.

Through this policy, Sklavenitis has become one of the most successful supermarket chains in Greece. Although between 2000 and 2001, the company had a very difficult period due to the expansion of Carrefour, it managed not only to survive, but also to remain competitive. In 2003, Sklavenitis had the highest turnover per store compared to all other Greek supermarkets. Even with relatively few stores, the company recorded a profit of 21.5 million euros, an increase of 13.86% from the previous year. Sklavenitis also seems to cooperate closely with its suppliers and is an active member of ECR-Hellas.

The process of ordering in Sklavenitis

Being a successful company, Sklavenitis had the resources and ability to use more advanced technology. However, they only had an information system in the central offices and investing to EDI-based technology was not in their immediate plans.

> The implementation of EDI or CRP was not one of our priorities and this is the main reason why we haven't done it so far [Sklavenitis-IT manager].

Since the ordering process was not supported by advanced technology, the company followed traditional methods. Therefore, suppliers' sales managers visited Sklavenitis'

warehouse to create orders in cooperation with an employee responsible for that suppliers' products. In order to avoid out of stocks they had to keep an increased safety stock level but they didn't need to spend much time negotiating as they worked together effectively. This process was further supported by purchase managers responsible for planning orders and handling promotions.

Sklavenitis also encouraged its suppliers to deliver full pallets, which speeded up unloading and facilitated storage.

Even without the support of an advanced technological infrastructure, most operations ran efficiently and mistakes (e.g. in their orders to suppliers, inventory reports or stores' orders) were rare. The company was very well organised and most employees were able and motivated to deal with everyday problems.

> The will of employees to deal with problems arising is impressive and one that you do not normally see in other supermarkets [Unilever - Sales manager for Sklavenitis].

Staff in Sklavenitis attributed the company's success to the continuous effort made in providing high quality products to consumers. Besides applying extensive product quality controls, especially for fresh food, they also put much effort into creating a friendly and pleasant shopping environment. To improve customer service they have many employees in the stores arranging products on the shelves, checking expiry dates and freshness and generally assisting customers. From a different viewpoint, Sklavenitis's success was also attributed to the keeping of strong relationships with suppliers.

Furthermore, as people in Unilever and Selecta argued, Sklavenitis would soon need to expand its stores outside of Athens to compete with the constantly growing AB and Carrefour chains.

> The expansion of our company and the building of new stores is considered to be much more important than the implementation of technology [Sklavenitis-Accounting manager].

5.4.2.5 Overview of findings for retailers

The issues concerning the implementation, use and impact of CRP in AB Vassilopoulos, Carrefour and Atlantic are summarised in **Table 11**. This table presents their technological infrastructure, the interoperability between their different information systems, the use of CRP, the workflow of ordering and the handling of inventory data. It also demonstrates the time and cost savings that CRP provided as well as the impact of the system on out of stocks, the inventory management and the work of purchase managers. It finally presents the handling of the corresponding processes, without the support of CRP, in Sklavenitis.

AB	Carrefour	Atlantic	Sklavenitis
Implementation of EDI-based systems			
PRICAT, Electronic Invoices, CRP	Unsuccessful implementation of EDI invoices. CRP	Unsuccessful implementation of PRICAT and CRP	N/A
Company's technological infrastructure			
In-house developed systems in central offices, warehouse & stores. After the acquisition of TROFO and ENA, their IS were quickly upgraded, incorporating CRP.	Four separate IS (central warehouse, central offices, ex-Marinopoulos stores, new Carrefour stores).	Central office system, no warehouse management system.	Central office system.
Issues of interoperability			
All systems are integrated & interoperate. CRP fully integrated with central office system.	Most systems do not interoperate. Updating of data manually or by exchange of electronic messages. CRP not integrated with central offices or warehouse.	CRP not integrated with central offices system.	N/A
Workflow of orders from stores to central warehouse.			
Fully automated. Stock in stores is automatically reduced when products are scanned at POS. When safety level reached, an order is automatically sent to their central warehouse. Picking lists and shipping invoices automatically issued. The stock in the central warehouse is automatically reduced.	In the new Carrefour stores orders are sent to the central warehouse automatically. In all other stores, orders are created & sent manually. Manual orders may contain mistakes Lack of staff causes delays in ordering.	N/A	N/A

AB	Carrefour	Atlantic	Sklavenitis
Use of CRP			
CRP used by EDP users, responsible for checking all electronic messages.	CRP user responsible for creating & checking CRP messages.	Staff responsible for traditional orders also responsible for CRP.	N/A
Workflow of ordering			
EDP user initiates the sending of inventory report to suppliers. Order accepted by purchase managers (usually this activity is omitted). Final order automatically inserted into company's IS.	CRP user types inventory report into CRP system & sends it to supplier. Does the mapping of codes (from barcodes to internally used ones). Finalised order typed into warehouse management system by CRP user.	Staff responsible for CRP, create inventory report, type it into the system & send it to suppliers. They also type the final order into central office system.	Suppliers' sales managers visit Sklavenitis central warehouse to create order with a person responsible for suppliers' products.
Handling of inventory report data			
Automatically issued form warehouse management system and imported to CRP. Inventory report usually error free.	Automatically issued by warehouse management system. Errors in product stock due to misplaced products or products delivered but not scanned. May contain inaccuracies in store's orders. Errors in product codes or confusion between mother and sticker. Mistakes caused by data entry in CRP.	Manually produced from different sources of information. Errors in product stocks due to lack of a warehouse management system. Mistakes due to manual creation and data entry to CRP.	Although not supported by IS, mistakes are rare.

<table>
<tr><th>AB</th><th>Carrefour</th><th>Atlantic</th><th>Sklavenitis</th></tr>
<tr><td colspan="4">Time savings</td></tr>
<tr><td colspan="3">Time savings due to automation of order issuing.</td><td>N/A</td></tr>
<tr><td rowspan="2">More time savings due to:
Automatic sending of inventory data.
Automatic insertion of order into company's IS.
Further time savings due to the use of electronic invoices and PRICAT.</td><td colspan="2">Time lost in data entry for the inventory message
Time lost in data entry of order into the company's systems</td><td rowspan="2"></td></tr>
<tr><td>Time lost in finding & correcting mistakes in inventory report.
Time lost in updating the different systems regarding orders to suppliers, new products and stores orders.</td><td>More time lost in verifying inventory data to create the message</td></tr>
<tr><td colspan="4">Cost savings</td></tr>
<tr><td colspan="2">Decreased cost of ordering.
Decreased cost of inventory & storage.
Savings can be diverted to investments, own-label products or promotions.</td><td>Slightly decreased cost of inventory and storage.</td><td rowspan="2">N/A</td></tr>
<tr><td></td><td colspan="2">Fewer savings due to the need to deal with mistakes & problems.</td></tr>
<tr><td colspan="4">Optimisation of stock</td></tr>
<tr><td colspan="2">Reduction of stock levels.
CRP has decreased 'out of stocks' in central warehouse, giving retailers competitive advantage and reducing the risk of losing customers.
Safety stock levels increase retailers' responsiveness to changing store needs.</td><td>Limited reduction of out of stocks
Stock reduced but not optimised. Due to mistakes in inventory report, ordering not always optimal.</td><td>They have to maintain higher safety stock levels.</td></tr>
<tr><td colspan="4">Inventory management</td></tr>
<tr><td colspan="2">Better utilisation of storage.
Standardisation of ordering speeded up unloading and storage.</td><td rowspan="2">Gains in inventory management constrained by lack of a warehouse management system.
Unloading speeded up but storage delayed due to a lack of a warehouse management system.</td><td rowspan="2">They accept full pallets, speeding up unloading & storage.</td></tr>
<tr><td>Better handling of unusual situations e.g. sudden decrease of demand, unexpected deliveries or last minute promotions.
Delays and returns due to FIFO.</td><td>Limitations of central warehouse.
Problems in storage.</td></tr>
</table>

<table>
<tr><th>AB</th><th>Carrefour</th><th>Atlantic</th><th>Sklavenitis</th></tr>
<tr><td colspan="4">Impact on purchase managers</td></tr>
<tr><td colspan="3">They do not lose time preparing orders with sales managers.</td><td rowspan="3">Purchase managers still greatly involved in ordering.</td></tr>
<tr><td colspan="2">Responsibility for out-of-stocks shifted to suppliers
More free time for important activities, such as own-label products.</td><td rowspan="2">Spend much time solving problems & correcting mistakes.</td></tr>
<tr><td>Purchase/stores managers still intervene if changes needed e.g. promotions
Management of product codes, facilitated by PRICAT</td><td>Still engaged in the handling of product code changes.
Check stores' orders for mistakes.</td></tr>
</table>

Table 11: Summary of findings for retailers

5.5 Postscript

Since the empirical work was conducted some years before the completion of this thesis, it was deemed necessary to examine the current situation of the organisations regarding their use of technology at the interorganisational level.

Both Unilever and Procter & Gamble are using the same CRP systems with their customers as described above. Since the end of the fieldwork, they have participated in some projects involving the implementation of electronic markets, but these remain pilot systems.

AB is still using the same CRP system to interact with both Procter & Gamble and Unilever, but has also started to exchange electronic documents (orders and invoices) with smaller suppliers through a third party organisation (a software company).

Carrefour is also using the same CRP system, but, as was mentioned in the findings above, has gradually improved its internal infrastructure. Nevertheless, problems in the interaction with suppliers are still being faced due to their continual expansion in terms of new supermarkets, which adds to the pressures on their supply chain.

Atlantic and Sklavenitis are still not using CRP, but are about to start exchanging electronic messages with some suppliers through a third-party organisation.

Selecta is still not using any technology at the interorganisational level.

Therefore, although most of the above data was collected some years ago, nothing has changed significantly that affects these findings.

CHAPTER 6 - RESEARCH FINDINGS AT THE INTERORGANISATIONAL LEVEL

6.1 Introduction

The previous chapter presented the findings regarding the impact of EDI and CRP on the suppliers' operations. It described findings in two multinational suppliers (Unilever and Procter & Gamble), that have used CRP since 1999, and juxtaposed them with those of a smaller supplier that handled product replenishment by traditional means. The chapter also presented findings in four retailers, two of which (AB Vassilopoulos and Carrefour) used CRP, one (Atlantic) that implemented it unsuccessfully, and the last (Sklavenitis) that never used EDI-based technology.

Since the aim of this thesis is also to examine flexibility at an interorganisational level, this chapter describes the findings related to the impact of EDI and CRP on the cooperation of suppliers with retailers. However, it should be noted that some of the findings presented here have been also mentioned in the previous chapter. The main reason for this overlap is that certain results apply to both the organisational and interorganisational levels.

To emphasise the differences found in retailers, the chapter describes the interactions of suppliers with each retailer. From these very different findings, it is clear that the way that a company uses CRP also affects its cooperation with trading partners. Therefore, the benefits from CRP are not the same for each dyad, but are influenced by the use of information systems and the mode of operation of the interacting organisations.

6.2 Interaction of suppliers with AB Vassilopoulos

All suppliers agreed that their interactions with AB had worked well and there had been no problems using CRP, at least until 2001 when AB acquired TROFO and ENA. When CRP was implemented, AB had only 33 stores and, as both Unilever's IT manager and CRP analyst stated, the company was very "flexible" and could quickly meet suppliers' requirements (e.g. to accommodate changes in stock levels or accept frequent changes in products):

> AB was one of the most efficient and flexible customers that cooperated really well with most suppliers [Unilever –IT manager].

This view was also supported by the CEO of Selecta, who said that before the acquisitions, AB was one of the most competent retailers, with whom they had never faced problems in product replenishment, release and distribution.

> Once one of our new products was accepted, we could start delivering it to AB without delays [Selecta-CEO].
>
> Our business transactions (e.g. orders, product changes, promotions) were very efficient, since mistakes were not an issue with this retailer [Selecta-CEO].

The efficiency of the interaction between suppliers and AB was mostly attributed to the retailer's well-organised structure as well as to their staff's competence and professional expertise. It was also attributed to the efficient technological infrastructure, supporting fully automated product replenishment from the retailer's central warehouse to the stores.

> Operations in AB are supported by an advanced information system. This customer is very well organised and its purchase managers are very experienced and know their job [Unilever- CRP Analyst for AB].

Furthermore, since most of the systems were developed in-house, the IT staff of AB had both the knowledge and the capability to update and expand them to meet changing needs. Therefore, through software bridges, they were able to fully integrate both EDI and CRP with the company's internal information system. They were also able to develop a specific layout for the CRP system, facilitating changes in the exchange of messages, and the establishment of CRP with new suppliers.

> By changing a few parameters in the system's layout we can easily start exchange CRP messages with additional suppliers [AB-IT manager].

Therefore, AB managed to successfully implement CRP with both Unilever and P&G relatively quickly. As Unilever's IT manager said, the fast implementation and effective use of CRP was only feasible with highly competent partners like AB, which had the appropriate technological awareness and infrastructure.

By providing a fully automated operation, CRP brought considerable benefits, both to AB and its suppliers, at least for the first five years of operation. It optimised the process of ordering, by decreasing costs, making it more efficient, decreasing the time spent on negotiations and standardising product quantities.

> The process of ordering is speeded up... We do not lose time in correcting mistakes, since the customer's inventory report is always accurate...Our sales managers do not spend time on negotiations anymore....With CRP we became more responsive to our customer's needs [Unilever - CRP Analyst for AB].

The only limitation associated with the ordering process was the rigid workflow that CRP imposed. It not only restricted the day and time that the messages needed to be sent, but also determined the type and number of messages to be exchanged. Although certain messages (e.g. proposed orders for AB's approval) could be omitted, the predetermined time and day for the sending of all other messages could not be changed.

> We need to send the messages when agreed; otherwise the efficiency of ordering is lost [Unilever- IT manager].

Besides increasing the efficiency of ordering, CRP also considerably increased the efficiency of deliveries through the standardisation of ordering and the delivery in full pallets. It also enabled the increased frequency of deliveries.

> With CRP, products are ordered and delivered in pallets. This has led to a considerable decrease of the cost and time spent for delivery. We deliver full pallets – full trucks. A truck can carry up to 32 pallets and the time needed to load it or unload it is approximately 20 minutes. Prior to CRP usage and pallet standardisation, it took much more time to unload a truck, since people in the warehouse were taking products out case by case and checking them before storing them. This increased efficiency is beneficial both to us and to AB [Unilever-Sales Manager for AB].
>
> The increased frequency of deliveries also means that the amount of products per delivery is reduced [P&G – CRP Analyst].

The optimisation of ordering and the increased frequency of deliveries enabled both suppliers not only to decrease their safety stock levels, but also to eliminate out of stocks in AB's central warehouse.

> By delivering products every other day, we can better meet our customer's needs as well as better deal with changes in demand or occurrences of out of stocks [Unilever-IT manager].
>
> Without CRP we had to keep a stock of 30-35 days for most of our products in AB's warehouse. Now this stock has been decreased to 10 days. With CRP we can control the stock of all products and replenish them on a regular basis [Unilever-Sales Manager for AB].

The decrease of stock in AB warehouse brought considerable cost savings. It also allowed for better utilisation of storage space, enabling the suppliers to distribute new products and increase stock levels in the run-up of product promotions.

In AB, new products and promotions were supported by the exchange of PRICAT (price catalogue) messages, which automatically updated the retailer's information system. Therefore, mistakes in product or sticker codes were rare, and the number of orders rejected was limited.

> Changes of products are conducted more efficiently and the issuing of new products is speeded up. Mistakes are avoided and orders containing these products can be created without further delays [Unilever - Sales Manager for AB].
>
> We have never faced problems in promotions due to mistakes in sticker codes [Selecta-CEO].

The handling of changes in products or promotions was additionally improved by the shifting of the responsibility for ordering to suppliers as well as by the increased trust of AB's purchase managers with the results of CRP.

> When a promotional activity is about to end or a product is about to be replaced, we gradually decrease its stock and when it reaches three days worth of availability, we send an order for the new product [Unilever – CRP Analyst for AB].

Besides allowing for better stock control, CRP further facilitated the handling of promotions and special offers through the provision of a detailed history of product demand.

> By knowing the demand of previous promotional activities, we are able to better plan our promotions, offers and discount stickers [P&G – Key account manager for AB].

All these improvements have not only increased the efficiency of interaction between the suppliers and AB, but have also improved their relationships and cooperation.

> The elimination of mistakes as well as the successful results of CRP, made our customer to trust us more. Our cooperation improved and we do not need to spend much time on negotiations in order to handle orders, replacements of products or changes of promotional activities [Unilever - CRP Analyst for AB].

The interaction of suppliers with AB was further affected by the changes in the work of sales and purchase managers. Thanks to CRP, they have been freed from a considerable amount of mundane ordering work, allowing them more time to build and improve supplier-retailer relationships, to the benefit of each party.

> We work closely with AB's purchase managers not only to increase sales, but also to improve our service level to this customer and become more responsive to its needs [P&G – Key account manager for AB].
>
> We have more free time to focus on issues such as products shelving, discounts and presentation of promotions, which affect sales of both companies [Unilever – Sales manager for AB].

As AB staff argued, this improved cooperation enabled them to better deal with unusual or urgent situations that were not supported by CRP.

> In unusual situations such as problematic products, return of products back to suppliers or need to immediately order additional products, the use of CRP or of other EDI-based systems does not particularly help. In such situations, it is only through human intervention and cooperation with suppliers that problems are solved [AB – Purchase manager].
>
> The better our cooperation with the supplier is, the easiest these problems are solved [AB – Warehouse manager].

Even though AB was considered as a highly competent partner, there were certain limitations related to AB's internal IS and the company's management practices.

To gain more flexibility in the management of products and stickers, AB's IT staff created an additional field in the warehouse management system referring to product status. They used this to temporarily deactivate a product code and to allow stores to order directly from the suppliers, sidestepping AB's central warehouse. This gave AB extra adaptability to meet changing market needs, but added a level of complexity that sometimes led to mistakes.

> If accidentally the status of a product is changed, the stores might stop ordering from their central warehouse, but directly from us. Therefore, although products may have been already delivered to their central warehouse, they are not distributed to stores, which are temporarily left out of stock ... Through a different change of product status, the central warehouse may in turn also stop ordering it [P&G – Key account manager for AB].

Another constraint was related to AB's policy not to accept two different promotional activities for the same product in its stores.

> When we change a discount sticker with one of a bigger discount, we have to wait until the first gets out of stock before delivering the second one. Although this is facilitated through CRP, the policy of AB does not allow us to run two different promotional activities for the same product in the stores [Unilever – CRP Analyst for AB].
>
> The problem with this is that in other supermarkets we are able to launch a new promotional activity quicker since they do not need to wait for the previous one to run out [P&G – Key account manager for AB].

This policy was also reflected in the company's information system, which could not directly associate a promotional activity with a second one for the same product. Therefore, when a promotional activity finished, the system automatically switched the sticker code back to the one of the main product.

An additional problem for AB's suppliers was related to the FIFO (First In First Out) practice in AB's central warehouse. This prevented suppliers delivering products with a shorter expiry date than that of the ones in AB's central warehouse. AB's IS would not accept them and the products had to be returned. P&G faced this problem with its 'Pringles' but this was not serious as the expiry dates were usually 18 months ahead.

> Unfortunately, we still have to lose time to check the products' expiry date, since CRP does not help us in this. When we find a pallet with a more recent expiry date that cannot be sent to AB, we send it to another customer [P&G – Key account manager for AB].

This was a more serious problem for Selecta, which had fewer customers:

> AB's requirement to keep a FIFO order creates many problems for us since we cannot control all imported products. Sometimes we may receive 1 or 2 containers of products with a specific expiry date, which may include a few pallets with more recent expiry dates. Although we have repeatedly asked our producers to also follow FIFO practice, we have not managed to eliminate these problems. We do not only spend much time in checking the products that we send to AB, but also often end up keeping many products that cannot be delivered, in our warehouse [Selecta- CEO].

After much thought, Selecta realised that it was only when AB's warehouse ran out of stock, could they send products with a more recent expiry date. This tended to encourage out of stocks.

> It is a strange and definitely not a proper way of dealing with it, but we have to do it otherwise we end up losing much money [Selecta –CEO].

Additional problems between AB and its suppliers started after the acquisition of TROFO and ENA. AB rapidly expanded to 93 regular stores and 11 cash and carries, making its management more difficult and complex. Moreover, ENA was involved with wholesaling and further problems arose due to AB's purchase managers' limited knowledge of this side of the business.

> In the beginning they did not know either how often products needed to be replenished or the optimum quantity to satisfy demand, in ENA [Unilever-CRP analyst for AB].

The uncertainty in demand was so high that even the CRP system could not generate accurate orders, based on demand history. Demand varied considerably from one day to the next, leading either to out of stocks or excessive inventory in the central warehouse. Clearly AB had to find alternative ways to cope with this different kind of business.

> Although people in AB cooperated closely with us and had the will to make the system work, they were lacking the experience to deal with this novel situation. They suggested various ways for calculating the expected product demand, but nothing really worked. It was only through working together with us for some time that they realised that they had to double the safety stock level so us to confront this different fluctuation in demand. [Unilever - CRP analyst for AB].

An additional and very serious problem that arose after the acquisition of TROFO involved considerable delays in the distribution of new products. These delays were not IS or CRP related but were mainly caused by the increased number of stores of varying size. Finding space on the shelves for a new product was a relatively complicated process, especially for the smaller stores. Even though purchase managers tried to improve this process through creating shelving plans, the delays were still remarkable. If spare space could not be found, purchase managers had to consider retiring products, which occupied their time in analysis, and negotiating and renegotiating with their suppliers. This also affected the management of promotions, as well as the operation of CRP, since without a decision regarding the placement of products in the stores, an order could not be generated. But, the most important side-effect was that:

> AB loses adaptability to changing market needs. It also becomes less competitive since other supermarket chains are quicker in distributing new products in the market, while in AB, already advertised products may not be found in the stores [P&G – Key account manager for AB].

6.3 Interaction of suppliers with Carrefour

Although Carrefour was one of the largest supermarket chains in Europe, it was not one of the most competent and efficient retailers in Greece. Rather, many problems in its interaction with the suppliers were mentioned, mainly involving the first two years of Carrefour's operation in Greece.

> Carrefour is very slow in changes. This customer is generally inflexible [Unilever-CRP analyst for Carrefour].
>
> For example, a new product was about to be issued in the market. But people in Carrefour were not accepting it, since they still had excessive stock of the previous product [Unilever –Sales manager for Carrefour].

Carrefour's inefficiency was mostly attributed to its technological infrastructure, which at the time consisted of four incompatible systems (one in the warehouse, one in the central offices and two in Champion-Marinopoulos and new Carrefour stores). It was also attributed

to the company's complicated organisational structure, by which responsibilities were dispersed across the company. As a result, tasks like product sales, updating of product codes and data entry to the different systems, were conducted by numerous people in different parts of the company.

> We asked at some point information for one of our competitor's products. We asked for its annual turnover. Apparently it turned out to be a very difficult question, since the person that we asked (although cooperating closely with us) told us that he had to ask four or five different people [Selecta – CEO].

This inefficient technological infrastructure and organisational structure also affected the implementation and use of CRP. The implementation took longer than expected, due to the frequency of mistakes in the inventory reports from Carrefour and the difficulties in building a proper history of product demand. Furthermore, since CRP was not integrated with the warehouse management system, its use was not automated and data entry was required both for creating the inventory report message as well as for updating the warehouse's system with the order.

Even though, at an operational level, the use of CRP was inefficient, it still provided benefits in the interaction of Carrefour with its suppliers. Of all the suppliers, Carrefour seemed to cooperate better with Procter & Gamble, which used a more advanced CRP system, which facilitated the detection and correction of mistakes.

> Procter & Gamble is a very well organised and efficient company. As a result, we gain more benefits and face fewer problems when using CRP with this supplier [Carrefour – Warehouse IT manager].

On the whole, the use of CRP improved and speeded up the process of ordering and product replenishment. To a certain extent, it provided similar benefits to the ones described in the interaction of suppliers with AB, such as increased frequency of deliveries, decrease of out of stocks, and reduction of product stock, as well as cost savings to both parties.

> Suppliers deliver products either every day or every other day [Carrefour- CRP user].
>
> The service level of both suppliers has been improved for 99% of the stores' demand, while their product stock has been considerably decreased [Carrefour – Warehouse IT manager].
>
> Before starting CRP with Carrefour, some products had 23 days of stock and now they only have 6 or 7 [Unilever - CRP analyst for Carrefour].

An additional advantage was the standardisation of ordering and the delivery of products in euro-pallets. Since CRP did not accept customised pallets, individual cases or items, the time that suppliers needed to prepare and deliver an order was considerably reduced.

In contrast, suppliers that were not using CRP faced difficulties in delivering to Carrefour. Carrefour was the only supermarket that did not accept pallets created by manufacturers and sometimes had special requirements for the packaging of products.

> For example, a pallet of a specific product (e.g. mushrooms of 300gr) contains 144 cans as imported from the manufacturer. Carrefour accepts pallets of this product that contain no more than 30 cans. This is a very difficult and time consuming task for us, since for every product we have to remake its packaging. We do not know why they have these restrictions but they are very rigid and do not accept even the smallest variation [Selecta –CEO].

Besides the advantages associated with CRP, there were also many difficulties in the interaction of suppliers with Carrefour. The technological and structural constraints of the retailer, added to the lack of integration of CRP with the warehouse management system, tended to produce errors within the CRP. The inventory report sent to suppliers often contained inaccurate information regarding products in-transit, stores' sales and actual stock, hindering the issue of a correct proposed order.

> If the stock is not correct or if all stores' orders have not been incorporated in the inventory report (e.g. on Monday they forget to include the sales conducted over the weekend), we cannot satisfy our customer's needs. The proposed order calculated by the system is based on a false stock of products and may either result in out-of-stocks or to an excessive stock in the customer's warehouse [Unilever- CRP analyst for Carrefour].
>
> Sometimes, although the products are delivered to their warehouse, they forget to erase the corresponding products in-transit. Based on their inventory report we assume that the stock can cover the expected demand of more days and we send fewer products than actually needed. Such mistakes are occasionally found by comparing the report with the previous one. Through our intervention they are corrected and out of stocks are avoided [Unilever – CRP analyst for Carrefour].

Additional inaccuracies in inventory data were caused by delays in stores' orders.

> The fact that one person is responsible for many stores orders, may cause delays in the ordering of products and may lead to one or two days of out-of-stock in certain stores [P&G – Key account manager for Carrefour].

Carrefour's organisational and technological constraints also impeded and delayed the issuing and distribution of new products. Since the exchange of PRICAT messages was not supported by Carrefour's central office IS, updates regarding new product codes and characteristics had to be entered manually. This, combined with the subsequent data entry required to update the warehouse system and stores, caused errors and considerable delays.

> A code of a new product might be issued in the central office system, but not in that of the warehouse or in those of the stores. Sometimes product codes are pending for almost a month. The result is that we lose sales, since this product cannot be distributed properly to this supermarket chain [Unilever –CRP analyst for Carrefour].
>
> Without issuing a correct product code into their warehouse system they can neither accept the proposed CRP order nor receive the products in their central warehouse. Besides delaying the delivery of new products, this may also often lead to product returns to us [Unilever-Sales manager for Carrefour].

Normally, by using CRP, product returns should not occur, since retailers are supposed to check the order before delivery. However, trusting CRP's results and aiming to save time, Carrefour staff did not always check the proposed order. But, even if they did, certain things,

such as incompatibilities in product codes, could remain unnoticed. For example, product codes could be correct in the warehouse system but incorrect or missing from the stores' systems. Such mistakes could lead to out of stocks or excessive stock in Carrefour's warehouse.

> Sometimes, although a new product code is issued in the warehouse system, it cannot be seen by one of the supermarkets' information systems. In this case, although a product is delivered to the retailer's central warehouse, it is not distributed to the stores since they cannot order it [Unilever –CRP analyst for Carrefour].

Similar problems were also faced with older products when their codes suddenly became inactive in error.

> Issues of deactivations or replacements of product codes are usually conducted by mistake or misunderstanding of the people involved. They can lead to out-of-stocks, since either the customer's central warehouse or certain stores do not send an order for these products. These problems are solved through human intervention. When we identify them, we usually need 3 - 4 days to distribute the missing products [P&G-Key account manager for Carrefour].

This inefficient management of product codes in the various systems of the company also affected the handling of promotional activities, special offers and discount stickers. Sometimes promotions were delayed because one of the company's systems had not been updated.

> We often face problems with promotional activities that are delayed because their code does not exist in one of Carrefour's systems [P&G – Key Account Manager for Carrefour].
>
> One of our promotions could not start because the system of the warehouse in Thessaloniki was not updated. Luckily our representative in Thessaloniki noticed the problem first. Thanks to the good professional relationships that he has developed with people there, they managed to find the problem quickly and solve it [Selecta-CEO].

Further problems occurred because of the way that Carrefour managed promotions, discount stickers or banded pack offers. In their warehouse, each product had a specific place where its promotions were also stored. Due to space limitations, normally the product had to run out of stock before a promotion, discount sticker or special offer could be distributed in the market. If this was not feasible an extra place needed to be found. A new code was then issued for the offer (sticker code), which was placed under the code of the product (mother code). When the offer started, the mother code needed to be deactivated and replaced the sticker code (in Carrefour's warehouse management system). When the offer finished, the mother code needed to be activated again. Besides the risk of mistakes, the main problem was that one of the new Carrefour store's systems could only recognise mother codes and not stickers.

> This sometimes causes delays in the distributions and handling of offers. It also generates mistakes or problems that are difficult to identify and solve [P&G- Key account manager for Carrefour].
>
> A promotional activity was running for three months. Suddenly they stopped ordering the products. In the beginning we thought that there was an abrupt decrease in the stores' demand, but after a few days we suspected that something else might have happened. We realised that someone had accidentally deactivated the sticker code. This means that the products remain in the warehouse and cannot be distributed to the supermarkets [Unilever- CRP analyst for Carrefour].

Even more problems could arise when two promotions were running in parallel. This meant that two sticker codes had to be issued under the mother code. Further confusion resulted when products of both promotions had to be stored in the same place (the one of the main product).

> There was a banded pack product that was about to finish and be replaced by a discount sticker of the same product. When the banded pack product stock ran out, its code was not replaced with that of the sticker. While there were 2000 items of the discount sticker in Carrefour's central warehouse, the stores were out of stock because they continued to order the previous offer. Although we realised what had happened and notified them immediately, the problem remained unresolved for another 3 or 4 days [Unilever –CRP analyst for Carrefour].
>
> We had a special offer that was supposed to finish at the end of the month and another that was running out earlier. When the first offer was over, the second was also accidentally deactivated. This was again noticed by our merchandiser and it was the case of cooperating with the people in charge and making the needed arrangements to start the offer again [Selecta –CEO].

These problems were exacerbated by the cumbersome organisational structure, under which numerous people were responsible for the insertion of new product codes, as well as for the activation/deactivation of promotions or stickers in the different systems. They would sometimes forget to switch from one promotion to another or accidentally cancel a discount sticker already running. Finding the cause of the problem, the person responsible for it, and the system in which the mistake was made was sometimes very difficult and required the cooperation of different departments/sections of the company. As Carrefour's CRP user argued, delays and difficulties in problem solving were not only caused by the cumbersome technological infrastructure or the numerous people intervening in these tasks, but also by the increased workload. Therefore, problem solving often involved persuasion and negotiation with the people involved.

In order to circumvent Carrefour's inefficiencies, responsibility was shifted to the suppliers' sales managers, CRP analysts or merchandisers.

> Our sales managers have to make sure that the new product codes are issued on time to the retailer's systems, both in the warehouse and stores. They have to spend time in finding mistakes and solving problems [Unilever-Head of Sales Department].
>
> Problems in promotional activities or product orders are usually identified by CRP analysts who monitor product demand regularly. As soon as they see an abrupt

> increase or decrease in demand they realise that something is wrong and they notify the sales managers [P&G –Key account manager for Carrefour].

Suppliers that were not using CRP identified these problems through their merchandisers. However, more time was wasted, since problems were usually noticed when the stores ran out of stock.

> We usually realise these problems with the help of our merchandisers. They are responsible to check the availability of products on the shelves and if they notice any product out of stock they notify the store's manager right away. In the beginning, finding out why a product in the agreed list was missing was very difficult and required a lot of time spent on negotiations. However, by improving our cooperation with the stores' managers and gaining their trust, we have managed to identify and solve such problems more easily and quickly. As soon as we notify the store's director regarding a product shortage, he checks the information system and if the product code is inactive, he undertakes the responsibility to activate it as soon as possible [Selecta - CEO].

Knowing that such problems were likely, suppliers took a proactive stance and notified people in Carrefour regarding a new product, a discount sticker or a promotional activity well in advance.

> Each time a new product code is about to be issued, I personally inform the purchase managers, in order to make sure that they are ready to order the new product on time [Unilever-Sales manager for Carrefour].
>
> We inform stores managers at least 15 days earlier for changes in our products [P&G – Key account manager for Carrefour].

Besides the warehouse in Athens, CRP was also implemented in Carrefour's central warehouse in Thessaloniki. Although the warehouse management system was the same, the situation was very different to that of Athens.

> The problems are much less and they can be solved more easily. We have the flexibility to tell them that we cannot do something today, but we will do it tomorrow. It is the communication and collaboration with these people that is better than the one that we have with people in Athens. Same company, same policy, but different attitude [Unilever – CRP analyst for Carrefour].

The procedures in the central warehouse in Athens were very different, not only due to the problematic organisational structure, but also due to the increased workload and the limited space in the warehouse. All suppliers reported delivery problems and argued that the situation was extremely difficult until the end of 2000, when a major expansion to the warehouse was carried out.

> We once had to deliver products that were already out of stock in the stores. When the trucks arrived at the warehouse, the products were not accepted because there was no storage space. We had to rearrange the delivery for the next day but this led to another three days of out of stock [Unilever-CRP analyst for Carrefour].
>
> To circumvent similar situations, when large quantities of products needed to be delivered (e.g. for a promotional activity) we sometimes arranged to distribute them directly to stores [Unilever – IT manager].

> After the enlargement of the central warehouse, the ordering process has become more efficient, out of stocks have been eliminated and product returns became more rare [P&G – Key account manager for Carrefour].

Although the situation seemed to improve, problems were still faced, especially in interactions with smaller suppliers. The CEO of Selecta reported an incident demonstrating the effort that was still required to overcome the limitations of space.

> It was Friday and we had to deliver two trucks of products for a promotion that would start running on Monday. Our drivers arrived at Carrefour's central warehouse very early in the morning. They had been waiting for hours to unload the trucks when they were notified that the warehouse was full and no other products could be accepted. The situation outside the warehouse was chaotic, the atmosphere was tense and you could hear threats and shouts all over. More than 30 trucks of scheduled orders were sent back to suppliers, even trucks that were coming from outside Athens. We had to handle the situation very carefully. After calling and begging the warehouse manager we managed to get one of our trucks through. For the other one, we arranged a delivery the next day, which was a Saturday. Even though on Saturdays our company is closed we managed to make the required arrangements to deliver the products [Selecta – CEO].

Even though the central warehouse was enlarged it was still not sufficient to serve the number of stores, which had increased disproportionately. However, the larger suppliers, and especially the ones using CRP, did not face delivery problems. Due to CRP, products had to be replenished on a predetermined date and time and Carrefour had to accept the deliveries in its central warehouse.

Although the suppliers faced problems with Carrefour, the company was still one of their most important and powerful customers.

> Carrefour holds more than the 14% of our annual turnover. Even if inefficiencies in our transactions are encountered, we still have to notify them first for any new product or marketing activity [Unilever - Head of Sales Department].
>
> Although we are facing a few operational problems with Carrefour, it is our number one customer. Our turnover with them has doubled over the last two years. This company is getting better and better, its stores have been improved and it always sends us increased orders. They not only order many products, but they also do many promotional activities [Selecta - CEO].

As stated above, the suppliers found ways to improve their cooperation with Carrefour over time. This was either through accumulating experience and improving the handling of problems or through developing closer professional relationships and mutual trust. For example, the usage of CRP between Unilever and Carrefour gradually improved thanks to the collaboration between the supplier's CRP analyst and the retailer's CRP user.

> If we didn't have such a good partner, the problems in Athens would have been even worse. This person is very competent and motivated and helps us as much as she can [Unilever –CRP analyst for Carrefour].

> Through close cooperation with her we learnt over time not only how to better deal with the problems that arise, but also how to circumvent some of the technological constraints [Unilever - CRP Analyst].

Companies that did not use CRP, such as Selecta, also managed to improve their interaction with Carrefour, by putting emphasis on relationship building.

> Carrefour was one of the few supermarkets with which we faced problems. But we knew it and we were more cautious and alert when working with them. However, by getting to know people, sometimes offering gifts and trying to cooperate more closely with them, we have managed over the years to identify and solve problems more quickly [Selecta- CEO].

As Procter & Gamble's key account manager noted, interactions of suppliers with Carrefour have improved remarkably since the beginning of 2001.

> Our interaction with Carrefour has changed over the last year. While before we had to face difficulties in 10 issues now we are facing only 2 [P&G – Key account manager for Carrefour].
>
> The handling of promotional activities has also improved. Lately, the promotional activities are always very well organised and presented in the stores without problems. It seems that issues, such as delays or shortages of products are now only exceptions [P&G – Key account manager for Carrefour].

The CEO of Selecta added that, although a few years ago they faced considerable delays in issuing and distributing new products, now in 10, or at most 15, days a new product can be distributed to the market.

Carrefour's technological problems are also gradually diminishing, following improvements in their internal information systems. A new system is now used to support the main operations of their stores.

> Besides managing efficiently stores' ordering, facilitating the distribution of new products and reducing considerably out of stocks, the system also brought improvements in the handling of discount stickers and special offers [P&G – Key account manager for Carrefour].
>
> This system has been also implemented in Champion - Marinopoulos stores, but it is still in a testing phase and creates a lot of problems [P&G – Key account manager for Carrefour].

However, although the problems associated with the technological infrastructure of Carrefour have gradually been solved, there are still constraints arising from a shortage of personnel.

6.4 Interaction of suppliers with Atlantic

The pressure from competitors and suppliers made Atlantic proceed to changes and investments in new technologies, even in a period when the company was not ready. As mentioned in the previous chapter, Atlantic first implemented PRICAT EDI messages, but many problems arose, mainly due to the lack of integration between EDI and the internal IS.

The extra data entry required led to delays and mistakes in the issuing of new product codes and promotional activities.

Atlantic also implemented CRP, first with P&G and a few years later with Unilever.

> We will start our meetings for the implementation of CRP next week. The truth is that we are not very optimistic, since Atlantic does not seem to be ready for CRP implementation. Nevertheless, Atlantic already uses the system with P&G and we need to do that as well [Unilever-CRP Analyst].

With the implementation of CRP, the efficiency of deliveries was slightly increased, leading to a limited reduction of out of stocks and decrease of safety stock levels. Nevertheless, many problems were encountered since Atlantic did not even have a warehouse management system. This decreased the efficiency of inventory management and complicated the process of stocktaking. As a consequence, the inventory report, sent to suppliers, often contained mistakes.

> Inventory report data is based on stocktaking, which may often lead to mistakes, especially when products are misplaced or hidden by other products' pallets. Such mistakes constrain the efficiency of CRP, since they hinder the optimisation of stock and may considerably delay the process of ordering [P&G – Key account manager for AB].

Due to the lack of automation, all changes regarding product stock, stores' orders, products in-transit, new products and promotions had to be conducted manually. This caused further delays and invited errors difficult to identify and resolve. Further mistakes were generated due to the data entry required both for issuing the inventory report as well as for updating the internal information system regarding proposed orders. As a result, the efficiency of CRP was constrained, the order process was delayed and the handling of changes and urgent situations was hampered.

Additional problems arose due to the lack of specialised CRP personnel, with the tasks being performed by traditional ordering staff. Due to their increased workload, a lot of responsibilities for problem solving were shifted to suppliers.

All these problems and inefficiencies made Atlantic and its suppliers postpone the use of CRP until improvements could be made to Atlantic's technological infrastructure.

> We worked together for some time and tried to make the system work. But the implementation failed. This was however predictable, since the retailer did not have an adequate infrastructure [P&G - CRP Analyst].

As expected, this incomplete CRP implementation did not improve Atlantic's relationships with suppliers.

6.5 Interaction of suppliers with Sklavenitis

None of the suppliers reported problems in interacting with Sklavenitis. Although this retailer has not implemented EDI and CRP and most transactions were conducted in the traditional way, the processes of ordering, change and distribution of products were carried out smoothly. Furthermore, mistakes and delays in issuing new product codes, discount stickers and promotional activities were rare. Comparing these results to the case of Carrefour it seems that:

> Sometimes it is better not to use advanced technology rather than having a malfunctioning one [Selecta –CEO].

As various suppliers stated, Sklavenitis is very flexible in managing promotions.

> If they see that a promotion achieves high levels of demand they order more products at once, without waiting for the predetermined day of ordering [Selecta –CEO].
>
> Sklavenitis can accept two or more promotional activities for the same product, while other retailers, like AB, do not [P&G – Key account manager for AB].

Since Sklavenitis uses traditional ordering rather than CRP, out of stocks are more frequent. However, such issues can be handled easily, thanks to their good relationships with suppliers and the collaborative environment developed in the company.

> The increased number of personnel in Sklavenitis stores supports our work and that of our merchandisers. We cooperate closely with them to arrange product shelving, but also to quickly identify and solve issues like delays in promotional activities or out of stocks [Unilever – Sales manager for Sklavenitis].
>
> Issues of out of stock are handled very quickly since, rather than waiting for products to be delivered from their central warehouse, they can arrange to bring products from the closest store in order to satisfy needs at least temporarily [Selecta –CEO].

The only deficiency reported by suppliers refers to the double delivery scheme whereby suppliers' sales managers had to visit both the retailer's central warehouse and individual stores to take orders. Certain products were delivered to the central warehouse, while others (e.g. more perishable items) to the stores. Furthermore, at certain individual stores, suppliers needed to deliver all products directly.

> The door-to-door delivery causes us delays and makes the whole process more complicated. Although we do not have to pay a fee for delivering to their central warehouse, as with other supermarkets, still the loss of time is not to our advantage [Selecta – CEO].

However, this complicated delivery scheme often enabled them to handle better out of stocks.

6.6 Overview of interactions

The impact of CRP on the interactions of retailers with suppliers is illustrated in **Table 12**. For each retailer this table presents the implementation of CRP with the suppliers as well as the impact of the system on ordering, delivery management, stock management, issuing of new products and management of promotional activities. It also demonstrates the operational constraints of CRP as well as its effect on the handling of changes and the relationships between trading partners. Finally, it juxtaposes these findings with those involving the interactions of suppliers with Sklavenitis that did not use CRP.

<table>
<tr><th colspan="5">Impact of CRP on interactions</th></tr>
<tr><td colspan="5">General remarks</td></tr>
<tr><td>Ret.
Sup.</td><td>AB</td><td>Carrefour</td><td>Atlantic</td><td>Sklavenitis</td></tr>
<tr><td>Unilever, P&G and</td><td rowspan="2">Competent efficient & flexible retailer.
Good cooperation with suppliers until acquisition of TROFO and ENA.</td><td rowspan="2">Many initial problems with suppliers.
Initially very slow to change.
Enhancements to IS & infrastructure improved interaction with suppliers.</td><td>Many problems using CRP.
Delays in the identification and handling of mistakes.</td><td rowspan="2">Advanced technology not used, but no problems cooperating with suppliers.</td></tr>
<tr><td>Selecta</td><td>N/A</td></tr>
<tr><td colspan="5">Implementation of CRP</td></tr>
<tr><td>Ret.
Sup.</td><td>AB</td><td>Carrefour</td><td>Atlantic</td><td>Sklavenitis</td></tr>
<tr><td>Unilever and</td><td rowspan="2">Fast implementation. AB's technological awareness & competence contributed greatly.
By changing a few parameters, AB can easily start working with additional suppliers.</td><td rowspan="2">Implementation & testing took longer than expected, because of many mistakes in data exchange.</td><td>A month after implementation started, the project was abandoned.</td><td rowspan="2">N/A</td></tr>
<tr><td>P&G</td><td>Implementation and testing took 1 year.</td></tr>
<tr><td>Selecta</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

<table>
<tr><th colspan="5">The Process of Ordering</th></tr>
<tr><th>Ret. / Sup.</th><th>AB</th><th>Carrefour</th><th>Atlantic</th><th>Sklavenitis</th></tr>
<tr><td>Unilever and P&G</td><td colspan="2">The use of CRP is based on a predefined workflow, restricting the day & time of sending/downloading messages.
To save time, the exchange of some messages is omitted or, in the case of Unilever, handled by fax
In general, the ordering process is speeded up.
The ordering process is standardised. Product quantities specified in pallets.
Suppliers became more responsive to the customer's needs.</td><td>The orders issued were not optimal.</td><td rowspan="3">Suppliers' sales managers visit the central warehouse to take orders.
Order efficiency is restricted since orders need also to be taken from individual stores, where products are delivered directly.</td></tr>
<tr><td></td><td>Order process fully automated.
The orders issued are always based on accurate inventory reports.</td><td colspan="2">Data entry required both for creating the message containing the inventory report as well as updating the warehouse IS.
Inventory report usually contained mistakes (e.g. products in-transit are omitted) that were difficult to identify and resolve.</td></tr>
<tr><td>Selecta</td><td>Always round up product quantities in pallets</td><td>Needed to create specialised pallets to fit Carrefour's requirements.</td><td>N/A</td></tr>
<tr><th colspan="5">Delivery management</th></tr>
<tr><th>Ret. / Sup.</th><th>AB</th><th>Carrefour</th><th>Atlantic</th><th>Sklavenitis</th></tr>
<tr><td>Unilever, P&G and</td><td colspan="2">Increased delivery frequency. They deliver within 1-2 days after the CRP order is issued. The quantity of products per delivery is considerably decreased.
Increased delivery efficiency. The standardisation of ordering (rounding up quantities into pallets) has speeded up the loading and unloading of trucks.
Product returns eliminated; retailers obliged to accept delivery of CRP orders.</td><td>Increased efficiency of deliveries.</td><td rowspan="2">Suppliers deliver both to the central warehouse and stores.
This double scheme of deliveries causes delays & decreases supplier efficiency.
Deliver full pallets.</td></tr>
<tr><td></td><td>Inability of suppliers to keep a FIFO order in all products handicaps the efficiency of deliveries and causes product returns.
FIFO can be sidestepped if AB's warehouse runs out of stock.</td><td>Problems encountered due to limited space of Carrefour's older central warehouse.
Problems reduced after implementation of CRP.</td></tr>
<tr><td>Selecta</td><td>They deliver full pallets</td><td>Problems related to limited warehouse space remain.
Specific pallet requirements from Carrefour.</td><td>N/A</td></tr>
</table>

Optimisation of stock				
Ret. / Sup.	**AB**	**Carrefour**	**Atlantic**	**Sklavenitis**
Unilever and P&G	Reduction of stock in the customer's central warehouse (from 30-35 days to 10). Considerable decrease of out of stocks.	Reduction of stock in customer's central warehouse (from 23 days to 7) Decrease of out of stocks. Delays in stores' ordering due to limited personnel can lead to out-of-stocks in specific stores.	The lack of a warehouse management system and frequent mistakes in the inventory report hinder stock optimisation.	Since traditional ordering is used, the stock is not optimised and out of stocks are more frequent.
Selecta	Out of stocks in stores found by merchandiser. Efficiently handled through close cooperation of merchandisers or sales managers with store managers or warehouse manager.			
Release of new products				
Ret. / Sup.	**AB**	**Carrefour**	**Atlantic**	**Sklavenitis**
Unilever, P&G and	Efficient new product release facilitated by PRICAT. Mistakes in product codes eliminated. An order containing the new product can be issued without delay. Considerable delays in the distribution of products to stores after AB's acquisitions. These were caused by the increase in the number of stores of varying size, many having limitations of space on the shelves.	PRICAT not used; mistakes in issuing or replacing product codes. Many delays in issuing new product codes due to incompatible IS. A code might be issued in the central offices but not in the warehouse. Without correct codes Carrefour cannot accept CRP order or receive goods in warehouse, leading to returns. Sometimes, products delivered to the warehouse cannot be distributed to stores – e.g. when the stores IS not updated with new codes. Products can be pending for a month. Sales managers responsible to inform store managers of new product codes. Carrefour may not accept new product if previous product in stock. Release of new products speeded up over time.	Many problems with the use of PRICAT. Mistakes & delays in issuing new product codes.	Very efficient in changing or adding new product codes although they do not use advanced IS. Mistakes and delays in issuing new products very rare.
Selecta			N/A	

<table>
<tr><td colspan="5">Management of product or sticker codes</td></tr>
<tr><td>Ret.
Sup.</td><td>AB</td><td>Carrefour</td><td>Atlantic</td><td>Sklavenitis</td></tr>
<tr><td>Unilever, P&G And</td><td colspan="2">Potential problems identified by CRP system or noticed by the CRP analysts.</td><td rowspan="2">Changes conducted manually leading to mistakes.</td><td rowspan="2">N/A</td></tr>
<tr><td>Discount stickers etc rarely affected by mistakes in codes.
Extra product status field offers more flexibility. However, status errors may lead to accidental deactivation of codes or products ordered directly from stores.
When a promotion finishes, its code switches automatically back.
Inability to have different codes for promotions/stickers for same product.</td><td>Each product has a mother code and each promotion (a sticker code) under the product. When a promotion starts, sticker code needs to be activated, when it stops it needs to be deactivated and mother code reactivated.
Accidental deactivations often cause out of stocks.
Many people responsible to update codes in the different systems leading to delays and mistakes, difficult to find and correct.
Code problems solved through cooperation between supplier & retailer.
After correcting code mistakes, 3-4 days needed for product distribution.
Responsibility shifted to sales managers and CRP analysts.</td></tr>
<tr><td>Selecta</td><td colspan="2">Problems in product codes identified by merchandisers. This causes further delays as products are already out of stock in the stores.</td><td>N/A</td><td></td></tr>
<tr><td colspan="5">Management of promotional activities.</td></tr>
<tr><td>Ret.
Sup.</td><td>AB</td><td>Carrefour</td><td>Atlantic</td><td>Sklavenitis</td></tr>
<tr><td>Unilever, P&G And</td><td colspan="2">CRP facilitates management of promotions by demonstrating demand changes.
It also provides valuable feedback regarding previous promotional activities.</td><td>Difficulties in promotions due to errors in CRP</td><td rowspan="2">Very flexible in managing promotions.
Multiple promotions for the same product can run in parallel.
Supplementary orders made when promotions achieve high demand.</td></tr>
<tr><td>Selecta</td><td>AB does not accept two different promotions for the same product.
Suppliers must wait for a promotion to get out of stock before sending a new one, while other supermarkets are more flexible.</td><td>Sometimes promotions cannot start due to product code problems.
A product needs to run out of stock before a promotion starts.
Difficulty changing from one promotion to another.
Promotion handling improved over time.</td><td>N/A</td></tr>
</table>

<table>
<tr><th colspan="5">Relationships</th></tr>
<tr><th>Ret.
Sup.</th><th>AB</th><th>Carrefour</th><th>Atlantic</th><th>Sklavenitis</th></tr>
<tr><td>Unilever and P&G</td><td colspan="2">Better cooperation. They do not need to spend time in negotiations anymore.
Sales managers spend more time with customers' purchase managers to set common strategies to increase sales and improve service levels to consumers.
Increased trust. Responsibility of ordering is shifted entirely to the supplier.
Better cooperation with P&G that uses a slightly more advanced CRP system.</td><td rowspan="3">Incomplete implementation of CRP did not allow improved relationships with suppliers</td><td></td></tr>
<tr><td rowspan="2"></td><td>Close cooperation between CRP analysts and Carrefour's CRP user facilitates problem solving.</td><td></td></tr>
<tr><td>All suppliers</td><td>Despite problems, Carrefour still a key customer. Therefore, suppliers put effort in building relationship & improving service levels.
Cooperation improved, not only due to improvements in Carrefour's technological infrastructure.</td><td>All suppliers cooperate well with Sklavenitis.</td></tr>
<tr><td>Selecta</td><td colspan="2">The building of close relationships, facilitated by the owner, is considered imperative for improving cooperation with retailers.</td><td>N/A</td><td>The company had longstanding good relationships with Sklavenitis.</td></tr>
</table>

<table>
<tr><th colspan="5">Handling of changes</th></tr>
<tr><th>Ret. / Sup.</th><th>AB</th><th>Carrefour</th><th>Atlantic</th><th>Sklavenitis</th></tr>
<tr><td>Unilever, P&G and</td><td colspan="2">Changes of products and promotions are more efficient and simpler. When a product is about to be replaced or a new promotion started they gradually reduce the amount of older products to send the new ones when ready.

Responsibility for ordering shifted to the supplier, enabling better handling of products' changes and promotions.

Changes facilitated by improved cooperation between suppliers' sales managers and retailers' purchase managers.

Better utilisation of storage space and more flexibility to deliver extra products or arrange promotions.

In urgent or unusual situations, such as damaged products, returns or supplementary orders, CRP does not particularly help. However, it neither constrains since it can be easily sidestepped.</td><td rowspan="3">The problems with CRP caused further delays in handling unusual situations.

To handle changes CRP is sidestepped</td><td rowspan="3">The handling of unusual or urgent situations is facilitated by increased staff in the stores and supported by close cooperation with suppliers.

The lack of an advanced IS facilitates handling changes, allowing staff to find ways to overcome issues, such as out of stocks – e.g. simply by bringing products from a store nearby.</td></tr>
<tr><td></td><td>When AB acquired ENA, many problems with using CRP. The large and frequent fluctuations in demand caused by ENA's wholesaling could not be efficiently handled by CRP.

This was solved through close cooperation between suppliers' CRP analysts & AB's purchase managers.</td><td>Many problems changing product codes.

Responsibility shifted to sales managers, CRP analysts and merchandisers. They act proactively –informing the retailer well in advance regarding changes.

The handling of urgent situations was restrained by the limited space in the company's central warehouse.</td></tr>
<tr><td>Selecta</td><td></td><td>The handling of changes has improved over time, not only due to improvements in Carrefour's infrastructure and organisational structure, but also due to the accumulated experience of the people involved in ordering.

Limitations in handling changes remain mainly due to staff shortages.</td></tr>
<tr><td></td><td colspan="2">Changes or difficult situations (such as inability of Carrefour's warehouse to accept products) are handled though close cooperation with retailers.</td><td></td><td></td></tr>
</table>

Table 12: The impact of CRP on the interactions between retailers and suppliers

6.7 Concluding remarks

This chapter presented the impact of EDI and CRP on the interaction of suppliers with retailers. It showed that CRP increases the efficiency of ordering, as well as the frequency of deliveries. It facilitates the loading and unloading of trucks and contributes to an improved utilisation of storage space. It shifts the responsibility of ordering to suppliers, facilitating the handling of promotions and distribution of new products in the market. It finally improves the cooperation of trading partners by increasing the trust of retailers and suppliers.

Even though there are many benefits at an interorganisational level, the use of CRP also has certain constraints. CRP imposes a predefined workflow of activities predetermining the day and time for the exchange of messages. It also requires the exchange of intermediary messages (e.g. sending of proposed order and acceptance of order), which might be omitted, depending on the organisations involved. Therefore, in urgent or unusual situations, that require supplementary or last minute orders, CRP does not particularly help. However, neither does it constrain, since it can be easily sidestepped.

As this chapter further showed, the benefits or constraints of CRP depend on the competence and efficiency of trading partners. Of all the retailers, Vassilopoulos was characterised as the most efficient and technologically aware. It was an "ideal" customer, with whom the implementation of CRP ran smoothly, the process of ordering was fully automated and the handling of product changes or promotions was conducted efficiently. However, problems started after its acquisition of TROFO.

Conversely, many problems were identified in the interaction of suppliers with Carrefour. The incompatibilities between the retailer's different information systems, with the consequent extra data entry, led to mistakes in orders, delays in distribution, and problems in handling promotions and product changes. These problems were exacerbated by the space limitations of the retailer's central warehouse, as well as by its cumbersome organisational structure. However, these inefficiencies have been improved over time, mainly through the enlargement of the central warehouse, the acquisition of new software, the upgrade of older systems and the close cooperation between suppliers' sales managers and CRP analysts and Carrefour's staff.

More serious problems were reported in the interaction of suppliers with Atlantic, which implemented CRP without an efficient warehouse management system or specialised staff. As a result, data entry was not reduced, mistakes in inventory reports were frequent, and the handling of promotions and product changes was not facilitated. Consequently, although considerable effort was put into the implementation, testing and training of the system, the results were not satisfactory and the project was abandoned.

In contrast, few problems arose between suppliers and Sklavenitis. Although this retailer lacked advanced technology, product changes and promotions ran smoothly. The order process was efficient, even though it was still conducted in the traditional way. In general, Sklavenitis was characterised as an efficient customer, having motivated and competent staff able to counterbalance the lack of technology.

These findings are further analysed in the following chapter, with a focus on whether the use of CRP increases flexibility, both at the level of the organisation as well as at the level of interactions between organisations. The analysis of flexibility is conducted by the examination of the process through which the organisations (independently or in cooperation) respond to environmental disturbances, as well as through the analysis of the context that influences this process of response.

CHAPTER 7 – ANALYSIS AND DISCUSSION

7.1 Introduction

This chapter incorporates two main sections. The first analyses the impact of CRP on the flexibility achieved both at an organisational and interorganisational (dyadic) level. Based on the framework presented in Chapter 3 (**Figure 10**, p.111), this section describes the ability of the organisation/dyad to change at an operational, structural and strategic level. It also analyses the process through which the organisation/dyad 'appreciates' an event and selects a response. Finally, it examines the organisational and interorganisational context that influences both the process of appreciation as well as the action of response. The conclusions of the analysis are further discussed in the second section, which leads to a refinement of the research framework as well as to a deeper understanding of the notion of flexibility.

As mentioned above, following the principle of the hermeneutic cycle, the process of understanding flexibility moved from a precursory understanding of the parts to the whole and from a global understanding of the whole context, back to an improved understanding of each part. In this chapter, a detailed analysis of the flexibility of different operations and departments (parts) is presented first, leading to an understanding of the flexibility of organisations (wholes – parts of broader wholes), followed by an analysis of the flexibility of interaction between organisations. In the discussion, the understanding of the concept of flexibility, as a characteristic of individual organisations or dyads, contributes to the conception of flexibility (as a whole). The multidimensional and dynamic nature of flexibility is discussed and the role of technology, people and organisations (as socio-technical parts of flexibility) is further examined.

7.2 Analysis

The analysis of our empirical data treats flexibility as the ability to respond to the flux of events and ideas, arising either from within the organisation/business network (e.g. the inability to receive products due to a shortage of warehouse space, unexpected promotions) or from the external environment (including unforeseen events, e.g. a very hot summer). The research findings are primarily analysed based on the initial conceptual framework (**Figure 4**, p.21), presenting flexibility as a multidimensional concept. Flexibility is thus examined through the notions of efficiency, responsiveness and variety of options, demonstrating the ability of the organisation or dyad to act/change at an operational, structural or strategic level. The limitations of analysing flexibility solely through the examination of its different dimensions are discussed and the need to incorporate further theoretical ideas concerning the process and context of change is argued. Based on an extended research framework (**Figure**

10, p.111), the process of appreciation, involving judgements of events and leading to decisions upon actions of response, is analysed. At a higher level of analysis the organisational/interorganisational context, which influences both the process of appreciation and the ability to change, is thoroughly examined. Consequently, flexibility is seen as a multidimensional concept, interwoven into the process of change and influenced by the context.

7.2.1 The ability to change at an operational, structural or strategic level

This section focuses on the analysis of the different dimensions of flexibility. It examines the ability of an organisation/business network to respond/act/change through the temporal (efficiency and responsiveness), range (variety of options) and scope (scale of organisational/interorganisational change) dimensions. As explained in Chapter 2, the scope of response is analysed based on (Volberda, 1997; 1996) operational, structural and strategic types/levels of flexibility. Although these three types are interrelated, for reasons of clarity they are examined separately. The different types of flexibility are analysed both at the organisational and interorganisational levels.

7.2.1.1 Operational flexibility

Based on examples from the research findings, the following sections analyse the impact of CRP on the ability of an organisation or dyad to change at an operational level. This type/level of flexibility refers to the ability of the organisation/business network to quickly respond to changing customers' needs (Lee, 2002) and to easily handle short-term changes in demand or supply either by using their current operations or by changing the kind or mix of activities based on their current structure and goals (Volberda, 1997; 1996).

Organisational level

The research findings show that the use of CRP generally facilitates the ability of suppliers and retailers to respond quickly to short-term changes in demand or supply.

Suppliers

Prior to CRP, distribution efficiency was increased through warehouse centralisation. By delivering to a retailer's central warehouse, suppliers required far fewer trucks (e.g. 2 instead of 20), as well as issuing a single invoice rather than one per store.

The implementation of CRP brought additional benefits to suppliers by facilitating the issuing and processing of orders. Based on the retailer's inventory report, the CRP system *automatically* creates a suggested order, incorporating minimum quantities to meet consumer

demand, while avoiding out of stocks. Therefore, CRP not only *speeds up*, but also *optimises* the process of ordering.

However, the issuing of an order is not fully automated, since it requires the intervention of a CRP analyst who checks and sometimes makes changes to the suggested order. The highly competitive market encourages frequent product promotions and discount offers. Since the CRP system cannot estimate the potential sales of new products, stickers or promotions, the intervention of CRP analysts and sales managers is needed. Although, this slightly limits the *efficiency* of ordering, it provides suppliers with *more options* to handle and influence consumer demand.

This process is conducted more *efficiently* in P&G (project initiator), where the CRP system, designed in-house, automatically identifies possible errors in retailers' inventory reports, highlighting missing product codes, products that are out of stock (without stock in transit) and products with excess stock. It additionally shows unusual fluctuations in demand, such as abrupt decreases of stock or a sudden falling off of orders by stores. This identification of *exceptions* by the CRP application improves the ability of CRP analysts to detect mistakes in inventory reports and adjust orders accordingly. Hence, they can *more easily identify mistakes*, such as forgotten products or accidentally deactivated product codes. They can also *better handle changes in demand*, e.g. unexpected increases in sales from promotions, simply through adjusting the stock levels.

In contrast, this feature is lacking from Unilever's system, where even though more time is spent in checking proposed orders, some mistakes may still remain. Furthermore, their CRP system does not allow the temporary replacement of product codes during promotions. These can only be performed manually and can lead to mistakes, especially when safety stock levels are adjusted. Nevertheless, by accumulating experience, CRP analysts can *more effectively solve problems* or deal with changes in demand even without the full support of the CRP application.

Regardless of the time spent checking orders, the time saved using CRP is still considerable. Ordering time is reduced, negotiations are eliminated, data entry is considerably decreased and the identification and correction of mistakes is facilitated. Therefore, the overall *efficiency* of ordering increases. This has also allowed for an increased frequency of ordering, enabling suppliers to *better handle small changes in demand.*

An additional feature of CRP, saving further time in ordering, is the automatic translation of product quantities into pallets and sometimes layers. In organisations that do not use CRP, this standardisation is conducted by sales managers but this is a time consuming process, better handled by IT. This standardisation also significantly reduces the time and staff

needed to prepare deliveries and load the trucks. Besides increasing the *efficiency* of deliveries, the standardisation of ordering also increases the ability to deliver more often: suppliers used to need almost 5 days to execute an order but can now deliver within 1 or 2 days. This increased frequency of deliveries enables them *to handle more efficiently everyday situations as well as to better respond to their customers' needs.*

The increased frequency of deliveries also led to a considerable decrease of out of stocks in their customers' warehouses. This is further facilitated by the CRP software, which provides detailed data regarding customer's stock, products-in-transit and store orders, therefore indicating potential shortages. The elimination of out of stocks increases their *options* for more sales, since out-of-stocks typically result in consumers buying the products of a competitor.

Suppliers that are not using CRP, such as Selecta, cannot easily predict or deal with customer out of stocks. This problem is exacerbated by their limited delivery frequency and rigid delivery schedule (they deliver ones a week on a specific day that cannot be easily changed). Therefore, to avoid out of stocks, they have to maintain higher safety stock levels at retailers.

The decrease of safety stock levels is an additional benefit of CRP. By delivering frequently, suppliers send fewer products per delivery and can *better adjust supply with demand.* Furthermore, by keeping low stocks at customer warehouses, they gain more *flexibility* to deliver extra products (e.g. to cover promotions) or to start supplying new products. As a sales manager of Unilever argued, some customers do not accept new products or promotions unless the stock of old ones is significantly reduced.

The handling of changes in products and promotions is further facilitated by the use of CRP. By having full control of orders, suppliers can gradually decrease the stock of an old product (or promotion) in order to send the new one. They can also gradually adjust the stock of a new product, based on the changes in demand, recorded in the CRP. Since they do not spend time in negotiations, they can *handle changes in products and promotions more efficiently.* This is further facilitated by the history of product demand, providing information regarding previous promotions.

With detailed data regarding demand and orders, suppliers can also *better handle product recalls*, which can be *quickly* pulled back based on the CRP history of orders and deliveries. This again *increases their responsiveness to situations where consumer safety is of high priority.*

The use of CRP has additionally improved forecasting and production planning. With detailed information of product demand throughout the year, suppliers can better plan their orders to manufacturers in order to keep their stock low and avoid out of stocks. The

decrease of out of stocks in their central warehouse *increases their ability to handle disruptions*, such as unexpected increases in demand. Furthermore, by avoiding over-ordering they keep their own stocks low, freeing-up space in their warehouses and *increasing their options to respond* to situations such as extra deliveries from manufacturers or unexpected product returns.

Handling returns is complex and time consuming. Returned products are either kept in the truck, for delivery the next day, or unloaded and stored back in the warehouse. If their original place is taken, extra space needs to be found. With the use of CRP, returns are reduced, not only due to more accurate deliveries to retailers, but also due to the obligation of retailers, under the CRP contract, to accept products ordered through CRP. All these improvements have increased the *efficiency* of inventory management and have provided considerable cost savings.

The costs of inventory and storage are diminished through faster stock turnover, decreased stock levels and improved inventory management. Further cost savings arise from the administration and issuing of orders, the exchange of messages, the loading of trucks and the reduced number of trucks per customer. These savings, corresponding to 0.5% of the average price of a case of products, offer extra *flexibility*, since they can be used for special offers or promotions.

The use of CRP has additionally affected the work of sales managers (or key account managers for P&G). Prior to CRP, sales managers used to spend two hours at each customer's premises calculating order quantities, considering previous demand, offers, promotions and seasonal variations. This process is still performed by Selecta's sales managers, who also have to follow different practices depending on the requirements of each customer[40]. In addition, they also spend much time negotiating for increases in order quantities.

In both Unilever and P&G, this time consuming and inefficient process is handled by the CRP system. However, the sales managers still *have the option to intervene* in order to add new products or promotions and handle unusual or urgent situations. Being disengaged from the process of ordering they have more time to deal with *more important activities*, such as spending time in the stores, creating attractive shelving, learning the habits and behaviour of shoppers and arranging promotions. They also use the product demand information provided

[40] In AB, they visit the central offices and cooperate with different purchase managers for different types of products, whereas in Carrefour they visit the three warehouses (in different parts of Greece) and cooperate with an employee responsible for all of their products.

by CRP, to improve future promotions or the distribution of new products. As they argue, their job has evolved and has become more sophisticated.

All these improvements enable suppliers to handle external disruptions or unusual situations more smoothly. They can thus respond more efficiently to uncommon events without being constrained by lack of information, storage and products. Therefore, their availability of options to respond is increased.

Retailers

Besides influencing operations of suppliers, CRP has also affected processes of retailers. Prior to CRP, through warehouse centralisation, retailers increased their control over inventory and became responsible for the delivery to stores. Therefore, their *flexibility in distributing products* was increased.

Further benefits in inventory management and product replenishment were realised by the implementation of CRP. Although, at first, retailers were afraid that they would lose the control of orders, they soon realised the potential benefits of CRP, which *automates the process of ordering*, while also *allowing for human intervention.*

Purchase/warehouse managers can still change orders, but this happens rarely since the system's results are optimal. For them, the complexity of ordering is considerably decreased, since they do not need to spend time negotiating orders, or worrying about out of stocks or excessive stock or maintain a separate history of demand (for the different products of suppliers). They thus have more time for ordering, promoting and selling their own-label or seasonal products.

Therefore, the use of CRP increased the *efficiency of the process of ordering*, not only by reducing costs, but also by saving time. It also increased the frequency of ordering, reducing out of stocks and keeping warehouse stocks low. The elimination of out of stocks enabled retailers to *better respond to their stores' needs* and *increased their options for sales*, since a missing product could lead to consumers shopping elsewhere.

The reduction of stock levels led to better utilisation of storage, increasing the retailers' *flexibility* to handle additional deliveries or sudden decreases in demand (leading to an accumulation of stock in the warehouse). It also brought cost savings, which could be used for a *variety* of other investments such as own-label products or promotions. Further cost savings were gained by the standardisation of ordering and the delivery of products in pallets, which *speeded up* the unloading of trucks, facilitated the storage of products in their warehouse and led to a reduction of personnel used.

AB Vassilopoulos

All of these benefits were realised by AB, where CRP was fully integrated with their internal IS. All IS in AB interoperated and most processes were automated. As a result, mistakes in the inventory report were rare and ordering was conducted *efficiently.* Further time and cost savings were accomplished through the successful implementation of PRICAT messages and electronic invoices. PRICAT messages *speeded up the replacement and issuing of new products* and reduced mistakes, facilitating the work of purchase managers, who were responsible for large numbers of product codes. Electronic invoices, received before deliveries, automatically updated the warehouse management system and could be used to check deliveries. These EDI messages eliminated data entry, reduced mistakes and increased the *efficiency of product replenishment.*

Carrefour

However, these benefits were not realised by Carrefour, due to its different systems (in central offices, warehouse and stores). The lack of integration between these systems and as a result the data entry conducted by different people to update (systems') data, led to *delays* as well as to mistakes, often difficult to be found and corrected. Consequently, the majority of replenishment operations were *inefficient.*

For example, when a new product was released, the central office system was updated first and, without PRICAT messages, product codes and logistics data had to be entered manually. The central warehouse system was updated the next day, followed by the different systems of stores (either updated manually or through electronic messages). This not only led to mistakes and inconsistencies but also to *delays in the distribution of new products.*

Similar problems were faced with promotions, which involved replacing product (mother) codes with sticker codes in the various systems. The temporary change of codes, as well as the fact that one of the store systems did not recognise sticker codes at all, made the management of promotions very complicated. The inevitable mistakes in codes often led to errors in store orders and *inefficient handling of promotions.* As Carrefour's CRP user argued, without the correct sticker code, stores cannot order products for a promotion and they end up without stock, while excessive stock accumulates in the warehouse. As a result, *the launching of promotions and the distribution of stickers in the stores* were often *delayed.*

Further delays were experienced due to the *inefficient ordering of certain stores.* Due to a lack of personnel, the orders of many stores were handled by the same person, *unable to efficiently meet all stores' needs. Delays* and mistakes were more common in stores that

relied on manual stock taking and ordering, resulting in incomplete orders and consequently out of stocks.

Problems were also faced in inventory management due to the limited space in Carrefour's central warehouse, which led to temporary storage, misplacements and losses of products. As a result *a lot of time and effort* was spent in finding a storage place, searching for products and stocktaking.

All these *limited the ability* of this retailer to *handle efficiently changes* of products or promotions as well as to *respond to consumers' needs or changes in demand.* They resulted in erroneous inventory reports and significantly reduced the benefits offered by CRP. Solving these problems required cooperation between staff in various parts of the company, which was further complicated by their increased workload. As Carrefour's IT manager argued, people in Carrefour needed to deal with daily changes in products and promotions with an inefficient technological infrastructure and without space in the warehouse. This caused difficulties, misunderstandings and mistakes.

Nevertheless, over time, people learnt how to avoid or solve the problems, the warehouse was extended and the information systems were integrated. Following these improvements, the *efficiency* of product replenishment is gradually increasing, influencing Carrefour's ability to better *respond to changes* in consumer demand.

Atlantic

In contrast, the incomplete implementation of CRP in Atlantic has *decreased the operational flexibility of this retailer.* Although it slightly reduced inventory costs by lowering stock levels, it has *not managed to increase the efficiency of ordering. A lot of time* was spent in the creation of inventory reports, in data entry and *in problem solving.* Furthermore, the CRP users were also responsible for traditional orders to other suppliers and the extra workload encouraged them to resist to the use of CRP.

Interorganisational level

Analysis of general findings

Most of the benefits gained from CRP at the organisational level also improved the flexibility of interaction between trading partners. The time and cost of ordering decreased for both trading partners, increasing the *efficiency of their interaction.* The standardisation of ordering facilitated the loading and unloading of trucks as well as the storage of products, leading to a decrease of personnel and supporting the *efficiency of deliveries across the supply chain.* The decrease of safety stock levels improved inventory management for both

retailers and suppliers, brought additional cost savings and reduced product returns, further contributing *to the efficiency of the interaction.* The improved utilisation of storage space provided *more flexibility to handle unexpected accumulation of inventory* due to unusual changes in demand. Finally, the reduction of out of stocks along the supply chain enabled trading partners to *increase their sales* and *better respond to everyday needs and small changes in consumers demand.*

All these benefits contributed to improved cooperation between retailers and suppliers. Although the responsibility of ordering shifted to the supplier, the increased trust between trading partners eliminated the time spent on negotiations. As a consequence *changes in products or promotions were facilitated.* These were simply handled through a gradual decrease of old stock until minimised and replaced by the new products.

Therefore, the use of CRP contributed to the efficiency of the interaction between retailers and suppliers, increased their responsiveness to variations in supply and demand and supported the handling of changes in products and promotions. All these led to an increase of operational flexibility at the interorganisational level.

Nevertheless, CRP also brings constraints as a complete implementation requires that a number of messages are exchanged between suppliers and retailers. These include the inventory report, the proposed order, the retailer's reply and then the finalised order. However, since much time is spent in exchanging messages, some (e.g. proposed order and retailer's response) may be omitted or sent by fax. Therefore by sidestepping certain functionalities of CRP, trading partners managed to increase *the efficiency of the process of ordering.*

As the findings showed, the handling of such situations and the cooperation between trading partners depend on the interacting organisations and on the way that they use CRP. Therefore, as the following paragraphs demonstrate, the operational flexibility of the interaction between suppliers and retailers is greatly influenced by the operational flexibility of the organisations involved (presented above).

Interaction of suppliers with AB

AB was considered as a very *flexible* partner. Unilever's IT manager argued that AB could *quickly* meet the supplier's needs; e.g. to accept frequent changes of products or to accommodate changes of stock levels. This view was also supported by the CEO of Selecta, who argued that AB was one of the most competent retailers, with which they never experienced problems in product replenishment or delays in the distribution of new products.

The *efficiency* of the interaction was mostly attributed to the retailer's efficient IS, which supported automated product replenishment from the central warehouse to the stores. It was also attributed to the competence and expertise of AB's staff.

Since CRP was fully integrated with AB's IS, the inventory report was mostly error free and ordering was optimised, resulting in considerable *time and cost savings*. The standardisation of ordering decreased the time needed to load or unload trucks to 20 minutes, while the increased frequency of deliveries reduced stock levels from 30-35 days to 10 days. This led to better utilisation of storage, enabling suppliers to *better distribute new products* or to *change stock levels* (e.g. to cover a new promotional activity). The *efficiency of changes* in products or promotions was further supported by the exchange of PRICAT messages, which *speeded up* the replacement/issuing of products and stickers by automatically updating the retailer's IS. These benefits improved cooperation between the suppliers and AB, *eliminated negotiations* and, in turn, enabled trading partners to *better deal with urgent or unusual situations*.

Although AB was considered as highly competent, certain of its management practices and IS features constrained its interaction with suppliers. For example, AB's policy of not accepting two different promotions for the same product was reflected to AB's information system, which could not handle two sticker codes under the same mother code. To accept a second promotion, that is to issue a new sticker code, the previous one had to run out first. This *limited the options* of suppliers *in the handling of promotional activities*. As a result, promotions were sometimes launched earlier in other supermarkets.

Furthermore, the FIFO practice in AB's central warehouse meant that the warehouse's system could not accept products with a shorter expiry date than those in stock. This facilitated AB in the handling of expiry dates, but *limited the options* of suppliers for deliveries. Since their manufacturers did not follow a FIFO order they had to *spend time* to check the products sent to AB. This was more problematic for Selecta, which had fewer customers to divert the products rejected by AB. Nevertheless, a weakness of AB's warehouse system gave them the *option* to deliver products with a more recent expiry date, when the warehouse got out of stock.

More problems in interacting with AB started with the acquisition of TROFO, which caused *considerable delays in the distribution of new products*. The limited space in TROFO's stores, decreased *the options* of purchase managers who, in order to find space on the shelves, often had to redistribute or retire products, *spending time in negotiating and renegotiating* with suppliers. These problems *limited* the ability of the supply chain to

quickly accommodate changes in products. It also affected the competitiveness of AB, since advertised products appeared late in the stores.

Interaction of suppliers with Carrefour

More problems at an operational level were faced in interacting with Carrefour, which during its first two years in Greece was inflexible and slow to make changes. The inefficiency of these interactions was mostly attributed to Carrefour's problematic technological infrastructure and complex organisational structure. Nevertheless, CRP still provided benefits, similar to the ones described above, including *increased efficiency of ordering, increased efficiency and frequency of deliveries, reduction of stock levels and decrease of out of stock.* With CRP, stock levels dropped from 23 days to 6 or 7 days and suppliers reached a 99% service level of store demand.

However, this increased efficiency was constrained by the incompatibility of Carrefour's four different IS and the lack of integration between CRP and Carrefour's warehouse management system. As explained above this tended to produce mistakes in the inventory report, such as typing errors, omitted products in transit, forgotten or delayed store orders and inaccurate product stock. As a result the orders proposed by suppliers were not always optimal and deliveries did not cover the retailer's needs, leading to out of stocks or excessive stock. However, fewer problems were faced between Carrefour and P&G, due to the effective error detection embedded in P&G's system, which relatively increased the *efficiency* of the interaction.

Carrefour's technological constraints also *limited the supply chain's ability to handle changes of products.* The errors and delays from manual updates of product codes meant that Carrefour staff could neither agree to the proposed CRP order, nor accept the deliveries of these products. Besides *delaying the distribution of new products in the market,* this could also lead to *product returns, further limiting the effectiveness of the interaction with suppliers.* Sometimes product codes were pending for almost a month, decreasing suppliers' *ability to beat competition.* Similar problems were faced with older products, due to accidental deactivations or replacements of codes. Such mistakes prevented the stores from ordering these products, which were often left in the warehouse.

Similarly, the handling of promotions suffered from the confusion between mother and sticker codes (described above), which *decreased the efficiency of the supply chain in the launching and handling of promotions.* Suppliers experienced delays in launching promotions and often found that certain stores suddenly stopped running a promotion, while the products were piled in the warehouse. Even more difficulties were faced when they needed to run two promotions in parallel, as stores often used the wrong codes (by

accidentally deactivating the codes of both promotions or forgetting to switch to the new promotion).

All these problems *limited the adaptability of the supply chain to changes*. The difficulties experienced in individual stores rippled backwards to the supplier, often leading to increased demand variation (bullwhip effect). Incorrect orders from stores resulted in inaccurate inventory reports and out of stocks at the stores. The retailer's warehouse was not notified to replenish them, the suppliers were not informed (and usually assumed a decreased demand) and the stock delivered to the retailer was not enough to cover store demand. Inventory accumulated at various stages of the supply chain, while shortages and delays occurred at others.

To circumvent Carrefour's inefficiencies, responsibility was shifted to the suppliers which, in turn, *reduced the suppliers' efficiency*, since their staff had to spend *more time and effort* in correcting orders, updating product codes, identifying problems in promotions and checking the availability of products on the shelves. They also began to inform Carrefour of new products or promotions well in advance (sometimes even 15 days before).

Suppliers using CRP were able to identify some of these problems simply by checking the inventory report. They could foresee potential out of stocks, identify wrong product codes or spot problems with promotions. This was further facilitated by their close cooperation with Carrefour's CRP user, who was very competent and capable of solving most problems relatively *quickly*. In contrast, suppliers without CRP could only realise such problems through their merchandisers, when out of stocks occurred at stores. In this case, *their ability to respond was constrained*, since they needed at least 3 or 4 days to replenish the missing products.

Additional constraints in interacting with Carrefour were caused by the limitations of Carrefour's central warehouse, which often prevented the acceptance of deliveries. Then suppliers had to negotiate for an extra delivery quickly to avoid out of stocks. This *decreased the efficiency of deliveries*, by causing *delays and adding costs though product returns and redistributions*. However, under the CRP contract Carrefour was obliged to accept deliveries ordered through CRP, which *limited* the retailer's *flexibility* by constraining its ability to accept products from other suppliers. It also *complicated deliveries of smaller suppliers* that had to spend a lot of time in negotiations to gain access.

Smaller suppliers (e.g. Selecta) needed also to cope with Carrefour's special pallet requirements, which meant they had to remake the packaging. Although this increased Carrefour's efficiency regarding product acceptance and warehouse management, it *limited*

the efficiency of smaller suppliers, increasing effort and labour costs, as well as causing delays due to the unpackaging and repackaging of products.

Nevertheless, the operational flexibility of the suppliers' interaction with Carrefour gradually increased with *experience* and the proactive stance of suppliers, leading to an improved handling of problems. Further improvements resulted from the enlargement of the central warehouse and upgrades of Carrefour's technological infrastructure. All these gradually increased the efficiency of ordering and deliveries, and facilitated the handling of changes in products and promotions.

Interaction of suppliers with Atlantic

Many problems were encountered by suppliers with Atlantic, mostly due to the lack of a warehouse management system and to the lack of integration between CRP and Atlantic's central office system. Additional problems arose due to the lack of specialised CRP users, who were also responsible for traditional orders. Because of their increased workload they put little effort into CRP, shifting responsibility to suppliers' CRP analysts. As a result, while *a lot of time* was *spent in problem solving*, some mistakes could still remain unnoticed. All these constrained the *efficiency* of CRP, *delayed* ordering and *hampered the handling of changes and urgent situations*. Moreover, the considerable amount of time and effort spent on CRP implementation complicated the interaction of suppliers with Atlantic.

Interaction of suppliers with Sklavenitis

In contrast, interactions with Sklavenitis were mostly free of problems, although this retailer had never implemented CRP. Even without technology, ordering and distribution went smoothly. *Changes in products and promotions* were also conducted *efficiently*, since mistakes and delays in issuing of new product codes, discount stickers and promotional activities were rare. Sklavenitis was very flexible especially in managing promotions. If a promotion achieved high sales they ordered more stock, even before the predetermined day of ordering. They could also handle two or more promotional activities for the same product, unlike AB and Carrefour. The only problem related to the double delivery scheme, whereby suppliers needed to deliver both to the central warehouse and to certain individual stores. This decreased the *efficiency* of suppliers by complicating and increasing the time spent in ordering, as well as adding costs to deliveries. However, this delivery scheme often provided *options* to handle out of stocks.

7.2.1.2 Structural flexibility

Structural flexibility refers to the ability of an organisation (or business network) to adapt its decision and communication processes, structure or workflow in response to changing needs.

At the interorganisational level it also refers to the establishment of new partnerships or the dismantling of old ones.

Organisational level

The implementation of CRP affected the structure of the sales departments of suppliers. P&G's was completely disengaged from ordering, which was shifted to Customer Services, and renamed as Customer Business Development, aimed at close cooperation with customers. These changes increased flexibility at a structural level, allowing key account (or sales) managers to work closely with customers *and develop multifunctional mirror teams to meet changing market needs and issue new products.* Unilever's sales department did not particularly change, except from freeing-up sales managers from ordering, allowing them, as described above, more flexibility *to get engaged to a variety of other activities.*

Apart from that, as the IT manager of P&G argued, the workflow supported by CRP *is rigid rather than adaptable* as the exchange of specific messages needs to be performed in a prearranged order with a predetermined day and time for downloading, updating and sending messages. It allows *limited options for intervention*, such as the omission of certain messages (e.g. proposed order or retailers' response). Therefore, CRP does not particularly help last minute changes, limiting the flexibility of suppliers to cancel orders, add supplementary orders (e.g. to add forgotten items), delay deliveries or send extra stock (e.g. to cover successful promotions).

In such cases, suppliers must either wait for the next CRP order or sidestep the CRP and create an extra order internally. Rather than cancelling a CRP order, which is time consuming; P&G prefer to change the order in their AS 400 and notify customers accordingly. Similarly, Unilever create a supplementary order in their SAP R3 and send it by fax. Therefore, to deal with last minute changes, suppliers *change the predetermined workflow of activities* because, although CRP is *inflexible*, it can be *easily sidestepped.*

An additional rigidity of Unilever's CRP was its inability to keep track of order changes made by CRP analysts. Afraid of making mistakes that could not be rectified, analysts made the changes in Excel files, produced as copies of the CRP proposed order. Although this *was not very efficient*, the Excel files gave them *extra flexibility*, allowing them to *change the predetermined workflow* in order to also inform the sales managers of the orders. This could not be done through CRP because it was not integrated with the SAP R3 system, used by the sales managers, and because the order, once finalised, was automatically sent to the retailer.

An extra constraint of CRP is that it *requires specialised analysts* within the supplier, belonging either to the sales department (Unilever) or customer services (P&G) and they

need both technical skills and market knowledge. They are responsible for checking the automatically produced orders and, if needed, changing quantities to handle product replacements or promotions. Since their job is specialised, they are *difficult to replace.*

Conversely, for the retailers, CRP does not normally require specialised staff, except where the retailer's technological infrastructure is problematic (e.g. Carrefour). In such cases, a special role (CRP user) responsible for data entry and error checking proved *imperative for improving the efficiency of CRP.* The lack of such a person in Atlantic was a key reason for their CRP failure.

Following the warehouse centralisation and the implementation of CRP, when stores ran out of stock they had to obtain products from their central warehouse. However, organisations without advanced technology are sometimes more *flexible in changing their normal workflow of activities.* For example, Sklavenitis's staff would get products from a nearby store (even using their cars) to cover out of stocks more quickly. As their IT manager argued, a more advanced information system would impose a rigid workflow and such informal processes would not be allowed.

Interorganisational level

The *limitations* of CRP regarding the *sequence and scheduling of the exchanged messages* additionally affected flexibility at an interorganisational level. As described above, CRP limits the *adaptability* of ordering, hinders corrective or supplementary orders and constrains changes in deliveries, forcing suppliers to sidestep CRP. For this they need to cooperate with retailers - CRP is not as flexible as people, who often *ignore the predefined workflow*, find solutions by telephone and send supplementary orders through fax or arrange additional deliveries. Suppliers like Selecta, without CRP, may also be constrained by their limited delivery frequency (once a week) and the predetermined day of deliveries and, to change this workflow, they need to collaborate further with retailers.

An additional constraint at the interorganisational level is that CRP does not support inventory reports or orders from stores, but only from retailers' central warehouses. Thus, CRP *limits the adaptability of the business network and its ability to efficiently respond to abrupt changes in demand, especially if these occur in specific areas.* Without detailed information from stores, suppliers cannot predict potential shortages in individual stores, usually realising these problems through their merchandisers when the stores are already out of stock. The predetermined workflow means that they must wait until the stock is ordered through the retailer's central warehouse and then incorporated into the CRP order (in smaller retailers this happens only twice a week). If they cannot wait until the next CRP order, they just send a supplementary order as soon as possible, using traditional ordering. However,

they still need to wait for another two days for products to be delivered to the warehouse and an additional day to reach the store. This means that the stores will be left out of stock for at least 3 or 4 days. It is only in exceptional and urgent situations that suppliers completely sidestep the predetermined workflow by arranging extra deliveries directly to stores. This mostly occurred with Carrefour, whose warehouse limitations meant that it was sometimes imperative to deliver directly to stores.

Suppliers without CRP, like Selecta, have more structural flexibility to solve such situations, by using their contacts in retailers to arrange an extra delivery either to the central warehouse or directly to the store. However, their ability to do this mostly depends on the retailers.

These issues were more easily solved with Sklavenitis, not only due to its internal structural flexibility (described above), but also due to the double scheme of deliveries supported by this retailer. As mentioned above, although this has *decreased the efficiency of suppliers' deliveries*, it has *increased structural flexibility.*

To also gain more structural flexibility in ordering and deliveries, a product status field was added to AB's information system, which showed whether a product was active or temporarily replaced (e.g. by a special offer) and whether the product needed to be ordered directly from suppliers rather than from AB's central warehouse. Although this feature increased AB's *ability to meet changes in consumer demand*, by providing more *options* for ordering, it added a level of complexity that sometimes led to mistakes. Due to an accidental change of product status, the stores could stop ordering it from their warehouse, and order directly from the suppliers. However, the extra flexibility from this feature conflicted with the CRP, which did not support store orders.

Establishment of partnerships

Structural flexibility is also related to the capability to establish new partnerships and, although interorganisational systems have been characterised as enablers of interorganisational cooperation, the findings of this thesis show that CRP may sometimes constrain the establishment of partnerships.

Early problems of incompatibility of VAN networks were overcome (with the use of the same VAN provider), after which incompatibilities were rare and related to different versions of EDI (or CRP). However, even with a common messaging standard and network, the implementation of CRP seems to constrain the *adaptability* of the business network.

Implementing CRP with a new trading partner is not easy and requires a significant amount of time. The system needs to be installed and integrated with the organisation's internal IS, CRP analysts or users have to be trained and the system tested before its actual operation

starts. Testing includes the time needed to gather a detailed history of consumer demand and the subsequent training of the CRP to produce optimal orders[41]. This can be speeded up if historical data is available and can be loaded to the system (as in P&G) but if all the data has to be gathered during implementation, this may take *up to a year.*

According to Unilever, the very first implementation with a retailer was the most difficult, but this was a *learning experience* with subsequent implementations being easier. However, in each new implementation they still need to spend time to test and train the system. The time needed not only depends on the knowhow and readiness of suppliers, but also on the technological awareness and competence of retailers. This time is also significantly affected by the cooperation between trading partners.

Suppliers were able to implement CRP with AB relatively quickly due to AB's expertise and appropriate infrastructure. Since most of AB's systems were developed in-house, the IT staff had both the knowledge and capability to expand them by developing software bridges to fully integrate both EDI and CRP with the internal IS. They were also able to develop an interface for CRP, facilitating changes in the exchange of messages, and the establishment of CRP with new suppliers. As AB's IT manager argued this gave them more *flexibility*, since by changing a few parameters they could easily start exchanging CRP messages with additional suppliers.

Conversely, the implementation with Carrefour took longer than expected, due to the frequency of mistakes in inventory reports and the difficulties in building a proper history of product demand. These were mostly attributed to the inefficient technological infrastructure, the lack of integration between CRP and the warehouse management system and the problematic organisational structure of Carrefour.

Even more difficulties were realised with Atlantic, leading to the postponement of the whole project after *a year of continuous effort and waste of time,* not only for Atlantic staff but also for the CRP analysts of P&G engaged in the project.

Smaller companies are generally less able to implement CRP. As Selecta's sales manager suggested, this is not only due to the high cost of installation and maintenance, but also due to the lack of technological awareness and appropriate infrastructure.

Therefore, structural flexibility at the interorganisational level seems to be decreased. The use of CRP does not always facilitate the establishment of partnerships but often leads to the creation of a business network, which is rather closed and restricted to a few organisations.

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[41] That is to keep an optimum level of stock.

7.2.1.3 Strategic flexibility

Strategic flexibility is the most radical type of flexibility, since it may involve fundamental changes in processes, products, services and structures. It refers to the ability of firms/business networks to reposition themselves in a market, transforming their plans and strategies.

Strategic flexibility is also associated with the range of strategic[42] options that a firm/business network may have to respond to environmental disturbances "in a timely and appropriate manner with due regard to the competition" (Das & Elango, 1995, p.62). It is associated with the ability of organisations to respond to large changes in aggregate demand or to new products or services launched by competitors (Hilhorst *et al.*, 2005). It is also the ability to expand into new markets or to create new product-market combinations in cooperation with trading partners.

Organisational level

The use of EDI and CRP cannot normally contribute significantly to the ability of a firm to respond to environmental changes with far reaching consequences. They further can do little to facilitate changes, such as fundamental renovations of processes, products, services or structures.

Nevertheless, CRP can influence strategic flexibility by helping a firm to *identify market trends before competitors* and by *increasing its capability to quickly respond to changes in demand*, as well as to *effectively match production with demand.* It also contributes to their *ability to influence consumer demand*, by facilitating the distribution of new products and promotions.

CRP further influences strategic flexibility indirectly by changing the work of sales managers. As mentioned above, automated ordering offered them time to observe supermarkets, understand shopper behaviour, examine the market and *initiate new promotions.* As sales managers argued, CRP gave them more time to spend on "growth" activities, enabling them to develop a better understanding of the market and create *more options to beat the competition* and *initiate new marketing ideas.* In this context the information provided by CRP regarding demand variations can be particularly useful, allowing them to proactively take actions (e.g. combined products or offers) to influence consumer demand.

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[42] In this study, the adjective strategic is used to describe any influence that has a lasting effect on the competitiveness of the organisation.

Nevertheless, as noted by Unilever's sales managers, they also need information directly from the POS (point-of-sales) to have a more accurate picture of demand from which to develop *a more complete marketing strategy.* AB's purchase manager added that such store-based data also helps retailers refine their purchasing plans, increasing stock levels of growth products and reducing stocks of declining products. Thus, further gains in flexibility could be achieved by combining CRP and POS data[43].

In another area of strategy, CRP may facilitate an organisation's expansion through mergers or acquisitions. When AB acquired TROFO, CRP accommodated the orders from the new stores without problems (through simple adjustments of the safety stock levels). Since CRP is only linked to the retailer's warehouse, it doesn't need to be directly integrated with the systems of the individual stores. Therefore, the only difficulty is to link the new stores with the retailer's central warehouse.

However, the use of CRP may be *problematic* if the *type of business is changed.* For example, difficulties were faces in AB's acquisition of ENA, which was involved with wholesaling, generating large fluctuations in demand. This *high uncertainty in demand* was difficult to handle with CRP that produces orders based on the average demand. Stock levels needed to be adjusted, but AB's purchase managers, unfamiliar with this business, could not accurately predict the stocks needed to meet such varied demand. Therefore, for some time AB had problems running this new type of business efficiently. It was only through experience and working closely with suppliers that they managed to make CRP work in this context. As they admitted, it was not so much the limitations of the technology but mostly their lack of experience that delayed the successful inclusion of ENA wholesale.

Interorganisational level

At an interorganisational level, CRP is unlikely to contribute significantly to increased strategic flexibility, since this typically requires increased flexibility at a structural level.

In a case reminiscent of AB, described above, the old Marinopoulos group (before its acquisition by Carrefour) decided to implement CRP to support ordering clothes from Marks & Spencer. This unsuccessful implementation was attempted long before most Greek companies considered using IOS. The main problem with the system was its inability to incorporate the different colours of clothes. As a result, when the stock, for example, of shirts dropped, Marks & Spencer sent shirts regardless of the colours of those sold. This resulted in unbalanced stocks and led to the rejection of the system.

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[43] This is one of the main aims of CPFR.

At the interorganisational level, CRP can indirectly influence strategic flexibility through improving cooperation and enabling the sharing of information between trading partners. This can facilitate decision making and enable trading partners to formulate a *common policy regarding sales and promotions*. It should also be noted that cooperation improved through participation in ECR-Hellas, leading to the adoption of new business practices and strategies, such as centralisation, pallet standardisation and the implementation of technologies such as CRP.

However, as mentioned in Chapter 2, the use of IOS can also cause conflict between organisations. During the early years of EDI, incompatibilities of VANs or messaging standards led to closed business networks that could be exploited by powerful organisations aiming to lock-in their smaller trading partners. Although such market power may, as (Volberda H. W., 1996) argues, increase the strategic flexibility of a large organisation, it decreases the flexibility of smaller partners. The findings of this thesis do not support this, since all the organisations studied had agreed on common standards before implementing CRP. Nevertheless, at the time of the study both P&G and Carrefour were building their own incompatible internet-based electronic markets, which were incompatible. Whether one of these will dominate in the market, whether they will lead to closed business networks or whether they will be interconnected remains unclear.

7.2.1.4 Summary of results

In the previous sections flexibility was examined as a multidimensional concept based on the framework (**Figure 4**, p.68) derived from the literature review. Flexibility was examined as the ability of the organisation/business network to respond to events through changing at an operational, structural and strategic level (scope dimension). The ease of response was indicated through the notions of efficiency and responsiveness (temporal dimension) as well as through the variety of options to respond (range dimension).

The analysis of the data showed that with the use of CRP the operational flexibility of both suppliers and retailers generally increases. Improvements in logistics and inventory management increase organisations' efficiency and range of options to respond to everyday situations, enabling them to cope more effectively with changes in demand. However, this type of flexibility is also influenced by the flexibility of trading partners. In some cases, CRP worked without problems, leading to an increase of operational flexibility at the interorganisational level but, in others, the inadequate infrastructure of a trading partner made cooperation difficult, reduced the efficiency of the interaction and constrained the ability to handle changes in products and promotions.

Structural flexibility seems to decrease both at the organisational and interorganisational levels. Although the implementation of CRP changed the sales departments of suppliers, leading to a more flexible structure, it imposed a rather rigid workflow. Furthermore, its operation requires specialised people, difficult to replace. CRP also constrains the establishment of partnerships and hence the adaptability of the business network. It is affected by an organisation's internal IS and requires time for testing. This may not be a problem when trading partners cooperate closely, are technologically aware and possess the appropriate infrastructure but, where this is not the case, implementations can be problematic or even fail completely.

Finally, CRP seems to positively influence strategic flexibility by increasing an organisation's options to respond to competition and changing markets, through the early identification of market trends. It also increases the availability of information for decision-making and influences the development of marketing strategies. At an interorganisational level it can lead to improved cooperation and the sharing of information, leading to common goals and strategies. CRP may also facilitate mergers and acquisitions, except in cases where the nature of the business changes.

Some of the results regarding the impact of CRP on the operational, structural and strategic types of flexibility are summarised in **Table 13**.

Levels / Types	**Organisational level**	**Interorganisational level**
Operational	Quick issuing of orders. Respond quickly to short-term needs of customers /consumers. Quick preparation of deliveries. Quick loading or unloading of trucks. Availability of space to better handle returns or unexpected deliveries. Availability of capital for marketing and own label products. More time available to sales and purchase managers to handle other activities.	Efficiency of ordering. Increased efficiency and frequency of deliveries. Handle changes in consumer demand. Quick issuing and distribution of new products. Better handling of promotions
		Decreased ability to change orders.

Structural	More flexible sales departments.	Development of mirror teams with trading partners
	Rigid workflow. Requires specialised CRP analysts, difficult to replace.	Constrains the time and date of the exchange of messages. The establishment of new partnerships is time consuming.
Strategic	Identify market trends before competitors. Ability to match production with demand. Respond quickly to market needs through new products or promotions. Availability of information for decision making and formulating strategy. Facilitates expansion through addition of new stores.	Ability to respond to market changes, through cooperation with trading partners. Availability and sharing of information to develop common strategy.
	Difficulty to accommodate new types of business or products.	Limited adaptability of the business network to change partners or business.

Table 13: Examples of different types and levels of flexibility

As shown in the above table, the boundaries between the different types of flexibility are not clear. For example, the inability of the business network to expand through the establishment of new partnerships is related to a decrease of both structural and strategic flexibility. Furthermore, the ability to quickly issue and distribute new products and promotions is related both to operational efficiency and to the strategic options that an organisation has to influence consumer demand and beat competition.

Nevertheless, examining the different levels/types (operational, structural and strategic) of flexibility through its temporal and range dimensions is not sufficient to thoroughly explain this complex notion. As shown in the above analysis, the ability of organisations or dyads to change at each one of these levels is greatly influenced by the technological infrastructure of the organisations, the people involved, their cooperation and policy decisions.

As described in Chapter 3, the limitations of analysing flexibility solely as a multidimensional concept were realised during the first stages of our fieldwork. The initial conception of flexibility was therefore enriched with additional theoretical ideas leading to the development of a more complete framework (**Figure 10**, p.111). Based on this framework, our empirical data are further examined through the analysis of the process of appreciation, leading to a decision upon an action to respond as well as through the analysis

of the organisational/interorganisational context that influences both the process of appreciation and the actual response (conducted at an operational, structural and strategic levels).

7.2.2 The process of appreciation

As discussed in Chapter 3, appreciation is a cyclic process of perceiving, judging and acting. It is a process of understanding and evaluating an event (e.g. a problem with deliveries, an abrupt decrease in demand or the launching of innovative products by a competitor) or an idea (e.g. a novel promotional activity), based on standards (familiar ways of deciding, operating and acting) generated in previous history. It involves dealing with a situation (event or idea), making judgements of facts (reality judgements), evaluating their significance (value judgements), identifying possible responses (depending on the range of options) and deciding whether to take action (which often involves management of relationships). The standards or criteria, which influence the judgements and the decisions upon actions, are developed through previous processes of appreciation and may be further changed by the very process of applying them.

Having embedded business knowledge, CRP has facilitated the process of appreciation involved in ordering. Based on a history of product demand (considered as a *standard* demand), CRP automatically generates a proposed order. This order is the outcome of the system's evaluation of the current situation (reflected in the retailer's inventory report) and of the expected (standard) demand. In case of variations in sales, CRP automatically updates the history of demand (gradually altering the expected demand). The system's intervention in the process of ordering increases the *efficiency* of the operation, since it substitutes work previously performed by sales managers. It also supports the process of appreciation conducted by CRP analysts.

CRP analysts check the order produced by CRP, assess the quantities of products specified and make changes, not only to add new products or promotions, but also to correct potential mistakes in the retailer's inventory report. In adding a new product or promotion, the analysts (sometimes in cooperation with sales managers) take into account the history of demand and orders for previous products or promotions, which provide them with a standard way of coping with such situations based on the past. Using this information, plus their personal *experience*, they make *judgements* regarding the potential demand in order to change the order. They also take into account additional *facts* (further *reality judgements*) regarding the stock of old products or previous promotions that will be replaced by the new ones. They may additionally make *value judgements* regarding how quickly the new product or promotion needs to be launched into the market. Based on these, they decide the quantity

of products to be added to the order. This decision may also be subject of *relationship management*, since it may require negotiations with retailers' purchase managers, who may not accept the new product until the older one runs out of stock or who may reject a promotion if another promotion is already running. These negotiations decrease as retailers realise the benefits of CRP and learn to trust more their suppliers. Furthermore, as time passes CRP analysts build up their own *experience* and can handle such changes *more effectively* without the help of sales managers.

As a key account manager of P&G argued, knowledge regarding product demand, impact of promotions and seasonality accumulates gradually and through this people learn how to deal with fluctuations in demand and create *standard* ways of responding by using the CRP system.

As mentioned above, the automation of ordering has mostly benefited the sales managers, who not only have more time but also more information on which to base decisions. In the past, they only had a rough idea about stock levels, the needs of stores and the actual sales. As (Vickers, 1968) argued the capacity for appreciative judgement depends on the 'materials' (information) that the people involved have at their disposal. Therefore, the availability of detailed information supports the ability of sales managers to appreciate situations[44], such as decreased sales, product shortages and promotion problems. It also enables them to better appreciate market trends and identify various ways to increase sales and beat competition.

For CRP analysts, it is sometimes more difficult to identify and *evaluate* mistakes in the retailer's inventory report. As mentioned above, this is conducted more *efficiently* in P&G, since the CRP system had more sophisticated error detection, pinpointing out of stocks or odd variations in demand. In Unilever the time *spent* checking the order greatly depended on the *experience* of the analysts.

When problems in distribution of products are identified, CRP analysts need to further *appreciate* the cause. If, for example, they observe an unexpected decrease in demand for a product, they need to identify the relevant facts (*reality judgements*). They usually check whether there is a problem with the product code, whether it was accidentally deactivated or changed, whether one of the retailer's information systems was not correctly updated or whether some stores have simply forgotten to order the product. After identifying the cause of the problem, the analysts *value its significance* (is it only a case of changing a product code? are some stores already out of stock? can products be replenished quickly?) in order to

[44] As mentioned before their capability to appreciate situations will be further increased with the use of POS data.

identify courses of action. Depending on the situation, these may vary from simple updates in the retailer's information systems to supplementary orders and extra deliveries.

Nevertheless, the appreciation of such problems can only be conducted through close cooperation with retailers' CRP users, since most of the inconsistencies occur in retailers' information systems. As described above, many problems arose in dealing with Carrefour, where problem evaluation and solving was facilitated by the competence and motivation of the CRP user. This shows that the efficiency of appreciation does not only depend on the cooperation between trading partners, but also on the capabilities of the people involved. As Vickers (1968, pp.146-147) argued, a person's capacity for appreciative judgement also depends *'on his relevant mental faculties'*.

However, the close cooperation between CRP analysts and Carrefour's CRP user is not always sufficient to facilitate the solving of the various different problems arising in Carrefour. Problem solving often involves *managing of relationships* that extend beyond the scope of the users of the CRP system. Carrefour's CRP user often needed to engage people from the warehouse, the central offices or various stores. But as their workload was high, she often needed to persuade them, encourage their cooperation and help them in order to increase the *efficiency* of problem solving. However, Carrefour's complex organisational structure constrained internal cooperation, decision making and action.

Nevertheless, much depends on *experience*. As both Unilever's CRP analyst and Carrefour's CRP user noted, the first time that they come across a situation they spent a long time understanding the problem and devising a solution. However, when they come across similar situations they can follow previous patterns of action. By knowing what to look for and who to engage, they become more *efficient* in solving problems.

Sometimes problems (e.g. out of stocks) relating to individual stores are noticed by merchandisers or sales managers who engage *reality judgements* (what might have happened and why? - Is the product out of stock in the central warehouse? Has the store ordered for it? Is there a problem with the product status?), *value judgements* (to understand the seriousness of the problem - How many days will the shelves stay empty? How much money is the company losing?), and *action judgements* to identify ways to replenish the stock and choose the most *efficient*. Due to the centralisation of ordering and the use of CRP, companies have limited options to respond, since stores can only order from the retailer's central warehouse. It is only in very urgent situations (identified through value judgements) that suppliers will deliver directly to stores. The delivery options increase if the retailer supports a double scheme of deliveries or uses less advanced technology, as in the case of Sklavenitis, where

stores can be replenished either from their central warehouse, directly from suppliers, or even from stores nearby.

Nevertheless, when the actions taken sidestep the predetermined workflow they involve a lot of relationship management in terms of communication, negotiation and persuasion between various people from both the supplier and the retailer. They need to find additional trucks, arrange extra deliveries, update the various information systems or, as in the case of Sklavenitis, ask staff to deliver products by using their own cars. As such situations are repeated, people become more efficient in identifying possible actions to follow, without spending a lot of time in negotiations and decision making.

Through appreciation people or organisations can also gradually adapt to changing needs or market requirements. For example, when AB acquired ENA, with its wholesale operations, both AB and its suppliers faced difficulties in coping with the changes in demand patterns. But, through repeated cycles of appreciation, whereby CRP analysts cooperated with purchase managers to evaluate the new situation, they realised that they had to double the safety stock levels to meet fluctuations. Therefore, through accumulating *experience* they developed an understanding of the different market needs and built up relevant *standards.*

An additional difficulty that suppliers faced with AB related to the latter's FIFO warehousing. To deal with this, people in Selecta had to *evaluate* the situation and decide what to do with products with more recent expiry dates. After considering various *alternatives*, they realised that only when AB was running out of stock could they send such products and this became a *standard* practice in that situation.

Regarding the problems of limited storage in Carrefour's central warehouse, the warehouse manager was responsible to decide which trucks would unload. His decision involved *reality judgements* (how much space is left) and *value judgements* (which products are the most urgent). His variety of options was reduced by the obligation to accept trucks of products ordered through CRP. His remaining choices involved a lot of negotiations and relationship management such that some drivers were forced to turn back, still fully laden, while others managed to persuade him to accept their loads. To deal with this situation, some suppliers sidestepped the *standard* delivery schedules and either delivered directly to the stores (e.g. for promotions that required large quantities) or arranged to deliver again the next day, even during the weekend. As the CEO of Selecta pointed out, arranging a delivery on Saturday is difficult and requires a lot of negotiations as both warehouses have to be opened and staff allocated.

All the above examples demonstrate the process through which people (individually or collectively) evaluate disturbances (such as problems or mistakes in orders, variations in

demand or supply, changes of products or promotions) and decide upon actions to respond. The analysis of the findings, based on Vickers's ideas, show that to evaluate a situation, people make reality and value judgements, which are not always clearly separated. Based on standards generated in previous history, they also identify possible responses and choose an appropriate action. Therefore, the identification of the range of options as an outcome of the process of appreciation, also mentioned by Vickers, needs to be further emphasised in this study's framework.

This analysis also shows that both the decision upon an action to take and the action itself often involve relationship management. As will be further analysed below, when relationships between people or organisations improve, cooperation is facilitated and the whole process of appreciation and its subsequent action becomes more *efficient*.

An additional issue raised by this analysis is that in a highly competitive environment, rather than finding the optimal solution, it is more important to solve the problems as quickly as possible. Therefore, the *efficiency* of the process of appreciation seems to be more important in practice than identifying possible responses or selecting the optimum action. This *efficiency* is even more important when the objective is flexibility and quick response to changing market needs. The efficiency of appreciation was not taken into account by Vickers probably because his main focus was on policy making.

As the findings demonstrate, the *efficiency* of the appreciation of ordering is increased with the use of CRP. The efficiency of decision making is further increased through the building of *experience*. The first time people confront a specific event (or try to materialise an idea), they might not be able to quickly identify possible responses, while much time is spent on negotiations. But, when they come across similar events again, they follow previous patterns of action. As time passes and these patterns of action are repeated they become *standards* of behaviour. As Vickers argues, these standards are mechanisms of *control* of the 'appreciative system'. Focusing on the process of appreciation, this study shows that standards tend to control or constrain both the range of options to respond and the selection of the action. Therefore, although the *efficiency* of the appreciation is increased by following a standard way of acting, the available options to respond are limited.

7.2.3 The context of technology

As shown from the above analysis, both the process of appreciation and the ability to change at operational, structural and strategic levels are influenced by the organisational and interorganisational context, which shape the use of CRP. In this study, the analysis of the context is influenced by Kling's (1987) work on web models and is conducted through examining the *history of commitments to technologies and people*, the *organisational*

infrastructure and the *social/organisational relations*. Since, the history of commitments leads to the development of the infrastructure, it is included as part of the infrastructure.

7.2.3.1 The role of infrastructure

As mentioned in Chapter 3, infrastructure is seen as consisting of hardware, software, messaging standards, physical resources (e.g. warehouse space), organisational arrangements and human resources. According to Kling these infrastructural resources are developed over time through a history of commitments to third party organisations, trading partners, information technology and people.

Of the organisations studied, P&G and AB had the most efficient infrastructure to support CRP, while the others faced problems in technology, organisational arrangements or staffing. The following sections show how infrastructure may influence flexibility both at organisational and interorganisational levels.

Procter & Gamble

The only weakness of P&G's technological infrastructure was the lack of interoperability between the AS 400 system (supporting ordering, billing & shipping) and the more recently implemented SAP R3 (warehouse management system). The resulting inventory data inconsistencies affected the CRP when the AS400 showed the availability of products that were not in the warehouse, resulting in delayed or incomplete deliveries. Nevertheless, such problems were rare.

Otherwise the CRP implementation, which was designed and partly built in house, was one of the most complete in Europe, meeting most of the company's requirements and incorporating a sophisticated error detection system (described above). Nevertheless, as noted by a key account manager, the CRP still depended on the capabilities of the highly trained CRP analysts, in terms of understanding market needs, seasonal products, product demand and the impact of promotions.

Thus, P&G invested not only in CRP software, but also in a revised organisational structure including the creation of the new department of 'Customers Services' comprising the specialised analysts. Each CRP analyst was responsible for one retailer and could handle ordering without the assistance of sales managers. This efficient infrastructure considerably increased the firm's operational flexibility. The analysts had the expertise to quickly solve problems arising from weaknesses of retailers' information systems, as well as the knowledge to deal with demand fluctuations, new products and promotions. Key account managers and sales managers had more time to focus on sales strategies and improving collaboration with the retailers (through developing mirror teams). Both AB and Carrefour

commented on the efficiency of P&G. This advanced infrastructure not only improved P&G's cooperation with retailers, but also facilitated the development of new CRP links.

Unilever

In contrast, the infrastructure of Unilever was not so efficient, comprising an advanced warehouse management system (named SMS), without which the benefits of CRP in terms of inventory management and deliveries would not have been realised. A few years later the company implemented a SAP R3 system for forecasting, ordering, financial management and invoicing which, due to the *history of commitments* to technologies, did not interoperate with either SMS or CRP. The CRP orders were re-keyed into SAP and sent to SMS through a batch process the next morning, causing delays and mistakes (from rekeying).

Furthermore, the CRP software was bought from a software company and adjustments were needed to make it fit with the operations of Unilever. As noted above, this system did not have advanced error detection and did not particularly assist the CRP analysts. In addition the software was unable to keep track of order changes made by analysts, decreasing the efficiency of ordering and making such changes difficult and risky.

However, these weaknesses were counterbalanced by the capabilities and cooperation of the people involved. The specialised CRP analysts were well trained and based in the sales department, cooperated closely with sales managers to add new products or promotions. To sidestep the rigidity of CRP tracking changes, they produced Excel copies of the CRP output, made the changes and informed the sales managers. As one of the analysts noted, the lack of integration between CRP and SAP R3 allowed the creation and exchange of these Excel files and gave them *more possibilities for intervention.*

Thanks to the competence and expertise of both sales managers and CRP analysts, Unilever gained similar benefits to those of P&G. Its operational flexibility increased and its ability to deal with demand changes as well as to handle new products or promotions improved. Its cooperation with retailers was also facilitated, despite rare mistakes or delays, due to the weaknesses of Unilever's technological infrastructure.

Selecta

Small suppliers, like Selecta, cannot easily implement CRP due to a lack of resources. The CEO noted the weaknesses of their technological infrastructure (comprising an information

system in the central offices supporting finance and ordering), and their inability to engage and train CRP analysts. Unclear of the likely financial returns, he did not view CRP as a priority.

The lack of an efficient technological infrastructure was counterbalanced by Selecta's motivated and hard working staff. Merchandisers checked the stores for out of stocks, product displays and promotions and sales managers converted quantities into pallets, layers or cases. The latter spent more time in taking orders, often negotiating for increased safety stock to prevent out of stocks. The *efficiency* of these processes increased through Selecta's close personal relationships with retailers, which as shown below was a key element of the company's business strategy. Selecta aimed to gain competitiveness, through continuously staying in touch with its customers and exchanging valuable information regarding market trends and new products.

Like Selecta, most small suppliers lacked the resources to implement CRP. As AB's IT manager argued, this not only limits the efficiency of these organisations, but also constrains the flexibility of the supply chain, by decreasing its responsiveness to changing market needs. It also limits the flexibility of retailers, since even if their own technological infrastructure is advanced, they still have to use traditional ordering with many suppliers.

AB Vassilopoulos

The retailer with the most efficient technological infrastructure was AB with most of its information systems developed in-house and most of its operations fully automated. Stock levels in the stores were automatically reduced when products were scanned at the POS and when they dropped sufficiently, orders were automatically sent to the warehouse. Picking lists and shipping invoices were issued right away and the stock levels in the central warehouse were reduced. As a purchase manager argued, the benefits provided by this technological infrastructure were more important than those from CRP, since they were able to monitor product stock and sales in all their stores. This information was more vital than monitoring the orders to suppliers.

Enabling efficient product replenishment to the stores, this technological infrastructure also supported the effective use of CRP. Since CRP was fully integrated with the internal IS, the inventory report was automatically issued and sent to the supplier, while the final order was automatically inserted into AB's IS. Since data entry was not needed and mistakes were almost non-existent, the use of CRP did not require a dedicated person and was operated by technical staff responsible for all EDI-based systems.

This infrastructure increased the efficiency of ordering, speeded up the replacement and issuing of new products and promotions and increased operational flexibility. It also positively influenced the flexibility of interaction with suppliers, by increasing the efficiency of operations, enabling responsiveness to changing market needs and facilitating new CRP links. These benefits were not only realised by the advanced technological infrastructure, but also by the efficient organisational structure, the expertise of purchase managers and the competence of the IT staff.

Thanks to the IT department, AB's IS were quickly upgraded to incorporate TROFO's stores, whose orders were easily incorporated into CRP. AB's IT staff managed to upgrade four new stores per week, supported by the store staff who quickly adjusted to the new systems. The difficulties faced after TROFO's acquisition were associated with the space constraints in TROFO's stores, which delayed the distribution of new products and promotions.

Less important problems (mentioned above) in interacting with AB were due to the retailer's FIFO practice and its policy not to accept two promotions for the same product. These were reflected in AB's systems and could not be easily sidestepped.

Carrefour

In contrast, the problems faced in interacting with Carrefour were considerable. Due to the *history of commitments to technologies* the company's operations were supported by four incompatible information systems. Three of them (in the central offices, warehouse and certain stores) originated from the old Marinopoulos group, whereas the fourth, installed in certain stores, was added after acquisition by Carrefour. Most of these systems did not interoperate and were updated either manually or through the exchange of electronic messages. The acquisition of these systems was based on choices made at various points in time and, although this inherited technological infrastructure created many problems, it could not be changed easily.

Furthermore, Carrefour's complicated organisational structure dispersed responsibilities across the company. Tasks like product sales, handling product changes or promotions and data entry to the different systems, were conducted by numerous people in different parts of the company. When the CEO of Selecta asked for information regarding a competitor's products, his contact in Carrefour needed to ask four or five different people. This structure made cooperation, appreciation and decision making difficult and this was exacerbated by the technological constraints.

As mentioned above, when a new product was added, some systems were updated through data entry and others through electronic messages. Further confusion arose in handling promotions where mother and sticker codes needed to be swapped in the different systems, while one system did not recognise sticker codes at all. This naturally led to mistakes, accidental activations or deactivations of product codes and considerable delays in distributing new products or promotions. Solving these problems was complicated by the cumbersome organisational structure and by the staff's increased workload.

This problematic infrastructure also affected the ordering from stores as only new stores used automatic ordering (from POS) while the others were manually based, being sent and typed into the warehouse's IS the next day. Further problems arose due to a shortage of personnel, where one (overworked) person was responsible for the orders from many stores leading to erroneous, missing or delayed orders.

Further problems in product replenishment occurred due to the limited warehouse space (discussed above) which created difficulties at the organisational level as well as with suppliers (product returns and out of stocks).

All these also affected the use of CRP by producing errors (e.g. inaccurate stock, omitted products in transit, wrong product codes, missing stock of promotions and omitted stores orders) in inventory reports. CRP was not integrated into the system of the central warehouse or that of the central offices, requiring data entry for the inventory report and to update the internal systems. Therefore, a dedicated person was responsible for this updating as well as mapping supplier codes to internal ones. Although this could generate mistakes, thanks to the competence and effort of the CRP user these were rare. As argued above, without this CRP user the implementation of CRP would probably have failed. She not only supported the CRP, she also helped in correcting mistakes arising in inventory reports.

This problematic infrastructure not only constrained the impact of CRP on Carrefour's operational flexibility, but also affected its interaction with suppliers. As noted above, to circumvent these constraints, suppliers spent much time and effort in solving problems and ensuring that stores were notified well in advance of new products or promotions. By being proactive and taking part in Carrefour's internal activities (becoming part of its infrastructure) they managed to slightly increase the flexibility of certain operations.

Nevertheless, improvements in Carrefour's internal IS and structure gradually reduced the problems. The central warehouse was expanded, the warehouse system was due to be replaced, and new systems were implemented in stores. All these improvements were expected to automate the ordering of stores, to speed up the distribution of new products, to facilitate the handling of promotions and to increase the ability of the supply chain to handle

changes in market needs. However, until all the different systems are integrated, many of the problems mentioned above will remain.

Atlantic

The infrastructure of Atlantic was more incomplete than problematic as they only had a central office system when CRP was implemented. Atlantic bought and tried to test CRP, before implementing a central warehouse system (*history of commitments to technologies*). The lack of a warehouse management system meant that stock taking was conducted manually and errors could be made due to misplaced products, forgotten store orders or products in transit. Further mistakes occurred due to the lack of integration between CRP and the central offices system, necessitating data entry both to issue the inventory report and to update the internal system regarding the final order. Such problems could only be solved through a trained and capable person dedicated to CRP. However, the shortage of personnel meant that CRP was added to the duties of traditional ordering staff who resisted the increased workload and responsibilities. The suppliers were prepared to help counter these infrastructural deficiencies but this was difficult, since it required close cooperation with the unmotivated CRP users in Atlantic. Thus, the operational flexibility of both Atlantic and of its interaction with suppliers decreased. After a year of continuous effort the CRP project was postponed until a new warehouse management project could be implemented.

Sklavenitis

Sklavenitis's technological infrastructure was also incomplete, since it only comprised an information system in the central offices. Ordering was conducted traditionally, meaning that more time was spend in order taking and higher safety stock levels were needed. The lack of technological infrastructure was counterbalanced by Sklavenitis's efficient organisational structure and the availability and motivation of its employees. This also affected Sklavenitis's interaction with suppliers, since warehouse or store staff would assist sales managers and merchandisers with shelving, checking promotions and product shortages. As a result Sklavenitis was more flexible than Carrefour or Atlantic in dealing with out of stocks, changes in orders, new products or promotions.

General conclusions

The fact that many organisations have not yet implemented CRP (or EDI) constrains their trading partners from realising all the potential benefits of interorganisational systems. The efficiency and operational flexibility of the business network will be considerably increased only when a critical mass of companies implements interorganisational systems.

As the analysis shows, the infrastructure of an organisation not only affects its flexibility, but also its interaction with trading partners. The infrastructure comprises both technology and the people that work with the technology, or cover for its weaknesses. As this section shows, no matter how perfect a system is, without the support of competent users it cannot provide the desirable results. The role of people is even more important when technology is problematic or non-existent.

As also shown in this analysis, the human factor plays a crucial role in handling unusual situations or identifying alternative courses of action. This argument is further supported in the following section which demonstrates how the relationships and cooperation between people influence the flexibility achieved by organisations and their trading partners.

7.2.3.2 The role of social and organisational relations

The relationships and cooperation attained both at the organisational and interorganisational level, proved to have a considerable impact on the flexibility achieved. As shown in this analysis, these relationships can influence the process of appreciation and the decision upon an action to take, while, as Vickers (1983a) argues, they can be further changed by the action of response.

Sometimes the use of technology can *impede cooperation* and worsen relationships; for example, Carrefour's cumbersome infrastructure tended to discourage cooperation, often leading to *misunderstandings, disagreements* and *conflict*. It delayed the process of appreciation and limited the ability to solve problems. In contrast, improved cooperation can often circumvent the deficiencies of technology; for example, the cooperation and commitment of Sklavenitis's staff enabled them to gain flexibility and circumvent the lack of technology. Similarly, cooperation between Unilever sales managers and CRP analysts enabled them to overcome the weaknesses of their CRP.

However, the use of technology may also support cooperation and improve relationships. The implementation of *CRP* generally *ameliorated* the *relationships* between trading partners. Sales managers used to spend much time taking orders and *negotiating* with purchase managers over product quantities with an implicit *conflict* between the former, who wished to increase sales, and the latter, who preferred smaller orders. This gradually improved with CRP although, according to Unilever's IT manager, it took time for retailers to realise the potential benefits of CRP and to overcome their fear of losing control of their orders.

> It was the beginning of the year and the stock left in Carrefour's warehouse of cleansers and toiletries was very low. Based on our experience and the history of previous demand calculated by the CRP system, we proposed that they needed 5 trucks of cleansers and 2 trucks of toiletries to cover their needs at least for the first

> few days. Carrefour's purchasers objected and started to negotiate reduced quantities. After spending time on negotiations we had to agree on 2 trucks per day. A day later the two trucks became three, but this was still not enough to cover their needs. The result was that they ended up being out-of-stock [Unilever-CRP analyst].

Companies gradually realised that they did not necessarily have *conflicting interests* and that it was for their mutual benefit to avoid out of stocks, while keeping stocks low. This was facilitated through CRP, which eliminated mistakes, better matched supply with demand and increased the efficiency of operations. Convinced by the success of CRP, retailers allowed suppliers to manage orders on their own. As a result, the *efficiency of ordering* increased and the time spent on *negotiations* was *eliminated.* As Unilever's IT manager said, "It is not that people have changed, but it is mostly that over time they realised the considerable improvements of CRP. Now customers see us as their partners and do not even look at the suggested order sent by the system".

Relationships were further *improved* through working together in ECR–Hellas to increase the efficiency of the entire supply chain. Companies learnt to *trust* each other more and this enabled them to cooperate *more efficiently* over product *changes* and promotions *without excessive negotiations.* As mentioned above, these were handled by CRP analysts who simply adjusted the CRP orders to run-out the old stock and replace it with new stock.

Improved cooperation also enabled them to *better appreciate* and *solve* operational problems; for example, as described above, the difficulties with Carrefour were largely overcome through effective personal collaboration between the respective CRP experts, despite the constraints of Carrefour's organisational structure.

Through collaboration trading partners were also able to *better deal with changes in the type of business.* As mentioned in Section 7.2.1.3, AB's problems with ENA's wholesaling business were solved by close cooperation between the suppliers and AB's purchase managers.

Realising the importance of improved cooperation, suppliers' sales managers put much effort into building stronger relationships with customers as they believed it was essential for improving customer service, launching more promotions and monitoring consumer demand in the different stores. This was facilitated by CRP, which gave them more time for relationship building, as was reflected in P&G's establishment of the customer business development department with its multifunctional account teams.

Both interorganisational and interpersonal relationships influence the product displays in stores, which may considerably affect sales and generate *conflict* between suppliers. Suppliers' sales managers or merchandisers check that their products are displayed prominently and if they are not satisfied they *negotiate* strongly for a better position. The

outcome of the negotiation greatly depends on the *power* of the supplier over its customer. As P&G's key account manager argued, "this power is closely associated with the turnover that the supplier generates in the customer". In this climate, smaller suppliers need to negotiate harder and much depends on their personal relationships with retailers' staff.

For example, Selecta lacked the *power* to handle ordering and distribute new products and promotions without spending time on *negotiations*. Orders were still conducted in the traditional way, promotions had to be agreed at the beginning of the year, and new products required a listing fee to be accepted by retailers. Each new product also had a trial period, after which, if sales had not met expectations, it could be withdrawn. To increase competitiveness, Selecta focused efforts on building close relationships with customers, much of which was handled personally by the CEO with his established friendships in the industry.

These personal relationships reduced the time spent on negotiating both orders and display arrangements, as well as allowing the CEO to exchange valuable information on consumer trends directly with store managers. This was particularly the case with Sklavenitis, whose owner was a longstanding friend of Selecta's CEO. As well as facilitating orders, promotions and distribution, this personal relationship facilitated the acceptance of new Selecta products without high listing fees.

Like the other suppliers, Selecta faced problems with Carrefour but, through relationship building, it gradually managed to improve cooperation; for example, Selecta's merchandisers work with Carrefour's store managers to spot mistakes and solve problems. Gaining the *trust* of the store managers reduced the time spent negotiating and led to the faster resolution of problems such that the store managers are more prepared to check whether, for example, shortages are due to faulty product codes in the store. Similarly, building good relationships with Carrefour's warehouse manager contributed to the acceptance of Selecta's products in the warehouse, when space was short. They were even able to negotiate a Saturday delivery, which required Carrefour opening the warehouse and providing extra staff.

As Selecta's CEO argued, through getting to know people, sometimes offering them gifts and trying to improve cooperation, they managed to increase their flexibility and improve their ability to overcome problems.

7.2.4 Concluding remarks

The first section of this chapter analysed the empirical data based on the research frameworks presented in the literature review and theory chapters. In the first part of the analysis, the juxtaposition of the empirical data with the preliminary research assumptions

(dialogical reasoning) showed the limitations of our initial conception of flexibility (focusing on its multidimensional nature) and justified the development of the extended research framework. Based on this framework, the analysis of the data focused on the process of appreciation, through which people evaluate a disturbance and decide upon an action to respond. It also focused on the examination of the organisational/interorganisational context influencing this process.

However, this analysis revealed additional issues that had not been included earlier. It demonstrated that the role of people is sometimes more important than that of technology in the attainment of flexibility, since they can circumvent weaknesses of technology and handle unusual situations through identifying alternative courses to respond. It also showed that through the process of appreciation, and influenced by their relationships, people identify a range of options to respond in order to select an action. However, the efficiency of the process of appreciation is sometimes more important than the selection of the optimum response. As people tend to follow previous patterns of action, the efficiency of the process of appreciation is increased, while the range of options might be limited.

These additional ideas regarding the role of people, the relations between the different dimensions of flexibility and its dynamic nature are further discussed in the second part of this chapter.

7.3 Discussion

This section elaborates the issues raised throughout the analysis of the empirical data. It discusses the relations between the different dimensions of flexibility, focusing on the tension between the temporal and range dimensions. Following the theory's argument, it also discusses the dynamic nature of flexibility which seems to change over time influenced by changes of the organisational/interorganisational context. It also emphases the socio-technical nature of flexibility by separating the elements of infrastructure (technology, people organisations) and further examining their role and impact on the flexibility of organisations/dyads or even business networks. Based on these conclusions, it discusses the weaknesses of the research framework, used in the analysis of the data, and presents a refined conceptual framework of organisational flexibility.

7.3.1 Flexibility as a multidimensional concept

In this study we focused on the time, range and scope dimensions of flexibility. The analysis presented in the previous section demonstrates that the relation between the different dimensions is not necessarily linear. Therefore, a statement like flexibility increases when

the efficiency of the appreciation and of its subsequent action increase, when the range of options to respond enlarges and when the scope of response expands, is rather simplistic.

As also supported by previous research (Golden & Powell, 2000; Upton, 1994) the larger the scale of organisational change the more time and cost is usually needed. A change at an operational level can normally be conducted right away (e.g. to incorporate a new product in an order, or to adjust safety stock levels to meet an unexpected increase in demand), while at a structural level (e.g. add a new trading partner) or at a strategic level (e.g. expand the business through acquisition) can take up to a year and require a considerable investment.

However, the degree of efficiency may vary depending on the situation. For example the implementation of CRP in AB was considered very efficient, since it only took a few months and required less effort, compared to the one in Carrefour, which took almost a year. Moreover, the incorporation of TROFO's stores in AB was conducted efficiently, since IT staff was able to upgrade 4 stores per week. This was considered as a proof of AB's flexibility based on technological awareness, competence and availability of resources. In contrast, the incorporation of ENA's stores was less efficient, since AB's staff needed to spend more time and effort to adjust CRP to this new kind of business.

According to Kumar (1999) quicker response times may mean higher costs. For example, to deliver extra products directly to stores, suppliers may need extra trucks that may not follow predetermined routes and may not be optimally loaded. *Higher costs* can be also required by an *increased range*; for instance, through a rich product portfolio or an increased number of promotions. Therefore, as Golden and Powell (2000) argue, flexibility is often associated with high costs.

Besides increasing the cost, an increased *range* may also increase the time and effort required for certain operations. For example, by sidestepping CRP and creating additional excel files to track changes, Unilever's sales managers and CRP analysts *decreased the efficiency* of ordering, but increased their ability to intervene and change orders.

Conversely, *increased efficiency* may sometimes *constrain the range of options to respond.* As shown above, although CRP increases the *efficiency* of ordering, it imposes a rigid workflow and provides *limited options* for intervention. It does not support supplementary orders and does not incorporate orders directly from stores.

When technology provides constraints, people usually try to find alternative ways to make changes and deal with urgent or unusual situations. Based on standards, they evaluate a situation, identify courses to follow and decide actions to take. But, the history of standards might restrict the *range* of options to respond, while at the same time increasing the *efficiency* of response. As our analysis showed when people come across similar situations

they usually use solutions tested in the past without spending time in thinking of alternative options or actions to follow. Their decisions are influenced not only by the specific situation but also by the sequence of past decisions or actions (Vickers, 1983b). By following previous patterns of action they increase the *efficiency* of appreciation, since they do not spend time in decision making. However, without thinking of alternatives they *limit their range of options* and decrease the possibility of finding a better way to deal with the specific situation.

Nevertheless, this does not mean that there is a trade-off between efficiency and flexibility. Although increased efficiency may sometimes constrain the range of options, and consequently flexibility (Hanseth *et al.*, 1996), flexibility normally requires efficiency (as examined in this study). As suppliers argued, in highly competitive environments, it is sometimes more important to respond quickly (e.g. to replenish missing products), rather than to find the best way to do it. Further supporting the importance of efficiency, Carrefour's IT manager argued that if all stores could order either from the central warehouse or from the suppliers, it would be impossible for the company to manage its orders or deliveries. As he said, this would be a nightmare since their efficiency[45] would be destroyed and their flexibility would be lost. Such an increased range of ordering options would make them lose control of their operations and consequently their ability to respond even to everyday situations.

Nevertheless, *efficiency* and *range* should not be considered as two conflicting dimensions of flexibility. As this analysis further showed an increased range of options can sometimes bring efficiency and vice versa. For example, the availability of space in the warehouse, providing more *options* for storage, increases the organisation's *efficiency* to deal with unexpected deliveries or product returns. Moreover, the improved *efficiency* and frequency of ordering increases an organisation's *options* to deal with changes in demand.

Therefore, the relations between the different dimensions of flexibility are complex and their importance may vary depending on the situation or the context (Kumar, 1999). Consequently, an organisation may be very flexible in some ways and less flexible in others (Golden & Powell, 2000). Therefore, to achieve flexibility organisations or people need to be able to evaluate the situation and strike an appropriate balance between their ability to follow alternative options, responsiveness and efficiency.

[45] The handling of changes in orders would be complex and would require more effort.

7.3.2 Flexibility as a dynamic concept

An important issue raised by both our framework and findings is the evolution or change of flexibility over time.

As the analysis showed, improvements in Carrefour's infrastructure (information and warehouse), increased the company's ability to deal with new or seasonal products, changes in promotions, and unexpected deliveries. These improvements also influenced the organisational structure as well as the ability of people to cooperate in order to identify mistakes and solve problems. All these changes positively influenced the company's flexibility by increasing its responsiveness to changing market needs. They also improved Carrefour's cooperation with suppliers, by diminishing problems and gradually increasing the operational flexibility of the dyads.

The flexibility of an organisation, or of its interaction with trading partners, can also change because of changes in interpersonal or organisational relationships. As our analysis showed, the improved cooperation between Selecta's merchandisers and the store managers increased their flexibility in handling out of stocks. Moreover, improved relationships with the warehouse manager facilitated access to Carrefour's warehouse. Finally, the development of interpersonal relationships between the owner of Selecta and that of Sklavenitis increased the supply chain's ability to distribute new products and promotions. As the analysis showed, when people work together and if their relationships improve, their ability to find solutions and respond to unusual or urgent situations increases through cooperation.

Even without technological, social or organisational changes, flexibility may still change through accumulated experience. Over time people 'learn' to deal with specific situations and become more efficient in their decision making. However, as discussed in the previous section, whether they also become more flexible is less clear, since in following previous practices they limit their range of options to respond.

Therefore, organisational flexibility may change through subsequent processes of appreciation, whereby people in organisations evaluate situations and, based on their experience, decide upon actions to take. Their decisions and actions are influenced not only by previous standards, but also by the organisational/interorganisational context. These decisions can further affect both the history of standards and the context, through changing information systems, structures, relationships and cooperation. As this section showed, these changes influence the following processes of appreciation and as a consequence affect flexibility.

7.3.3 Flexibility as a socio-technical concept

This thesis demonstrates that flexibility needs to be analysed as a context embedded notion. By examining the use of the same technology in different organisations the study demonstrates how specific characteristics of context can influence flexibility as well as how they can affect the impact of technology. The examination of the organisational/interorganisational context was based on web models (Kling, 1987), which analyse the impact of information technology by focusing on the infrastructure available for its support, the history of commitments to technologies and people creating this infrastructure, and the relations of people or organisations involved. The impact of these issues on the ability of an organisation/business network to appreciate and respond to market changes, threats or opportunities, has been analysed based on examples from our case study.

The analysis revealed the technological characteristics providing or constraining flexibility, as well as the importance of the human factor in taking decisions and identifying alternative courses of action. Putting emphasis on the socio-technical nature of flexibility, this discussion separates the elements of infrastructure to further examine the role of technology and the role of people in achieving flexibility at an organisational level. It also discusses the role of organisations in attaining flexibility at an interorganisational level. By putting emphasis on the different characteristics of these elements, this discussion aims to provide a more comprehensive view of flexibility as well as identifying potential weaknesses or limitations of the theoretical approach.

7.3.3.1 The role of technology

The objective of this thesis was to examine the impact of specific interorganisational systems, such as CRP, on the flexibility of organisations and on their interaction with trading partners. As Kurnia and Johnston (2000) argued the use of electronic communication between trading partners increases the efficiency of communication, enabling more frequent replenishment and better control of demand uncertainty. This was further supported by this study, which showed that the use of CRP not only increased the efficiency of ordering and the frequency of deliveries, but also the ability of organisations to accommodate fluctuations in demand. Apart from that, this study showed that CRP also facilitated the handling of changes or unusual situations. By improving the planning of deliveries and eliminating out of stocks, CRP enabled organisations to deal better with issues, such as an abrupt increase in sales or a problem with a delivery. By decreasing safety stocks, freeing storage space and improving inventory management, CRP facilitated the handling of unusual or urgent situations, such as product recalls, returns or unexpected deliveries. Finally, CRP facilitated the handling of changes in products or promotions and speeded up distribution. Although

previous researchers, e.g. (Raghunathan & Yeh, 2001; Clark & Hammond, 1997), argued that CRP is probably inadequate for products, such as seasonal products, where demand changes frequently, this study showed that with human intervention and adjustments of safety stock levels this type of products can be also accommodated in CRP. These issues can be handled better with the use of a system, like CRP, rather than without one.

As this study showed, CRP also changes the work of sales and purchase managers by providing them with valuable information for decision making as well as by offering them more time to think of ways to increase sales, while meeting consumers' changing needs. By facilitating information integration and making consumer demand and inventory visible to both retailers and suppliers, CRP creates a basis for collaborative forecasting (Raghunathan & Yeh, 2001). By sharing this information, supply chain members can improve customer service, respond more flexibly to customer demand (Mouritsen *et al.*, 2003) and think of ways to influence demand and beat competition.

Therefore, CRP not only increases operational flexibility, but also influences strategic flexibility. Besides optimising ordering and enabling organisations to deal better with changing situations, it also improves their ability to predict and influence market needs. However, as the analysis showed, CRP also provides constraints and limits structural flexibility, both at an organisational and interorganisational level.

As shown in the analysis, the implementation of CRP with a new trading partner is not easy and requires time and effort. Furthermore, due to its high cost, as well as its requirements for infrastructure (a well trained CRP user and an advanced warehouse management system), it cannot easily be implemented by smaller organisations. Therefore CRP, instead of facilitating interorganisational links, often leads to the creation of a business network, which is rather closed and restricted to a few large organisations.

At the organisational level, CRP also provides constraints by imposing a rigid workflow, based on the exchange of specific messages, in a prearranged order and on a predetermined day and time. It provides limited *options* for change, since it constrains the ability of trading partners to delay sending inventory reports or orders, to correct an already sent order or to create an extra one. Therefore, when a supplementary order is needed, the system must be sidestepped and alternative methods used.

CRP does provide some options for intervention, allowing CRP analysts to adjust safety stock levels or add new products. According to Unilever's IT manager, a more complete CRP implementation would support fully automated ordering, where orders would be automatically created and sent as soon as the stock in the retailer's warehouse dropped below

a specific level. However, this would further limit the options for human intervention. Therefore, it seems that the more *efficient* a technology is, the less *adaptable* it becomes.

An additional constraint imposed by CRP is that it calculates orders based on the central warehouse's inventory report, without providing information regarding sales or product needs per store. Consequently, it only supports transactions with the central warehouse, while failing to accommodate orders of individual stores. As mentioned above, the centralised replenishment of stock increases the *efficiency* of deliveries but limits the ability to handle in-store promotions or out of stocks quickly.

Such limiting issues could have been avoided if a flexibility analysis (Fitzgerald, 1990), showing the potential need for change, had been conducted during the development of CRP. A flexibility analysis could have demonstrated the need to enrich its functionality to enable the cancelling and resending of orders or the sending of supplementary products and promotions. It could have also shown the importance of incorporating and supporting ordering from individual stores. However, whether these additional features would increase the flexibility of the organisations using CRP or would provide excessive complexity limiting the control of operations would probably depend on the level of freedom allowed by the system. As Gebauer and Lee (2005) argue, insufficient flexibility to support a given business process may sometimes prevent the use of the system, while too much flexibility can make a system too complex to use and hence reduces its usability, in addition to becoming an unnecessary investment.

However, as this study further showed, both the *efficiency* and the *adaptability* of a technology are greatly influenced by the broader technological infrastructure. Therefore, technology needs to be seen as being embedded in an infrastructure of hardware and software systems that support its operation and handle related business processes. For example, without an efficient retailer warehouse management system and accurate inventory reports, CRP works ineffectively, resulting in out of stocks or excessive stock.

Further problems arise from incompatible information systems. If CRP is not integrated with internal information systems, data entry is required and errors can be made. Even more problems arise when internal systems (e.g. in central offices, warehouse and stores) do not interoperate, leading to mistakes or delays in updates of products or promotions, forgotten or erroneous stores' orders, inaccurate stock taking and forgotten products in transit and as a consequence inaccurate inventory reports. Therefore, issues of integration tend to decrease the efficiency of operations by generating errors and requiring much time and effort on problem solving.

Aiming to automate their processes, eliminate human intervention and data entry, as well as to reduce problems, companies gradually improve their technological infrastructures, through creating batch processes or implementing new systems. However, the use of more advanced information systems does not necessarily bring more efficiency or more flexibility. As the IT manager of Unilever argued, with the older IBM system they were able to issue an invoice once a truck was loaded, whereas with the new SAP R3 system this was much more complicated and time consuming and invoices had to be pre-issued some hours before.

Sometimes organisations without an efficient technological infrastructure can be more flexible in changing their normal workflow, as the case of Sklavenitis. Other times the lack of integration between systems (e.g. between CRP and SAP R3 in Unilever) may provide more options for intervention (e.g. creation and exchange of auxiliary Excel files).

The main reason for these constraints is that information systems development is still based on structured design methodologies focusing on the provision of efficient and automated processes (Ciborra 1999). Although the need to build adaptable information systems able to grow, change and evolve over time is increasingly supported in the IS literature (Lycett *et al.*, 1997) issues of software compatibility, scalability, modularity and connectivity are still being examined in computer science research. These issues are exacerbated with interorganisational systems due to constraints of interoperability with multiple internal systems of different organisations.

As discussed in Chapter 2, the public and cheap Internet is expected to improve interconnectivity (Chou *et al.*, 2004) by providing more flexible communication linkages (Daniel & White, 2005) and facilitating the access of smaller organisations (Threlkel & Kavan, 1999). Further benefits are expected from the use of XML, which is a more scalable and flexible standard than EDIFACT (Power, 2005). Nevertheless, these newer technologies are still associated with security and privacy risks, immature XML standards and a lack of a common messaging standard (Angeles *et al.*, 2001). Further problems arise due to the proliferation of technologies (e.g. BizTalk, ebXML, web services), their incompatibility and the difficulties of integrating them with legacy systems (Chou *et al.*, 2004).

Following market trends and aiming for innovation, third party organisations (software companies), as well as large suppliers or retailers, leading the market, are currently developing internet-based platforms (electronic markets). Nevertheless, the technological constraints that still exist impede the efficiency and even more the flexibility of interorganisational communication. Whether the organisations will try to impose their own electronic markets or try to make them interoperate with those of trading partners is still unclear. Nevertheless, this may again create problems to smaller organisations, unable to

participate in different electronic markets, and consequently lead once more to lock-in or closed business networks.

All these demonstrate that technology is not static but dynamic with changes occurring through the invention of new materials, innovation, correction and improvement of current functions, expansion, upgrades and patches (Orlikowski & Iacono, 2001). They are not only implemented to improve a company's technological infrastructure (e.g. in the case of Carrefour), but also to meet its information and operational needs, which change over time (e.g. the CRP system in AB had to be reconfigured to accommodate ENA's stores). Changes may be also triggered by trading partners or competitors, while further changes result from market trends or the need for innovation. Their impact is not always clear; they may improve efficiency and enable automation or complicate operations and create new incompatibilities. Nevertheless, as this study showed, even the most insignificant alterations of the technological infrastructure can positively or negatively influence the flexibility of operations.

However, as the following section further discusses, the impact of a technology on the flexibility of organisations, or of their interaction with trading partners, is greatly influenced by the people involved in its use.

7.3.3.2 The role of people

As the analysis showed, technology cannot easily handle changes or unusual situations, without the intervention of people. As technology is often inflexible, it imposes a rigid workflow hindering the handling of situations that differ from the norm. In contrast, people are flexible, creative and can find ways to overcome the constraints imposed by technology. They often sidestep it, change the predetermined workflow and find solutions through cooperating with people from trading partners.

For example, to send a supplementary order they may sidestep CRP, communicate over the phone, update their internal information systems and arrange for an extra delivery. To circumvent warehouse space limitations, in urgent situations they may sidestep the predetermined workflow and arrange to deliver products directly to stores. Finally, to deal with problems in new products or promotions, suppliers may act proactively, intervening in a customer's operations and notifying them well in advance regarding changes.

To deal with unusual or urgent situations people (individually or collectively) engage in a process of ***appreciation***. They perceive and evaluate a situation, identify possible courses to follow and decide upon an action to take. This process of perceiving, judging and acting is influenced by standards (ways of operating and acting in similar situations) generated in previous history.

People's capacity to perceive a situation, compare it against judgements and decide upon an action to take is influenced by their ***competence*** and ***capabilities***. This is also supported by Vickers (1968, p.158), who argues that a person's capacity for appreciative judgement depends on his relevant ***"mental faculties"***, which vary between individuals. As this study showed, the use of CRP itself depends on the knowledge and expertise of CRP analysts. As suppliers argued, without the involvement of specialised and properly trained analysts, CRP could not provide the desired results.

In retailers, dedicated CRP users are only required if the technological infrastructure is problematic; in which case, the users must overcome the weaknesses of technology, by solving problems and updating the system manually. For example, the *competence* of Carrefour's CRP user, contributed to the efficiency of ordering, facilitated the identification of mistakes in the inventory report and supported problem solving. In contrast the lack of such a person in Atlantic was one of the reasons leading to the failure of their system.

The importance of people's *competence* and *expertise* for the flexibility achieved by an organisation (or dyad) was demonstrated in this study. For example, the knowledge and expertise of AB's IT staff contributed to the company's flexibility by increasing its ability to meet changing market needs, whereas the lack of expertise of AB's purchase managers in wholesaling did not facilitate the adjustment of the CRP and delayed the company's adaptation to this business.

However, as Vickers (1968, p.158) also argues people's capacity for appreciation is also influenced by the "materials" at their disposal. As he says, these can be "externally accessible" or derived "by further mental process". Supporting this, the analysis showed that CRP analysts could better evaluate safety stock levels for a new product or promotion, based on the system's information regarding the history of demand and previous orders. This information also supported sales managers, who could better appreciate market trends, changes in consumer demand, increased or decreased sales and the impact of new products or promotions.

As the analysis further showed, the "materials" supporting appreciation can also affect the *efficiency* of people's judgements and decision making. For example, ordering is *speeded up* by the use of CRP, which has embedded business knowledge and can calculate an order based on previous product demand. Ordering is conducted even more *efficiently* in P&G, where the CRP has an advanced error detection system, facilitating CRP analysts in the appreciation of mistakes or problems.

Regardless of their capabilities or the materials available, the first time people confront a specific situation, they might not appreciate it efficiently. They might not be able to quickly

identify possible actions to follow, while a lot of time might be spent on negotiations. But, as similar situations arise they accumulate ***experience*** and improve their ability to deal with them. According to Vickers (1972) experience is the readiness to see and value particular aspects of a situation, as well as to evaluate them and compare them with standards, built in similar ways. Therefore, experience is built over time through subsequent processes of appreciation.

Through handling and evaluating orders, CRP analysts gradually acquire knowledge regarding product demand, the impact of promotions, and new and seasonal products. Through accumulating experience, they learn how to deal with fluctuations in demand and create *standard* ways of responding. For example, after many cycles of appreciating the results of CRP in covering the demand of ENA's stores, CRP analysts developed an understanding of these different market needs and built up a standard (doubled safety stock levels) to cope with them.

Through *experience*, CRP analysts also improved their capability to identify mistakes in orders or inventory reports, even without the support of CRP (as in the case of Unilever). Furthermore, through cooperating with retailers' CRP users, they gradually improved their ability to identify and solve problems, such as accidental deactivation of product codes, mistakes in promotions, forgotten products in transit and omitted store orders. Their cooperation further improved due to the gradual reduction of problems. Over time people identified the most common problems and became more cautious in avoiding them and more capable in overcoming them. As AB's IT manager argued, although human experience cannot reach the calculative capacity and efficient operation of an advanced IS, it can often provide more effective solutions.

However, when people deal with similar situations or problems, they tend to follow previous patterns of action. As time passes and these patterns are repeated, they become *standards* of behaviour. For example, when Selecta's staff realised that they could sidestep AB's FIFO practice by sending their products when the warehouse ran out of stock, this became standard practice.

Following previous ways of acting, people tend to increase the *efficiency* of their response, but *limit their range of options* to respond. Without spending time in thinking of alternatives, they limit their ability to find better ways to deal with situations. However, in competitive environments, it is often more important to respond quickly rather than to find the optimum response.

Nevertheless, people's capacity to respond and act quickly is also influenced by their ***motivation.*** The problem-solving ability of Carrefour's CRP user was attributed both to her

competence and motivation. Similarly, Selecta merchandisers' ability to efficiently deal with out of stocks in stores was due to their motivation and intelligence. Finally, the efficient incorporation of TROFO's stores in AB was accomplished not only by the hard work of AB's IT staff, but also by the motivation and willingness of TROFO's employees to adapt to the new business environment.

Although the issue of motivation was beyond the scope of this study, the findings showed that it is an important contributor to flexibility. According to Mullins (1996, p.480) "The underlying concept of motivation is some driving force between individuals by which they attempt to achieve some goal in order to fulfil some need or expectation". People's motivation is related to issues of achievement, recognition, responsibility and advancement, which Herzberg *et al.* (1993) call motivators[46]. It may be also affected by[47] working conditions, organisational policies, salaries and interpersonal relations, which if problematic may lead to job dissatisfaction (Herzberg *et al.*, 1993).

Without motivation, people can sometimes limit the flexibility of operations. By resisting the use of technology and not putting in the effort needed for its implementation, they can also impede the realisation of its benefits. For example, the ***resistance*** of people in Atlantic and their inability to put much effort on the CRP's implementation hindered problem solving, delayed the system's testing and contributed to the postponement of CRP. Nevertheless, this resistance was mostly attributed to the people's increased workload.

The lack of motivation or resistance can be often overcome through cooperation and ***management of relationships***. For instance, the CRP project in Atlantic (even though postponed at the end) was kept afloat longer by the efforts of P&G's CRP analysts and their influence over Atlantic's employees. Furthermore, the problems faced, due to the infrastructure in Carrefour and the increased workload of many employees, were often solved thanks to the efforts of the CRP user, who coordinated problem solving though engaging people from different parts of the company.

According to Vickers (1983b) most actions taken to respond to a specific event or situation may involve the management of relationships. This thesis showed that relationship management is even more important when people need to sidestep the predetermined workflow. Then, actions often depend on communication, negotiation, persuasion and agreement between people, in various parts of the same or different companies (e.g. to return

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[46] In his motivation-hygiene theory Herzberg calls 'motivators' the factors that can bring the kind of job satisfaction and the kind of improvements in performance that a company seeks from its workforce.

[47] The hygiene factors relate to the job environment and can be used to prevent dissatisfaction.

products, to create supplementary orders, to arrange for extra deliveries, to find additional trucks or to reopen the warehouses during the weekend). Again, as such situations are repeated, people become more efficient in identifying possible actions to follow, without spending a lot of time in negotiations and decision making. Nevertheless, both decision making and relationship management are influenced by their *cooperation* and *interpersonal relations*.

The analysis showed that ***conflict*** in negotiations (e.g. between sales and purchase managers in traditional ordering) delays decision making and limits the efficiency of the process of appreciation. In contrast, improved ***interpersonal relationships***, close ***cooperation*** and increased ***trust*** speed up negotiations, facilitate decisions and contribute to a quicker identification of solutions and actions. For example, the increased trust between purchase and sales managers speeded up ordering and facilitated the handling of changes in products and promotions. Moreover, the interpersonal relationship between Selecta's CEO and the owner of Sklavenitis facilitated the distribution of new products. Finally, the improved relationships of Selecta's staff with store managers and warehouse staff increased the efficiency of problem solving, facilitated the distribution of products and improved the handling of out of stocks.

Nevertheless, people are part of organisations and their cooperation and decisions are also influenced by organisational characteristics.

7.3.3.3 The role of organisations

As previous research (Golden & Powell, 1997) showed the ***initiators of an IOS project*** are more likely to achieve flexibility by the implementation of technology than non-initiators. This was supported by this study demonstrating that P&G (CRP initiator in Greece) gained more efficiency and flexibility in certain operations, than other organisations (non-initiators). The successful implementation of CRP in P&G was attributed to the fact that the CRP was designed and partly built in-house, *matching* the *company's structure* and covering most of its needs. The other suppliers implementing CRP mostly outsourced the application, but these implementations could involve weaknesses and needed to be adjusted to the company's structure.

Pressure from suppliers made retailers proceed with the implementation of CRP. This implementation was successful and relatively quick in retailers having the ***expertise*** and the ***appropriate infrastructure*** (including legacy systems and people), while it took longer for retailers with a problematic infrastructure. Weaknesses in infrastructure can also lead to unsuccessful implementations, as in the case of Atlantic, which decided to implement CRP (after P&G's suggestion) without having an appropriate warehouse management system or

staff. To avoid such problems, organisations need to make the appropriate investments in their infrastructure before proceeding with CRP.

Nevertheless, as this study showed, many organisations do not have the ability to make the required changes to implement CRP. They not only ***lack the resources*** (adequate technological infrastructure, well trained staff and money), but also have *other priorities* preventing them from proceeding with such a large investment.

However, the inability of these organisations to implement IOS (and specifically CRP) not only limits the efficiency of their operations, but also constrains the responsiveness (to changing market needs) of the supply chains in which they participate. Therefore, some organisations, even with an advanced technological infrastructure, cannot achieve the desired flexibility since many of their trading partners still use traditional ordering. As this study showed, the use of CRP will not provide all the expected benefits until a large number of organisations (a critical mass) adopt it. Nevertheless, it can still provide benefits to the trading partners using it.

As shown in the analysis, the flexibility of the interaction between trading partners is greatly influenced by the flexibility of the individual organisations. One of the main organisational characteristics affecting flexibility is the ***organisational structure*** (Das & Elango, 1995). According to Volberda (1996, p.364) "organizational structure comprises not only the actual distribution of responsibilities and authority among the organization's personnel, but also the process of ... decision-making, coordination, and execution". Previous research on flexibility focused on the distinction between centralised or hierarchical structures and more decentralised or flatter structures, often associating the latter with more flexible organisational forms (Volberda, 1996; Ahmed *et al.*, 1996). This study showed that by building multilevel and multifunctional customer business development teams, P&G staff gained more flexibility and increased their ability to respond to changing market needs. Nevertheless, it also showed that the *organisational structure* (regardless of its form and type) needs primarily to facilitate cooperation and decision making. As discussed, the complex organisational structure of Carrefour, where people in different parts of the company had overlapping responsibilities, hindered the process of appreciation, delayed problem solving and decreased flexibility.

Both the process of appreciation and the decision upon an action may be further influenced by the ***organisational culture***. Morgan (1986) describes culture as a process of reality construction that allows people to see and understand particular actions and events in distinctive ways. As he argues, culture is a living phenomenon through which people create and recreate the world in which they live. According to Vickers (1983a), cultural issues

influence the standards affecting the process of appreciation as well as the selection of subsequent actions. Arguably such standards, set by individuals or shared by the organisation or society, allow people to interpret events and actions in distinctive ways. As these standards change over time, so does the way that people interpret and react to events.

Hence, the way that Sklavenitis's staff covers out of stocks, by transporting products between stores in their own cars, may be related to the company's culture. Similarly, Atlantic's culture may account for their resistance to CRP and its extra workload.

Although the analysis of organisational culture was beyond the scope of this thesis, it seems to be an important issue influencing flexibility. Cultural issues arose after the acquisition of the Greek Marinopoulos group by the French Carrefour, where people needed to adjust to the new French management. To a lesser extent cultural changes were also required by AB's acquisition of TROFO. Nevertheless, the detailed analysis of such issues can be better conducted through a single in-depth case study rather than the multiple-case design followed in this study.

Organisational culture may also influence the policies[48] of an organisation, which in turn affect decisions. Following ***organisational policies*** regarding sales, acceptance of new products and handling of promotions, people decide upon actions to respond to (or influence) changes in consumer demand. However, their decisions may often be constrained by policies like AB's prohibition of more than one promotion for the same product.

At the interorganisational level, decisions are further affected by organisations' ***policies regarding trading partners***. For example, purchase managers followed different policies for accepting new products from different suppliers. Moreover, Carrefour's warehouse manager gave priority to products ordered by CRP, even when space in the warehouse was limited. These policies are often determined by ***contractual agreements*** (e.g. contracts for the use of CRP) between trading partners. They can be further influenced by the relationships developed between the organisations.

As previous studies (Angeles *et al.*, 2001) argued, interorganisational relationships are critical success factors for the implementation of EDI-based systems. The coordinated activities envisioned by interorganisational systems cannot be accomplished through "self-interested" behaviour by participants, but require them to engage in an interaction involving trust and cooperation (Kurnia & Johnston, 2000, p.7). As this study showed, the more retailers *trust* suppliers and let them manage orders, the more *efficient the process of ordering becomes*. In general, increased ***trust between trading partners*** decreases the time

[48] Organisational policies are also affected by market regulations or legislation.

spent on negotiations, increases the *efficiency* of *appreciation, facilitates the handling of changes in products and promotions* and increases the ability of organisations to *respond to changing market needs.*

As mentioned in the analysis, the relationships between trading partners were improved through their participation in ECR-Hellas. ECR adoption (with or without CRP) leads to improved cooperation, through the sharing of information and the design of inter-firm routines to enhance consumer value (Corsten & Kumar, 2005). Companies - members of ECR-Hellas - recognized the benefits of common strategies and running projects to improve their operations and services to consumers. They realised that they can benefit working hand-in-hand with their partners and competitors. As Unilever's head of sales argued, by working together and building common *standards* they increased the *efficiency* of their operations. For example, the standardisation of pallets benefits all, since as this study showed, the use of different pallets increases suppliers' workload and considerably decreases delivery efficiency. Evidently, ECR's benefits can be realised only if a critical mass of organisations (especially the larger ones) participates (Brown & Bukovinski, 2001).

The building of ***collaborative relationships*** is even more important between trading partners. Through working closely together, trading partners can "create unique value" that cannot be produced independently (Corsten & Kumar, 2005, p.80). They can also align their interests and gain competitive advantage through increasing efficiency. According to Lee (2004) if a company's interests differ from those of its partners in the supply chain, its actions will not maximise the chain's performance. In contrast, if supply chain members manage to align their interests through exchanging knowledge and information, distributing responsibilities among partners and equitably sharing costs and risks, they create "better incentives for performance" and contribute to the supply chain's agility (Lee, 2004, p.105). In this study, ***alignment of firms' interests*** was accomplished, to a certain extent, through sharing information (forecasts, sales and plans), the establishment of delivery standards and the effort to decrease inventory across the supply chain (suppliers do not try anymore to increase their sales by pushing products to retailers). As the analysis showed, all these improved the efficiency of operations and increased the flexibility of trading partners' interaction.

Nevertheless, the collaboration between suppliers and retailers and the extent to which their interests are aligned are additionally influenced by an organisation's position in the market, which is normally related to its ***market share*** and size. Size was identified by previous research (Golden & Powell, 1997) as an important factor influencing organisational flexibility. This study showed that an organisation's market share does not necessarily influence flexibility at an organisational level. For example, Carrefour is larger than

Sklavenitis but it is less flexible. However, Carrefour has the *resources* to improve its infrastructure and increase its flexibility.

As this study further showed, an organisation's market share affects its relationships and interaction with trading partners. It influences the ***power*** of the organisation over its trading partners, which is associated with its actual and potential turnover and profitability. As the analysis showed, the more powerful a retailer is, the more benefits it gains in the interaction with suppliers. For example, although the suppliers faced numerous problems with Carrefour, they never considered reducing marketing activities (e.g. offers, stickers and bounded pack products). As the CRP Analyst of Unilever argued, Carrefour has the biggest market share in Greece and, regardless of the problems, it draws most of the attention from suppliers. As Brown and Bukovinski (2001) argued this phenomenon tends to encourage consolidations and makes it difficult for small companies to remain competitive.

Similarly, the more powerful suppliers are most privileged in the interaction with retailers. For example, Unilever and P&G have full control of orders, can quickly distribute new products and have more flexibility in handling promotions.

In contrast, smaller suppliers, such as Selecta, have to comply with restrictions imposed by their larger customers. They cannot easily distribute new products, they often pay high listing fees and have no flexibility in handling promotions. They may also need to cope with packaging and delivery restrictions.

To gain competitiveness, they try to increase consumer value and improve collaboration with retailers. For example, Selecta imports high quality and niche products and tries to offer a flexible product portfolio. To further increase their flexibility, they focus on building close relationships with retailers' staff.

Therefore, an organisation's market share seems to be an important factor influencing its relationships with trading partners, affecting the flexibility of its interaction with them.

7.3.4 Refining our research framework

The discussion above showed that besides being dynamic and multidimensional, flexibility is also a socio-technical concept. The analysis of the context, in terms of the available infrastructure (including the history of commitment to technologies and people) and the social and organisational relations, was further discussed and additional technical, social and organisational issues influencing flexibility were raised.

By separating the elements of infrastructure and examining their impact on flexibility, the discussion revealed specific characteristics of these elements influencing flexibility. It showed that, while ***technology*** increases the *efficiency* of certain operations, enables the

monitoring of product demand, provides information and improves communication, it often imposes a *rigid workflow of activities* and does not necessarily facilitate the handling of unusual or urgent situations. In contrast, ***people*** are more flexible and overcome the weaknesses of technology through following alternative courses of action. They deal with unusual situations through engaging in processes of *appreciation* and deciding upon actions. As this discussion showed, people's capacity for appreciative judgement and conduct of action is influenced by their *competence*, *expertise*, *experience*, *motivation* and *relationships*. Their cooperation and decision making is also influenced by characteristics of the ***organisations*** to which they belong. They are affected by the *organisational structure*, the availability of resources, the *organisational culture* and the *policies* regarding new products, promotions and trading partners. At the interorganisational level the attainment of flexibility greatly depends on the *relationships between trading partners* (conflict, trust, power-dependence), influenced by their *market share*, competence and flexibility.

As this discussion showed, these elements are interrelated. Technology supports or constrains people's appreciation and actions, as well as facilitating or hindering their cooperation. It affects the organisational structure and the structure of the business network, by enabling interorganisational links or leading to closed business networks. In contrast, people can affect technology's results and overcome its rigidities; they are part of the organisational structure and through their interpersonal relationships they affect interorganisational cooperation. Finally, characteristics of organisations influence the decisions of people and enable or constrain the implementation or benefits of technology.

The relations between these elements are presented in **Figure 14**. As this discussion showed, all these interrelated elements affect flexibility and can be further affected by processes of appreciation and their subsequent actions.

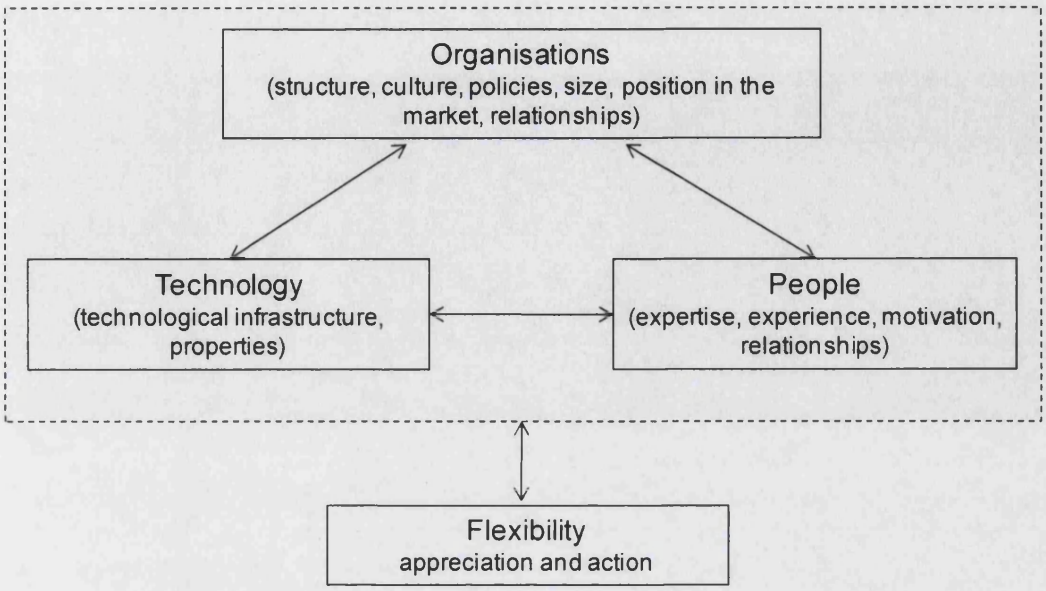

Figure 14: Relations between elements of context

By examining the role and impact of technology, people and organisations on flexibility, this discussion showed that the web models approach does not provide an exhaustive list of contextual factors that influence flexibility. Additional issues, such as expertise and motivation, organisational culture, policies and market share also need to be considered. The discussion also showed that a better understanding of the concept of flexibility can emerge, if the elements of infrastructure are examined separately. It finally demonstrated that the social and organisational relationships can be analysed as part of the infrastructure[49], since they influence the interactions, decisions and actions of people or organisations. However, following Kling's (1987) suggestions and emphasising the importance of relationships in the attainment of flexibility, the study's theoretical framework examines relationships separately.

Further weaknesses of our theoretical approach and framework were raised in the analysis, which showed that the history of commitments to technologies and people can be analysed as part of the infrastructure. It also showed that the boundaries of the infrastructure cannot always be clearly determined. For example, suppliers' sales managers or merchandisers intervening in Carrefour's operations to increase efficiency and solve problems can be considered as part of the retailer's infrastructure.

The analysis further demonstrated that flexibility is additionally affected by the *time* needed by a person/organisation/dyad to appreciate an event/situation and decide upon an action to

[49] This is also supported by previous research e.g. (Ciborra, 2000)

respond. Therefore, the *efficiency and responsiveness of the process of appreciation* need also to be seen as part of the ease of response.

Finally, the analysis showed that the *range* of options to respond needs to be considered as an outcome of the process of appreciation, since it is through this process that people or organisations identify the variety of options available to respond. Although this was mentioned by Vickers it was included neither in Checkland and Casar's (1986) model nor in this study's framework.

These remarks have led to a refinement of the study's conceptual framework, presented in **Figure 15**.

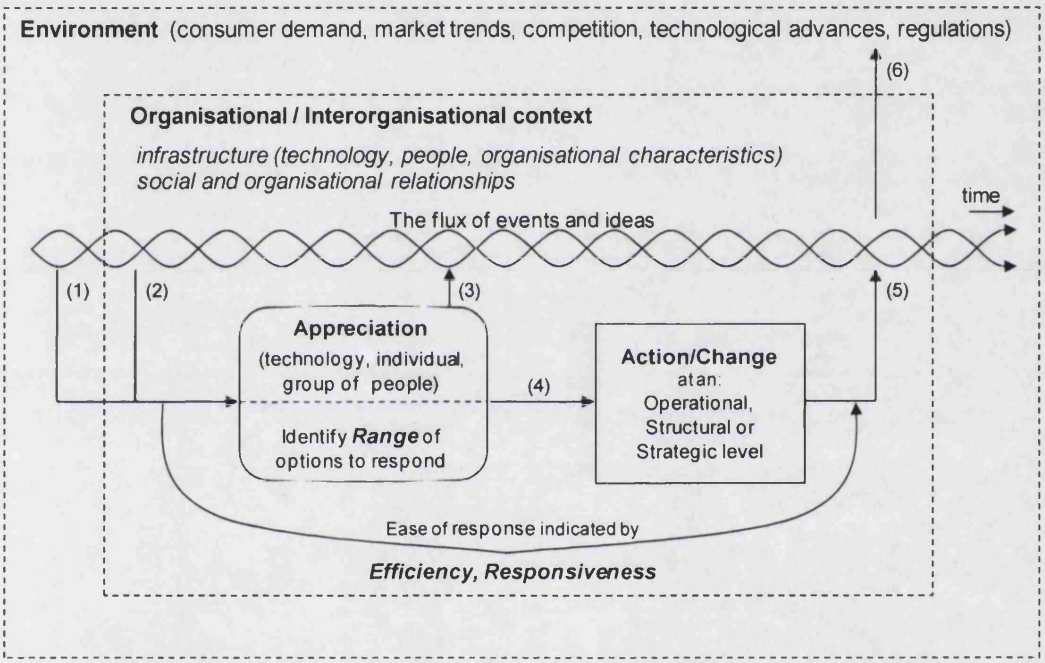

Figure 15: Synthesized research framework of flexibility

Based on this framework, the organisation/business network responds to events or ideas arising either from the environment (1) or from the organisation/dyad/business network itself (2). Environmental disturbances may arise due to competitive intensity[50], demand uncertainty and technological changes (Grewal & Tansuhaj, 2001). They may also relate to changing market trends or regulations.

The organisation/dyad/business network reacts to the incoming events through the process of appreciation. Appreciation can be conducted by individuals or groups, belonging to the same or different organisations. It can also be supported by information technology, having

[50] Relates to the degree of competition that a firm faces (Grewal & Tansuhaj, 2001).

embedded business logic. For example, changes in demand can be handled by CRP, which automatically adjusts the safety stock levels.

When an event occurs, through appreciation people identify the possible options to respond and decide upon an action to take. The variety of possible options reveals the *range* of flexibility, which is often affected by the available infrastructure. The outcome of the appreciation can be another idea (3) or an action/change (4). Both the process of appreciation and the selection of subsequent actions are influenced by the relationships of the people or organisations involved. Depending on the *scope* of response, the action/change can be conducted at an operational, structural or strategic level, influenced by and influencing the context.

The ability to respond is further indicated by the *efficiency* and *responsiveness* of both appreciation and action. The process of appreciation and selection of the subsequent action are based on standards generated by previous history. Their efficiency increases as people come across similar situations/events repeatedly and follow previous patterns of action (which become standards). The efficiency of the action is further affected by the underlying infrastructure.

There is a recursive loop in which the flux of events and ideas generates appreciation, while appreciation itself leads to action/change. This change can have an impact on the environment (6) or can affect the organisation/business network itself, by leading to changes in the context or by provoking another event or idea (5). Flexibility is thus seen not only as the ability to respond to environmental disturbances, but also as the capability of the organisation/business network to produce a changed self.

Based on the above framework, flexibility is perceived as a dynamic characteristic changing over time, following and influencing changes of context. It is seen as related to the variety of options to respond (range) as well as to the responsiveness and efficiency of both the process of appreciation and its subsequent action.

7.4 Concluding remarks

The interpretive field research conducted in seven organisations allowed the detailed examination of the context, influencing flexibility both at an organisational and interorganisational level. The context was first analysed based on ideas form web models, focusing on the history of commitments, infrastructure and social relations. However, this analysis demonstrated the need to further examine the context and especially the different components constituting the infrastructure. The distinction between technology, people and organisations, emphasises the socio-technical nature of flexibility and revealed issues that

were not considered in the theoretical framework. The interrelation of these elements was discussed and a schematic representation of their interdependence was given.

This chapter additionally discussed the multidimensional nature of flexibility, showing the relations between its different dimensions (temporal, range and scope). It also demonstrated the development of flexibility over time following changes of the organisational/interorganisational context. Finally, it revealed the weaknesses of the study's theoretical approach and proposed a refined conceptual framework of flexibility. The study's conclusions, its contributions and limitations will be further discussed in the following chapter (Chapter 8).

CHAPTER 8 – CONCLUSIONS

8.1 Introduction

This chapter summarises the research objectives, approach and conclusions. It discusses the contributions of this study to theory and flexibility research. It also presents the implications of the results for practitioners. Finally, it considers the limitations of the study and pinpoints the issues raised as an incentive for further research.

8.2 Summary of research

Although flexibility is becoming increasingly important for the survival and competitiveness of organisations, its meaning is still unclear and a rigorous analysis of the concept is lacking in the literature. The majority of previous studies have mainly taken a positivistic view (De Leeuw & Volberda, 1996; Golden & Powell, 1997; Philips & Tuladhar, 2000), failing to demonstrate the dynamic nature of flexibility as well as to thoroughly analyse the organisational context that influences it. Moreover, they have mainly focused on the flexibility of the individual firm, neglecting the flexibility of the interaction between firms.

Furthermore, although information technology and specifically interorganisational systems have been increasingly proposed as tools offering organisational flexibility (Lucas & Olson, 1994; Lim & Palvia, 2001; Golden & Powell, 1996) they also impose constraints and do not provide equivalent benefits to all organisations (Webster, 1995; Reekers & Smithson, 1996; Angeles & Nath, 2000).

The aim of this research was twofold: first to develop an understanding of the complex notion of organisational flexibility and second to examine the impact of information technology, and in particular of IOS, on it. This study sought to address the limitations of previous literature by broadening the research focus and clarifying the concept of flexibility, not only as a characteristic of an individual firm, but also as a property of the interaction between firms. It also proposed an interpretive approach enabling a thorough examination of the organisational and interorganisational context within which flexibility is embedded.

The increased competition in grocery supply chains encouraged suppliers and retailers to develop strategies to cut costs, to quickly comply with changing market needs and to identify market trends before competitors. The increased need for flexibility in this market influenced the selection of the case study. The study was conducted in seven organisations (3 suppliers and 4 retailers), enabling the examination of flexibility not only at the level of the firm, but also at the level of interaction between trading partners. Most of the organisations had been using a CRP system for some years, while others had either tried to use it without success, or had not implemented it at all.

Initially, the main reasons for examining organisations that were not using IOS were to identify differences in operations associated with the process of replenishment as well as to pinpoint the difficulties of CRP implementation and customisation. Nevertheless, this supplementary data strengthened the argument that organisational flexibility is closely interwoven in the organisational context and that technology is an important but not an exclusive factor influencing organisational flexibility.

Therefore, the examination of flexibility was based on the analysis of the process through which organisations (or dyads) respond to events or ideas stemming either from the environment or from the organisation or business network itself. It was also based on the analysis of the context that shapes and is influenced by this process of response. The examination of the process through which organisations evaluate a situation (event or idea) and decide upon an action of response was influenced by 'appreciative systems thinking' conceptions, whereas the analysis of the contextual factors was guided by 'web models' ideas. Anchored in these two theoretical perspectives a synthesized theoretical framework was developed and used for the analysis of the empirical data.

The proposed framework also suggested the concepts of *efficiency, responsiveness* and *range* of options to respond as indicators of the flexibility through which organisations or dyads respond to environmental disturbances. Therefore, based on this framework, flexibility is seen as a multidimensional, context-embedded and dynamic characteristic changing over time, influencing and following the changes of context. The process through which the understanding and theoretical development of flexibility was gradually shaped is summarised in the following section.

8.3 Research approach

An interpretive approach was used to analyse flexibility as a context embedded notion. This enabled the acquisition of a richer insight than the specification of predefined factors or the testing of predetermined hypotheses. It also allowed the examination of flexibility as a dynamic characteristic changing over time influenced by and affecting the changes of organisational/interorganisational context.

A case study of a grocery retail supply chain was selected to analyse flexibility both at the level of the firm as well as at the level of the interaction between suppliers and retailers. The examination of the impact of IOS on the flexibility of different organisations, not only demonstrated how different organisational contexts affect the impact of technology on flexibility, but also enabled the extraction of more general conclusions through cross-data analysis.

Although specific retail-supply chains in Greece were studied, the risk of conclusions being dominated by the local context was reduced by the inclusion of large multinational organisations. These organisations normally follow the management practices of their mother companies in Western Europe or the USA. Furthermore, being members of both the ECR-Europe and the ECR-Hellas committees they follow the initiatives and projects agreed at a European level. Therefore, it can be argued that the results of this study are relevant beyond their local context.

As was elaborated in the fourth chapter, the interpretive field research conducted was based on the seven principles proposed by Klein and Myers (1999). The way that these principles have been applied in this research is summarised in **Table 14**.

Application of the principles in this study
1. The fundamental principle of the Hermeneutic Circle The conceptualisation of flexibility in this study evolved through repeated cycles of the hermeneutic circle. At each cycle the understanding of flexibility at an interorganisational level (whole) contributed to and was influenced by the understanding of flexibility at the level of the organisation (whole – part of a broader whole), of different organisational departments (parts) and of their specific operations (smaller parts).
2. The principle of Contextualisation Aiming to analyse flexibility as a context embedded notion, the understanding of the organisational/interorganisational context influencing it was of importance in this study. Following Pettigrew's (1985b) suggestion a multi-level analysis of context has been conducted in this study. Emphasis was given not only to the analysis of the inner context (organisational context) but also to the outer context involving the interaction with trading partners. To analyse the different levels of context this study used a web models approach enabling the drawing of boundaries (for analytical purposes only) around groups or organisations using a focal technology (the interorganisational systems examined in this study). Web models analysis focused on the examination of the organisational infrastructure and of the social/organisational relationships influencing the use of technology. Besides revealing the impact of technology on flexibility, it also revealed the role and impact of people, as well as that of organisations.

3. The Principle of Interaction between the Researchers and the Subjects

Considering that the study's participants may change their perspectives by the appropriation of concepts used by the researcher, I tried to decrease the potential influence of the research as much as possible. Data collection was mainly based on semi-structured interviews, which, although partly influenced by the general themes and theoretical constructs of the research, allowed respondents to express freely their view without being directed or constrained by specific questions. Acknowledging the potential limiting effect of predetermined concepts on the results, I tried not to influence respondents during the interviews. In contrast, I tried to enrich my preconceptions by embracing new ideas or perspectives expressed by respondents, while also arranging for additional interviews when further information or clarifications were needed.

4. The Principle of Abstraction and Generalisation

Abstraction and generalisation are achieved by the theoretical insight gained through the understanding of the research results and their analysis based on general theoretical concepts. The theoretical approaches, adopted in this thesis, resulted from the study of social and information systems theories and their interrelation with the results of the fieldwork. Based on the selected approaches, a conceptual framework of flexibility was developed. This framework demonstrates the multidimensional nature of flexibility and enables the examination of the process of response to environmental disturbances and of the context that influences this process. It combines appreciative systems and web models ideas, for the respective analysis of the process and context, and is abstract enough to provide a generalisable understanding of flexibility.

5. The Principle of Dialogical Reasoning

Based on the principle of dialogical reasoning, the themes and theoretical preconceptions guiding the research design were juxtaposed with the actual findings at various stages of the research. The identification of contradictions or supplementary issues in the empirical data led to revisions and gradual improvement of the theoretical conception of flexibility.

I started the fieldwork by having formalised a preliminary conceptual framework of organisational flexibility, focusing on its multidimensional nature. The juxtaposition of this initial framework with the findings demonstrated the limitations of this approach. The findings revealed the need to thoroughly analyse the process through which organisations (or groups of people) evaluate an event (environmental threat or opportunity), identify possible options to respond and decide upon an action to take. They also demonstrated the

importance of examining the organisational/interorganisational context that influences and is affected by this process of response. Therefore, appreciative systems thinking conceptions have been used for the analysis of the process of response, whereas web models ideas have been incorporated for the examination of the context. The synthesis of these two perspectives led to the development of a refined theoretical framework of organisational flexibility. This framework presented flexibility as a dynamic and context embedded notion and was used for the analysis of the empirical data. Its juxtaposition with the whole set of findings led to a discussion of limitations or further improvements of the theoretical conception of flexibility.
6. The Principle of Multiple Interpretations To acquire a more balanced view of the phenomenon under study, the views of various stakeholders were considered. Since the aim of the study was to examine flexibility both at organisational and interorganisational levels, information was collected from suppliers as well as from retailers. To examine the impact of technology and of varied organisational contexts on flexibility, several suppliers and retailers were incorporated in the study. Since interorganisational systems, and specifically the CRP system, have a different impact on suppliers than on retailers, differences in opinions were expected. These differences were also identified between people of the same organisation. Interviews were conducted in various departments, and in some cases the views of more than one person were considered. Persons engaged with different activities sometimes had diverse views regarding flexibility or the impact of technology. However, these diverse views were complementary rather than contradictory. They offered alternative perspectives and their confrontation contributed to a more thorough view of flexibility.
7. The Principle of Suspicion This principle is the least used in this study. By following an interpretive approach, the focus of the study was not to critically examine the views of various stakeholders in terms of political and vested interests. It was rather to develop an understanding of the phenomenon under study based on the participants' opinions. Although most views were taken at face value it was suspected that certain biases or distortions existed. In order to eliminate biases that could provoke misleading interpretations of data, the views of multiple stakeholders were taken into account both at an organisational and interorganisational level.

Table 14: Principles for interpretive field research

This research evolved through repeated cycles of the hermeneutic circle, where all the principles have been applied iteratively forming a complex web of interpretations. In summary, through the interaction with the subjects of study and the consideration of multiple stakeholders' views an understanding of the context of study was gradually developed (contextualisation) and idiographic details were related to general theoretical ideas (abstraction and generalisation). The theoretical conceptions were juxtaposed with the study's findings at various stages of the research (dialogical reasoning) and a theoretical framework of organisational flexibility was developed and gradually improved during the course of the study. This framework was used for the analysis of the empirical data, leading to the discussion of further refinements and limitations in the conceptualisation of organisational flexibility.

8.4 Research conclusions

The analysis of the empirical data based on the research framework showed that the use of IOS, such as CRP can both enable and constrain flexibility.

It increases the operational flexibility at an organisational level, by facilitating, speeding up and optimising ordering. Although it automates ordering it also provides options for intervention to CRP analysts. It facilitates the identification of mistakes and automatically handles small changes in demand. For larger changes, it provides useful information from a history of product demand. It automatically translates product quantities into pallets, bringing improvements in logistics and increasing the efficiency of deliveries (speeds up the preparation of deliveries and loading of trucks). It also increased the frequency of deliveries, enabling companies to better adjust supply with demand, as well as to respond better to customer/consumer needs. The elimination of out of stocks in both partners' warehouses increases their options for sales and improves their ability to handle unexpected increases in demand. Furthermore, the decrease of safety stock levels across the supply chain provides the organisations with more flexibility to deal with unexpected or supplementary deliveries, product returns and product recalls. All these lead to cost savings, releasing funds that can be used for other activities, such as promotions or own label products. Finally, the use of CRP changes the work of both sales and purchase managers by providing them with more time to deal with a variety of more important activities.

Most of these benefits additionally affect the operational flexibility at an interorganisational level. By bringing time and cost savings, as well as increasing the efficiency of ordering and deliveries, the use of CRP increases the efficiency of the interaction. It improves the cooperation between trading partners, speeds up the distribution of new products and facilitates the handling of promotions. Therefore, besides increasing trading partners'

responsiveness to variations in supply and demand, it also improves their ability to respond to changing market needs.

However, this type of flexibility is also influenced by the flexibility of the trading partners. In some cases, CRP is used without problems, leading to an increase of operational flexibility at the interorganisational level. But, in others, the inadequate infrastructure of a trading partner and its limited flexibility at an organisational level make cooperation difficult and reduce the adaptability and efficiency of the interaction.

In contrast, structural flexibility decreases both at the organisational and interorganisational level. Apart from leading to a more flexible structure in the suppliers' sales departments, CRP limits this type of flexibility. It leads to a rigid rather than adaptable workflow of activities, predetermining the day and time of the downloading, processing and sending of electronic messages, while allowing limited options for change. The cancelling, changing or sending of supplementary orders is difficult and can be conducted better if CRP is sidestepped. Finally the use of CRP requires specialised and well trained people that are difficult to replace.

Moreover, the implementation of CRP does not facilitate the establishment of interorganisational links. It requires time for integration with legacy systems, training of CRP users and testing of the system to produce optimal orders based on a history of consumer demand. This time can be relatively short when trading partners cooperate closely and have the technological awareness and the appropriate infrastructure. Conversely, the use of CRP with less competent partners can lead to problems or even fail completely. Smaller organisations are usually unable to use it, due to the high cost of implementation and maintenance, as well as due to their inadequate infrastructure. This limits the flexibility of organisations, which do have the technological infrastructure and expertise, since they can only apply CRP with a limited range of partners.

In contrast, the use of CRP positively influences strategic flexibility by providing valuable information regarding the history of demand and enabling sales managers to develop a better understanding of market needs. It not only increases a firm's ability to match production with demand and quickly meet changing consumer needs, but also its capability to identify market trends before competitors. It also contributes to its ability to influence consumer demand through quickly distributing new products or promotions. Nevertheless, strategic flexibility would be further increased if CRP's information was combined with POS data or with a more advanced forecasting and planning system.

At an interorganisational level CRP influences strategic flexibility by improving cooperation and enabling the sharing of information between trading partners, allowing the formulation

of common marketing strategies. CRP can also support the expansion of companies through mergers and acquisitions by adjusting safety stock levels to accommodate the orders of extra stores. However, it may cause difficulties when the type of business changes and customisation is needed to adjust it to different types of products (e.g. cloths) or demand requirements. Therefore, CRP does not enable fundamental changes of interorganisational structures, links or activities, as these primarily require an increased flexibility at a structural level.

The aforementioned benefits or constraints are influenced not only by properties of the CRP application, but also by the infrastructure within which it is embedded. Some CRP applications may be more efficient or complete than others, which may not entirely satisfy the requirements of the organisations using them. The use of CRP brings more benefits to organisations that are properly prepared for its implementation (often the initiators of CRP project). These not only have the expertise and infrastructure to support CRP, but also manage to match it with their organisational structure and needs.

The interoperability of CRP with the technological infrastructure is also important for the realisation of benefits. The lack of integration between CRP and internal information systems may decrease the efficiency of ordering and lead to mistakes due to rekeying data. Further inefficiencies may arise by the lack of a warehouse management system, leading to delays in stock taking and to inaccurate inventory reports, as well as limiting the efficiency of deliveries. More problems can occur due to incompatibilities or lack of integration among a company's internal information systems, leading to delays and mistakes in updates regarding deliveries, new products or promotions, as well as erroneous stores orders.

All these demonstrate that the impact of CRP on flexibility can be examined only if CRP is considered as a part of a broader technological infrastructure. As the discussion further showed, a more advanced technological infrastructure does not necessarily bring more flexibility. Less advanced technologies or lack of integration between different information systems may sometimes enable flexibility by allowing more options for human intervention. In contrast, more efficient and integrated technologies may demand a rigid workflow, allowing limited options for intervention. Finally, an increased number of checks or options for customisation, provided by an advanced system, instead of bringing flexibility may add complexity and decrease efficiency.

Nevertheless, as this study showed, the impact of technology on flexibility is affected both by the people involved in its use and by the organisational characteristics influencing it. The constraints and weaknesses of the technological infrastructure are often overcome by the intervention of people, who are more flexible and creative. They often sidestep technology or

the predetermined workflow of activities and find alternative ways to act through close cooperation with trading partners. To respond to unusual or urgent situations they engage in a process of appreciation, whereby they perceive the situation, make judgements about it, identify alternative options to follow and decide upon an action(s) to take. Their capacity for appreciation is influenced by their competence and expertise. It is also influenced by the materials at their disposal (e.g. availability of information, or a technology that supports their decision making). Furthermore, as time passes and people come across similar situations they accumulate experience and become more efficient in their appreciation and decision upon an action. As they usually follow past decisions and previous patterns of action, they do not lose time in considering alternative actions. Therefore, although their responsiveness increases their range of options is limited.

The ability of people to deal quickly with emerging situations is further influenced by their motivation and willingness to engage and contribute to problem solving. In contrast, their resistance may not only delay problem solving, but also hinder cooperation and impede the realisation of benefits from the technology. The actions that people take to respond to a situation or problem may often involve management of relationships. This is especially important when people need to sidestep a predetermined workflow through cooperation, communication, negotiation, influence or persuasion. As this study further showed, improved interpersonal relationships, close cooperation and increased trust speed up negotiations, facilitate decision making and support the conduct of action. In contrast, conflict may delay negotiations and decrease the efficiency of response.

Both the process of appreciation and the actions that people take to respond to emerging situations are greatly influenced by characteristics of the organisations to which they belong. One of the main organisational characteristics affecting flexibility is organisational structure. A more adaptable structure comprising of multifunctional and multilevel teams may improve the process of appreciation and lead to better solutions in terms of identifying market needs and finding ways to influence consumer demand. In contrast, a problematic organisational structure, where responsibilities overlap, may obstruct cooperation and appreciation and delay problem solving. People's appreciation and actions may be also influenced by the organisational culture. Their decisions regarding actions are further affected by the availability of resources (e.g. funds, space in the warehouse and stores). They are additionally influenced by the organisation's policies regarding sales, new products and promotions.

At the interorganisational level people's decisions are influenced by policies regarding trading partners. These policies are affected both by contractual agreements and by the relationships between suppliers and retailers. Through improved collaboration and increased

trust, trading partners can better handle changes in products and promotions, as well as dealing with changes in demand. Through sharing information they can better evaluate market trends and increase the competitiveness of the supply chain. Finally, through aligning their interests they can increase the efficiency of their operations and improve the flexibility of their interaction.

Nevertheless, their collaboration is also influenced by their respective market shares. An organisation's market share does not necessarily affect the flexibility achieved at an organisational level, but it may affect its availability of resources and consequently its ability to make improvements in order to increase its flexibility. An organisation's market share may also affect its power over trading partners. The more powerful the organisations are, normally the more privileged they are in their interaction with trading partners. They have control of orders and are more flexible in distributing new products or handling promotional activities. In contrast, smaller organisations have to comply with restrictions imposed by their larger customers. They cannot easily distribute new products, have little flexibility in handling promotions and may even need to cope with packaging and delivery constraints.

As these results demonstrate, flexibility is a socio-technical concept interwoven into the organisational context. Although technology is an important factor influencing flexibility, it is not an exclusive one and its impact needs to be examined by taking into consideration the role of people that are involved in its use as well as the organisational characteristics influencing it.

As time passes and organisational conditions change, flexibility may also change. It may be affected by improvements in the technological infrastructure, in physical facilities and in the organisational structure. It can be also affected by changes in interpersonal and organisational relationships. Finally, flexibility may be further influenced through the experience and expertise that people acquire over time through their involvement in everyday situations and problem solving. Therefore, organisational flexibility is a dynamic concept, changing over time through subsequent processes of appreciation and action influencing and following changes of the organisational/interorganisational context.

But, most importantly flexibility is a multidimensional concept, with its different dimensions (responsiveness, efficiency, range and scope) often having conflicting relations. As this study showed, the larger the scale of organisational change, the more time and cost is normally needed for its implementation. In some cases higher costs may also be incurred to improve responsiveness or increase range (e.g. a varied product portfolio). Therefore an increased range may often lead to decreased efficiency, while increased efficiency may in turn limit the range of options. Nevertheless, this does not mean that there is always a trade-

off between flexibility and efficiency, as efficiency is often imperative for the attainment of flexibility. The degree of importance between the different dimensions may vary, depending on the situation. Therefore, organisations, which may be flexible in some aspects and inflexible in others, may often need to strike a balance between the scope of their response, the range of available options and their efficiency.

8.5 Contributions

This study aimed to clarify the complex notion of flexibility and to examine the impact of IOS. It aimed to address the limitations of previous research, presented in **Table 15**, by following an interpretive approach and examining flexibility both at the level of the firm and at the level of the interaction between firms.

Limitations	Aims
A thorough analysis of the concept of flexibility is missing in the literature.	Clarify the complex concept of flexibility.
Most studies follow a positivist approach.	Follow an interpretive approach.
Flexibility is mostly seen as a static characteristic of the firm, affected by certain organisational characteristics (often predetermined).	Examine flexibility as a dynamic concept embedded in the organisational context.
Most studies focus on the flexibility of the individual firm neglecting the flexibility of interaction between firms.	Examine flexibility both at an organisational and interorganisational level.
Whether IOS increase organisational flexibility is still debated.	Examine the impact of IOS on the flexibility of the individual firm and on the flexibility of the interaction between firms.
Previous research examining the impact of IOS on organisational flexibility is limited and theoretically weak.	
The organisational context influencing the impact of technology on flexibility is not thoroughly examined.	Thoroughly investigate the organisational /interorganisational context influencing the impact of technology.
The varying results of IOS on different organisations are not thoroughly explained.	Follow a multiple case design to reveal differences between different organisations.

Table 15: Limitations of previous literature and aims of this study.

The results of this study contributed to the development of a more complete view of flexibility, both at an organisational and interorganisational level. According to Barrett and Walsham (2004), contributions in an interpretive research may arise from the construction of qualitative generalisations. As Walsham (1995b) argues these comprise the *development of concepts*, the *generation of theory*, the inference of *specific implications* in particular

domains of action and the drawing of *rich insights* not easily categorised as any of the other three types. It can be argued that this study developed a richer understanding of the concept of flexibility, suggested a theoretical framework for its examination, both at an organisational and interorganisational level, revealed implications associated with the use of technology in grocery retail supply chains and provided a richer insight by analysing the social, organisational and interorganisational issues influencing flexibility. These are discussed in the following sections.

8.5.1 Contributions to theory and flexibility research

Based on an extensive literature review, this study primarily clarified flexibility as a multidimensional concept, building a framework that focused on the temporal, range and focus dimensions of flexibility. Although this provided an initial understanding of flexibility, it could not address the plurality of issues emerging from the study's empirical work. Preliminary research findings demonstrated that flexibility cannot be thoroughly explained only through the analysis of its different dimensions or the examination of predetermined organisational factors that may enable or constrain it.

Addressing the limitations of this approach, this study argued that flexibility needs to be viewed as a property of the organisational discourse and action. It further argued that flexibility needs to be seen as a context embedded notion. It thus suggested a context/process analysis enabling the examination, not only of the process through which people or organisations respond to events or unusual situations, but also of the organisational/interorganisational context, which influences and is affected by this process.

For the analysis of the process of change this study adopted an appreciative systems approach (Vicker, 1968; Checkland & Casar, 1986). This approach enables the examination of the process through which individuals, groups of people or organisations evaluate an event or an idea, make judgements about it, identify possible courses to follow and decide whether to take an action(s) to respond. As this approach does not explain the organisational context affecting the process of appreciation, an additional theoretical perspective was considered.

For the examination of the organisational/interorganisational context influencing flexibility, this study adopted web models (Kling, 1987) approach. As this approach puts emphasis on a focal technology and examines the social and organisational context shaping its use, it was found adequate for this study aiming to examine the impact of technology on flexibility. Hence, the context of technology was examined based on the history of commitments to technologies and people, the infrastructure available for its supports and the social relations between the people involved in its use.

However, as this study further showed, the web models approach has certain weaknesses. Although it gives special attention to the social relations, influencing the use of technology, it only addresses issues of conflict and power imbalance between the negotiating parties, neglecting issues of cooperation or trust, which may limit negotiations and facilitate decision making. Furthermore, it does not explain the process through which the organisational context changes over time and fails to present the dynamic interaction between the organisation and its environment. Moreover, it does not analyse the process through which people evaluate a situation and engage in discourse in order to decide upon an action to take.

Taking into account the strengths and limitations of both theories this study synthesised them into a more refined approach enabling the examination of both the context and process of response. The combination of these theoretical approaches with the initial understanding of flexibility, as a multidimensional concept, led to the development of a more complete framework of flexibility.

The analysis of the empirical data based on this framework further contributed to the conceptualisation of flexibility and impact of technology by drawing the conclusions presented in the previous section.

This analysis demonstrated the impact of technology on the operational, structural and strategic types of flexibility, both at an organisational and interorganisational level. It showed that the flexibility of an organisation can affect the flexibility of its interaction with trading partners, while also influencing the flexibility of the partners. Besides revealing certain features or characteristics of technology, enabling or constraining flexibility, it argued that technology is not an exclusive factor affecting flexibility as it is embedded in a broader organisational infrastructure.

Further analysing the concept of infrastructure, this study demonstrated the important role of people, engaged in processes of appreciation, influenced by their competence, expertise, experience, motivation and interpersonal relationships. It also elaborated on organisational issues, such as resources, structure, culture and policies affecting people's decisions and actions. Finally, it showed how interorganisational relationships can affect flexibility both at the organisational and interorganisational level.

Further reflecting on the concept of flexibility, this study elaborated on the tension between flexibility's different dimensions. It showed the importance of efficiency in the process of appreciation and revealed its conflict with the range of options to respond. Finally, it demonstrated the dynamic nature of flexibility, changing over time through subsequent processes of appreciation, accumulated experience, changes of the infrastructure, and alterations of social and organisational relationships.

All these have led to a refinement of the research framework, which is sufficiently general and can be used for the examination of flexibility in other contexts or industries. The conclusions and framework of this study can be also used by practitioners, as explained in the following section.

8.5.2 Contributions to practitioners

The conceptual framework of flexibility proposed in this study can be used not only by researchers aiming to explain the dynamics of context affecting flexibility, but also by practitioners aiming to understand the impact of technology on the flexibility of an organisation's operations and interaction with trading partners. This study not only clarified the complex notion of flexibility, but also revealed the organisational and interorganisational issues influencing the impact of technology on organisational flexibility. Therefore, it provided a foundation for reflection and debate on how the use of technology can be an enabler or an impediment to flexibility.

As the findings showed, in some situations or operations efficiency is imperative even if it may lead to a rigid workflow but, in others, an increased range of options is much more important than efficiency. While some years ago the main requirement for the implementation of technology was increased efficiency, now the focus has shifted to the provision of flexibility.

Before implementing technology, practitioners have to be aware of the constraints or lock-in effects that can be imposed by the use of technology. In an interorganisational system they should consider the number of trading partners that also use it, as well as whether it can interoperate with other interorganisational systems used in the market. They should also consider the size of the investment.

Furthermore they should try to choose the technology based, not only on the improved efficiency, but also on the level of 'freedom' that it allows organisations in handling operations. But, even if rigidity is imperative for the attainment of efficiency (as it usually is), practitioners need to know whether in important operations where, besides speed, flexibility is also needed, they can sidestep technology in order to achieve their aim. Therefore, an evaluation of how unusual situations could be coped with, while using a specific technology would be very useful to identify courses of action to follow in order to respond to a specific situation.

However, practitioners need to bear in mind that technology cannot on its own increase or constrain flexibility, since its impact is greatly influenced by the organisational context within which it is embedded. The history of commitments to technologies and people also

plays a very important role. Are any contracts of previous technologies going to affect its implementation? Does the organisation have the appropriate technological infrastructure to support its use? Are any improvements to current information systems needed prior to its implementation? Are the organisation's information systems integrated and to what extend? Can the new technology interoperate with them, or is data entry required to replace the missing interface?

Besides issues related to the technological infrastructure, practitioners need also to take into consideration the capabilities and skills of the people using the technology. As this study showed, through their intervention and actions people can often sidestep the weaknesses, rigidity or even lack of technology. Therefore, the process through which the people involved evaluate a situation, identify alternative options to follow (with or without the use of technology) and decide upon an action to take is equally, and sometimes more, important than the benefits of technology. Practitioners need to consider whether people are properly trained, whether they have experience in dealing with everyday situations and unusual events, and whether they are motivated and willing to identify and efficiently solve problems. They also need to consider people's relationships, keeping in mind that improved cooperation can facilitate problem solving and provide a quick response to threats or opportunities, while conflicting interests might create delays, misunderstandings and erroneous decisions.

Nevertheless people's capability for decision making and action is also influenced by organisational issues, such as structure, culture, policies and resources. Therefore practitioners need to consider whether the company's structure supports communication and facilitates decision making or whether it is inefficient and many people are responsible for the same or supplementary tasks. They should also decide whether the company's structure needs to change before the implementation of technology. Furthermore, they possibly need to consider cultural issues that may encourage either motivation or resistance to change and technological advance. They also need to take into account organisational policies that may influence the impact of technology or affect people's decisions. Finally, they need to consider the availability of resources (such as funds, space in the warehouse or in stores) that may further increase or constrain the organisation's flexibility.

At an interorganisational level they need to consider the flexibility or inflexibility of trading partners as this may also affect the flexibility of their company. They also need to consider relationships with trading partners. As this study showed, while improved cooperation, increased trust and alignment of firms' interests may increase the flexibility of the interaction, conflict may lead to excessive negotiations and decreased efficiency. Finally, practitioners need to consider whether the company is in a position to influence its trading

partners or does it need to comply with restrictions regarding new products, promotions, product packaging and deliveries imposed by more powerful partners. In this case practitioners need to think of alternative ways (e.g. improve the product portfolio or improve interpersonal relationships) to increase the company's flexibility.

All these issues are summarised in **Table 16** presenting some factors that may inhibit or enable flexibility.

Context of technology	Inhibitors of flexibility	Enablers of flexibility
Technology	- lock-in effects - few user organisations - very high investment - problematic technological infrastructure. - lack of integration - problems of incompatibilities - rigid workflow	- integration with legacy systems - allowing options for intervention - availability of alternative options - easily sidestepped - easily customised - availability of information for decision making - supporting process of appreciation
People	- lack of expertise/training - resistance - increased workload - conflicting interests	- competence and expertise - motivation - experience - cooperative relationships
Organisations	- lack of resources - problematic physical facilities (e.g. lack of space in warehouse or stores) - problematic organisational structure - culture that favours resistance - inflexible policies - rigid contracts - conflicting interests with trading partners - limited market share	- availability of resources - structure that facilitates decision making and action - multifunctional/multilevel teams - culture that encourages motivation - flexible policies and contracts - flexibility of trading partners - cooperative relationships with trading partners - power over partners

Table 16: Inhibitors or enablers of flexibility

Although this table does not provide an exhaustive list of factors, it can be used by practitioners as a base to evaluate the flexibility that their organisation can achieve by the implementation and use of technology. However, it should be noted that some of these issues may not apply in all contexts.

8.6 Limitations

This thesis focused on the examination of IOS and analysed their impact both on the flexibility of the individual firm and on the flexibility of the interaction between firms. As IOS handle communication between the different organisations, they mainly affect the interaction between trading partners, while influencing limited operations at the

organisational level. Therefore, they do not have the pervasive effect that other types of systems (e.g. Enterprise Resource Planning (ERP) systems) may have on the operations of the organisation. As a consequence, the focus of the study did not enable the detailed examination of all organisational aspects that may influence the impact of technology on organisational flexibility.

The research findings demonstrated that the organisational culture is probably an important issue influencing people's resistance or motivation, as well as affecting their decisions and actions. However, this issue was not thoroughly analysed as it was beyond the scope of this thesis. Moreover, by conducting a multiple case study (in seven organisations) and by focusing on their interactions, the cultural issues could not be thoroughly investigated. A detailed analysis of organisational culture can be better conducted through a focus on the organisational level using a single in-depth case study.

An in-depth case study would also enable a better understanding of the political issues influencing both the process of appreciation and the decision upon a response. This research showed the importance of improved cooperation and close interpersonal relationships in the attainment of flexibility. However, it did not reveal power imbalances between the participants at the organisational level. According to Walsham (1993) the analysis of power is required in contexts where individual interests are diverse and conflict is common. As people tend to conceal their motives to protect their interests, a researcher needs to spend a considerable amount of time in the field in order to gather and interpret data, which represents political actions and conflicting interests (Walsham, 1993). However, as the organisational activities examined were relatively limited, the political issues involved seemed also to be limited.

Nevertheless, since the study's framework can equally be applied at an organisational level to investigate the impact of other types of systems (e.g. ERP) on organisational flexibility, it can provide further insight through future research.

8.7 Future research

As new business needs emerge, more advanced internet-based systems, such as electronic markets, are currently being developed. These electronic markets, developed either by large suppliers/retailers or by third-party organisations, aim to expand the traditional EDI links and provide platforms for the support of CPFR. Therefore, they aim to integrate activities across the supply chain (from the POS to the manufacturer). Whether these electronic markets will interoperate or whether they will lead again to lock-in effects is still unclear. Nevertheless, the examination of the integrated business environment aimed at by CPFR could lead to

interesting insights regarding the flexibility of the supply chain. It could be used not only to test, but also to enrich the theoretical framework developed in this study.

Besides changes at the interorganisational level, technological advances are also proceeding at an organisational level. At the time of the study only a limited number of companies had implemented ERP. Over the years, more and more organisations even medium-sized ones have implemented these systems seeking to automate their activities and become more efficient. The fact that ERP systems improve efficiency has been increasingly supported in the literature (Ash & Burn, 2003), but whether or not they bring flexibility has not been thoroughly analysed. P&G's warehouse manager suggested that, if I wanted to study the impact of technology on flexibility, I needed to study the implementation and use of an ERP system. He supported his argument through examples revealing the difficulties and constraints imposed by the new warehouse management system. Driven by this preliminary knowledge and taking into consideration the insight gained in this study, the flexibility provided by large scale information systems will be the subject of future inquiry. The study of ERP systems and their impact on organisational flexibility requires an in-depth case study which would enable the thorough analysis not only of the technological but most importantly of the cultural and political issues influencing flexibility. Such a study would counterbalance the limitations of this thesis by enabling a more detailed analysis of the process of appreciation as well as a deeper understanding of the cultural and political context influencing it.

Besides grocery retail supply chains, the notion of flexibility needs also to be examined in different industries and especially in business environments such as the software industry, where innovation is imperative for the survival and maintenance of organisations' competitive advantage.

An equally important expansion of this study would be to examine more closely the flexibility of technology and, in particular, how different development approaches constrain or enhance flexibility. This study examined the impact of technology on the organisational flexibility but without examining how this technology could become more flexible and how this could in turn influence the flexibility of an organisation or of its interaction with trading partners.

8.8 Concluding remarks

The primary aim of this study was to examine the impact of IOS on the flexibility achieved both at the organisational level and at the level of interaction between trading partners. However, the research focus was expanded to include the examination of the social, organisational and interorganisational issues influencing the impact of technology.

This study showed that organisational flexibility is not only a multidimensional concept, but also a context embedded notion. It is enacted by the process under which people or organisations evaluate environmental disturbances and decide upon actions to respond. It is also embedded in the organisational/interorganisational context influencing this process of response. Flexibility is also a dynamic concept changing over time following and influencing changes of the context. All these ideas were reflected in a conceptual framework of flexibility, which is sufficiently general to be applied in different contexts or industries.

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APPENDIX I

Systems thinking approaches

Systems thinking has emerged as a meta-discipline that can be used to analyse phenomena in various disciplines (Checkland, 1981; 1999). Systems thinking provides a consistent and cumulative body of understanding that is "sufficiently flexible to be open to new thinking and to accommodate new ideas in a coherent framework" (Garnsey, 1993, p.229). Systems ideas can be traced back to the 1950s when the first mathematically expressed theoretical approaches emerged. Since then, systems ideas have been developed and used in different disciplines and strands of research.

In order to reflect the breadth and diversity of systems thinking, Lane and Jackson (1995) published an annotated bibliography of significant work in different approaches in systems thinking, such as general systems theory, cybernetics, hard systems thinking, soft systems thinking, system dynamics and critical systems thinking.

One of the first theoretical approaches was that of von Bertalanffy (1968) who developed a mathematically expressed general theory of systems. General systems theory (GST) was supposed to provide a meta-level language and theory that could be applied to various disciplines. It suggested a general model, principles and laws that apply to the concept of systems regardless of the nature of their components and the interrelationships between them. According to Checkland (1981) the concepts proposed by GST, although relating to various disciplines, were not widely embraced by systems researchers who preferred less imperious concepts of systems thinking.

Cybernetics is a subset of systems thinking and was launched by Wiener (1961) as the general (meta-level) science of communication and control in human and mechanical systems. In Cybernetics I (Emery, 1969), attention is drawn to the important distinction between systems that are open to their environment (von Bertalanffy, 1969) and those that are closed (Koehler, 1969). Organisations are seen as a special class of open systems, having properties of their own and sharing other properties in common with other open systems. According to Katz and Kahn (1969) characteristics of open systems include the importation of energy from the environment, the throughput or transformation of imported energy into some product form, the exporting of that product into the environment, and the re-energizing of the system from sources in the environment. Open systems are thus in constant interaction with their environment, transforming inputs into outputs as a means of creating the conditions necessary for survival (Katz & Kahn, 1969). Ashby in his Law of Requisite Variety argued that environments are continually changing and that a system, in order to be

effective, must be capable of a variety of responses to match those changes in the environment. According to Ashby (1969, p.110), "only variety can destroy variety".

Until the 1970s, systems thinking was dominated by positivism and functionalism. It was assumed that systems of all types could be analysed by essentially the same methods used in the natural sciences (Jackson, 2001). Systems, as exemplified in operational research, involved algorithms, modelling, game theory and queuing theory (Blunden, 1985). Systems had become embedded in faculties of technology and the very word had become dehumanised (Vickers, 1983a).

In information systems and management science the prevalent systems thinking approach was for many years the 'hard' systems approach with the word 'hard' standing for an objective/positivistic scientific view (Checkland & Holwell, 1998; Checkland, 1995). 'Hard systems thinking' supposes that the world contains systems that can be 'engineered' (Checkland, 1991) to achieve declared objectives. It is systematic in character, since it examines and selects one of a number of alternative systems to accomplish a predefined desirable objective (Checkland, 1999). It is, thus "limited to the small subset of situations in which objectives are undisputed" and mainly examines problems of "how to do it" rather than of "what to do" (Checkland, 1999, p.52).

Herbert Simon's work, arguing that human behaviour, both individual and corporate, is largely goal-seeking, is considered as one of the most influential in management sciences (Checkland, 1995). In his theory of decision making, Simon (1960) argues that problem solving is conducted through problem detection and collection of relevant information, identification of alternative solutions and finally selection of a solution and monitoring of its application and outcome. He abandons the classical model of a "perfectly rational decision maker" (Checkland & Holwell, 1998, p.45) and argues that his aim is 'satisficing' rather than optimizing (Simon, 1960). Following's Simon's ideas, various management and information systems studies explain the nature of 'managing' as problem-solving through decision making. Managing is seen as consisting of planning, organising, coordinating and controlling while decision making is defined as analysing alternative solutions and selecting one of them (Davis, 1974). Organisations are analysed as open systems that contain a set of functional subsystems (e.g. accounting and marketing) with their own information needs, goals and objectives (Davis & Olson, 1985). They are thus seen as social entities devoted to the attainment of goals (Zwass, 1992), which can only be achieved through management of material and human resources (Davis & Olson, 1985). A manager is seen as a problem solver with his main activity being decision making and an information system has the role of supporting the process of decision making (Zwass, 1992). All these ideas convey the concepts that emerged in the management science and hard systems paradigm of the 1960's

(Checkland & Holwell, 1998) and that have been presented repeatedly in the management literature.

In late 1970's a different research approach following a subjective/interpretive view emerged. "While there remain pockets of functionalism (e.g. in general systems theory), these are but a subset of a field which is considerably more sophisticated" thanks in large part to the contribution of Beer, Ackoff, Maturana, Varela, Vickers and Checkland (Galliers *et al.*, 1997, p.275).

Beer is one of the researchers that pushed systems thinking in a 'structuralist' direction (Jackson, 1997). He initiated organisational cybernetics (Beer, 1972) as a response to the failure of traditional approaches to explain highly complex situations. Beer's (1985) work on the viable system model (VSM) is significant, aiming to derive understanding of organisations and seeking to improve their efficiency and effectiveness through the application of cybernetic principles and laws. Beer (1985) develops a model of a viable system – a system able to respond to environmental disturbances, even when they are not foreseen. This generic model, involving five subsystems (implementation, coordination, control, development and strategy), can be applied to various types of organisations. According to Galliers *et al.* (1997, p.271) models such as the VSM are worthy of consideration "as 'hermeneutic enablers'- helping to structure debate" around observable phenomena in complex social systems.

Soft systems thinking has offered a new perspective on the way systems ideas can be used in situations of decision making and problem solving (Galliers *et al.*, 1997). Soft systems approaches take a process view of organisations (Checkland & Holwell, 1998) abandoning the notion that reality consists of systems that can be engineered (Checkland, 1995). They are premised upon an alternative theoretical assumption, in which social reality is seen as continuously socially '(re)constructed' (Galliers *et al.*, 1997, p.269).

At this point mention should be made of the work of Maturana and Varela on autopoietic or self-reproducing systems (Maturana & Varela, 1980), which is considered as one of the most important developments in systems thinking (Mingers, 1995). Maturana and Varela (1980) developed the concept of a system whose elements generate the system itself. They produced a theoretical account not only of living systems in general but more specifically of human cognition and language. The term autopoiesis was used by Maturana and Varela (1980) to describe "the self-referencial nature of living systems... and the 'circular organisation' which they display" (Walsham, 1993, p.32).

The autopoietic view sees a system as operationally closed, continuously self-producing and changing by a process of 'natural drift' (Varela, 1984). An autopoietic system is

autonomous, since it depends essentially on itself for its continued reproduction (Mingers, 1995). It may also be disturbed by "events in the environment, but under no circumstances are these perturbations internalised as components in the autopoietic process.... Perturbations can only stimulate processes in the system that always follows its self-defined rules" (von Krogh & Roos, 1995, p.38). Based on these ideas, organisations are seen as dynamic and autonomous systems that strive to maintain their identity by subordinating all changes to the maintenance of their own organisation as a given set of relations (Maturana & Varela, 1980).

Autopoiesis has influenced research in information systems (Mingers, 1995) and organisation theory (von Krogh & Roos, 1995) as well as inspiring research in other disciplines such as sociology, where it formed the basis of Luhman's (2004) theory of society. Nevertheless, the implication for the use of this approach in a study of organisational flexibility is the need to examine change as always internally determined. Although autopoiesis acknowledges that changes of systems occur in response both to internal dynamics and to interactions with external systems, it sees change as specified solely by the properties of the system's components. There can be no "instructive interactions" with the environment (Mingers, 1995, p.30) and no explanations of the impact of change on the environment or external systems. In autopoiesis emphasis is given to "the way in which the organisation is structured to view the world rather than the way the world is" (Walsham, 1993, p.32).

However, there is no single body of work that underlies the 'soft' or interpretive approach to information systems (Checkland & Holwell, 1998). Soft systems researchers believe that social reality is constantly being constructed and reconstructed in a social process in which meanings are negotiated. For them an 'organisation' does not exist as an independent entity, but is part of sense making by a group of people engaged in dialogue (Checkland & Holwell, 1998). They regard the world as complex and problematical, but accept that the process of inquiry into it can be organised as a learning system (Checkland, 1999). They thus shift systemicity from the world to the process of inquiry into the world (Checkland, 1999).

Checkland (1991; 1995) introduces the soft orientation by referring to Vickers's (1968, 1972; 1983a; 1983b) work on appreciative systems. Vickers's core idea is that of 'appreciation' and the 'appreciative process', which constitutes a system (Checkland & Casar, 1986). Vickers describes appreciation as a process through which people perceive a specific situation, make comparisons between 'facts' and 'standards' and potentially decide upon an action to take in order to maintain, change or evade relationships. He replaces the goal-seeking model by relationship managing and argues that seeking a goal can be a special case of managing relationships (Checkland, 1991). In an analogy to autopoietic systems,

Vickers develops and analyses the process of creation and recreation occurring in organisations. In Vickers's appreciative system standards can change by the very act of using them, and it is the change of standards or the outcomes of actions that lead to the system's continually changed self.

Although considered as part of the soft systems approach within the systems movement, Vickers's work was mainly carried out independently (Checkland & Casar, 1986). During the years that Vickers was expounding his theoretical ideas, Soft Systems Methodology (SSM) (Checkland, 1981) - a methodology for rational intervention in human affairs - was being also developed (Checkland, 1991). SSM aims to bring improvements in areas of social concern (Checkland & Holwell, 1998), yielding insight into a problem situation through the adoption of the world-views of the people involved (Checkland, 1998). It "uses models of human activity systems to explore with the actors in a real-world problem situation their perceptions of that situation and their readiness to decide upon purposeful action which accommodates different actors' perceptions, judgements and values (what Vickers calls their appreciations)" (Checkland, 1984, p.98). It is organised as a cyclic learning system, since the initial choice of models, when used to question the real situation, lead to new knowledge and insights concerning the situation, thus leading to further ideas for relevant models (Checkland, 1998). In summary, SSM provides an "interpretive philosophy and approach for organised intervention and purposeful action" recognizing and building on different stakeholders' perceived realities or world-views (Walsham, 1993, p.11). The implied philosophical base of SSM is therefore seen to lie in phenomenology (Galliers *et al.*, 1997).

SSM has been very influential but it has been criticized as largely ignoring the constraining effects of existing power relations (Jackson, 1991) in the reaching of consensus. It has also been criticised as disregarding the fact that there are no universal or absolute values ('cultural relativism') and that different people may have different interpretations of the same situation (Fuenmayor, 1991).

These criticisms have led to the development of critical systems approaches. Critical systems thinking can be defined by three commitments: "to critique, to emancipation and to pluralism" (Schecter, 1991, p.213; Midgley, 1995). The commitment to critique involves questioning of existing methods, theories and practices, uncovering their assumptions and identifying their conceptual weaknesses (Schecter, 1991). This category embraces criticisms of cybernetics (Ulrich, 1981) and of structuralist approaches such as VSM (Jackson, 1988), as well as of the soft systems approaches (Jackson, 1985). It also embraces specific criticisms, presented in Critical Systems Thinking: Directed Readings (Flood & Jackson, 1991a), which identify weaknesses of particular systems approaches (Jackson, 1991), stress

the need to recognize 'coercive' contexts, where there is fundamental conflict between stakeholders (Jackson, 2001), and discuss the commitment to human emancipation.

The commitment to emancipation is a commitment for development of human beings "via free and equal participation in community with others" (Schecter, 1991, p.13). It is an attempt "to create circumstances in which communicative action takes place aimed at achieving mutual understanding" (Walsham, 1993, p.11). It recognises barriers to perfect communication, such as unequal power relations, and contributes to human emancipation through critical reflection on these barriers (Walsham, 1993).

Critical Systems Heuristics (Ulrich, 1983) is one of the first approaches that supported human emancipation. Based on the work of Churchman (1971), Ulrich (1983) employed as its primary device the critical potential present in the concept of 'boundary' and developed a method to help people think critically about a system's design. This method provides planners as well as affected citizens with the heuristic approach they need, for instance, "to lay open and reflect on, the normative implications of systems design, problem definitions or evaluations of social programs" (Ulrich, 1991, p.105).

Emancipatory systems approaches also recognize coercive contexts, defined as "situations where there is fundamental conflict, and the only consensus that can be achieved arises from the exercise of power" (Jackson, 2001, p.237). In order to provide theoretical depth to emancipatory methods and approaches, critical systems thinkers have also adopted concepts from social theories and especially from the work of Habermas and Foucault. Using Habermas's critique of distorted communication, Jackson (1985) enriches systems thinking with issues of power domination, distorted communication false consciousness and the selection of appropriate strategies for social action. Based on a conceptual analysis of power and ideology, Oliga (1990) arrives at the justification that the stability and change tendencies of a social system are a consequence of historical processes of power relations, the exercise of power and the ideological formation of human subjectivities. Furthermore, based on Foucault's concept of multiple knowledges (Foucault, 1980), which can be suppressed or liberated, Flood (1991) develops liberating systems theory. This theory can be summarised in terms of a process that starts with liberation of suppressed knowledges and critique of their rationalities, empowers those who are oppressed and leads to a progressive change of social conditions (Flood, 1991).

Taking into consideration different systems thinking approaches, Flood and Jackson (1991b) developed Total Systems Intervention (TSI) as a meta-methodology attempting to operationalise various critical systems ideas. TSI does not only employ a critique of different

systems approaches, but also recognizes coercive contexts and is based upon a sophisticated form of pluralism (Jackson, 2001).

Attempts to reconstruct systems thinking upon pluralist foundations (Mingers & Brocklesby, 1996; Mingers & Gill, 1997; Garsney, 1993; 1995) are also included in Critical Systems Thinking. The commitment to pluralism recognises the contributions of different systems approaches and suggests combinations of approaches to address problematic situations (Schecter, 1991). Approaches concerning pluralism may use "a variety of research method in a theoretical coherent manner, becoming aware of their strengths and weaknesses" (Midgley, 1995, p.61).

In that sense, the work presented in this thesis also concerns pluralism since it uses a systems approach for the analysis of the process of change combined with an additional theoretical approach for the analysis of the context. However, according to Jackson (2001), further defining characteristics of a critical systems approach are the concern of emancipation and the recognition of 'coercive' contexts. Although our approach examines the relations and distribution of power between stakeholders, it cannot be characterised as critical, since it does not see conflict as fundamental and recognizes that common interest might also be shared between stakeholders (involving not only competitors, but also trading partners).

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