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Strategic Role of Internet-related Technologies in Supply Chain Networks: Integration, Flexibility & Personalisation

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ABSTRACT

Organisations are operating in increasingly competitive market places. To enhance competitiveness, organisations are shifting their focus from individual supply chains to improving the responsiveness of the whole Supply Chain Network (SCN) that serves and impacts the level of final product or service provided to customers. Consequently, there has been a major upsurge of interest in the role of Internet-related technologies (IRT) in advancing SCNs. This area was examined by conducting case studies with large organisations from a range of industries that focused on the function of IRT in inter-organisational supply chain processes.

A number of major themes emerged. Firstly, it is clear that IRT will be at the heart of future SCN communication surrounding enabling, operational and strategic supply chain processes. IRT provide a mechanism for integrating different supply chain-related systems thus leading to improved information sharing and visibility. Furthermore, it widens the scope and flexibility of intra-organisational and inter-organisational linkages and pathways that are available between different network members. In addition, IRT is being used to broaden and deepen relationships with key partners and within teams formed around supply chain processes. IRT can also be personalised to suit different organisations and people in the SCN and to provide appropriate access to web links, information and applications.

However, it is important to understand that IRT cannot be equally applied throughout the supply chain. A number of factors will influence its suitability including the type and stage of supply chain processes, the nature of activities, the content of communication and the people communicating. The thesis will provide guidance to academics and practitioners on the strategic role of IRT. Finally, future research is recommended to investigate the additional impact that smart tags and mobile technologies will have and the long term effects of technological linkages on social relations between different network members.

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LIST OF ABBREVIATIONS

ANX	Automotive Network Exchange
ADSL	Asymmetric Digital Subscriber Line
ARPANET	Advanced Research Projects Agency Network
B2B	Business-to-Business
B2C	Business-to-Consumer
BPR	Business Process Re-engineering
CPFR	Collaborative Planning, Forecasting and Replenishment
DBMS	Database Management System
DSS	Decision Support System
EDI	Electronic Data Interchange
EFT	Electronic Funds Transfer
EPOS	Electronic Point of Sale
ERP	Enterprise Resource Planning
GPRS	Global Packet Radio Service
GSM	Global System for Mobile Communications
HRM	Human Resource Management
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
ICT	Information and Communication Technologies
IRT	Internet-related Technologies
ISDN	Integrated Service Digital Network
ISP	Internet Service Provider
IS	Information Systems
JIT	Just In Time
LAN	Local Area Network
MIS	Management Information Systems
MRT	Media Richness Theory
PAN	Personal Area Network
PDA	Personal Digital Assistant
RFID	Radio Frequency Identification
SCM	Supply Chain Management
SCN	Supply Chain Network

SMS	Short Messaging Service
TCP/IP	Transmission Control Protocol/ Internet Protocol
TQM	Total Quality Management
UMTS	Universal Mobile Telecommunications System
URL	Uniform Resource Locator
VAN	Value Added Network
WAN	Wide Area Network
WAP	Wireless Application Protocol
WWW	World Wide Web
XML	Extensible Markup Language

Chapter 1:

Introduction

1.1 INTRODUCTION

This research is concerned with the study of Internet-related technologies (IRT) and Supply Chain Networks (SCN). The opening chapter of the thesis will introduce, contextualise and position the research in relation to other IS and E-Business research and it is organised as follows. It will begin by clearly articulating the rationale and the focus of the research and the principle aims and objectives of the research. A summary of the research data collection strategy will be provided followed by an overview of the key contributions and significant findings of the empirical research. Finally the chapter will finish by presenting the structure of the body of the thesis.

1.2 RESEARCH RATIONALE & FOCUS

Information Systems (IS) is a discipline which focuses on the development, use and impact of information technology in business and organisational settings and emerged in the 60s (Myers & Avison, 2002). Early IS research focused on technical issues while more recent research has broadened to embrace the relationship between IS and the organisation. The IS field is involved in research in a range of areas. Amongst these are e-commerce, e-business, the Internet and inter-organisational systems.

E-Commerce has been coined 'buying and selling over the Internet' (Earl, 2000). It concentrates on the use of the Internet to support sales and customer service to end users (Van Hoek, 2001). Electronic communication linkages for buying and selling have been widely used since the 70s through the uptake of Electronic Data Interchange (EDI) and then e-mail in the 80s (Cagliano, Caniato & Spina, 2003). However, the commercialisation of the Internet has revolutionalised and further popularised commerce. There are two main categories of E-Commerce. These include B2C (Business-to-Consumer) E-Commerce which is where consumers are provided with products and services via the Internet e.g. shopping malls (Lee, Cho & Lee, 2002). The second main category is B2B (Business-to-Business) E-Commerce and is where transactions between organisations are performed on-line e.g. manufacturers purchasing raw materials, manufacturers selling their products to retailers on-line

(Barlow, Siddiqui & Mannion, 2004; Dai & Kauffman, 2002; Lee, Cho & Lee, 2002). Some researchers have extended the definition of e-commerce to include not only transactions but also the corporate processes that support the commerce within organisations (Gebauer & Shaw, 2002; Zwass, 1996; etc).

Other researchers and practitioners argue that these definitions are actually over-spilling into the wider sphere of e-business and they choose to distinguish between e-commerce and e-business. For example, IBM classify e-commerce as only being concerned with the way that customers, suppliers and partners transact while e-business is a broader field that is concerned with the use of IRT to improve and transform business processes (IBM, 2004). As well as encompassing e-commerce, e-business is concerned with the front end and back end applications that form the core engine of modern organisations (Kalakota & Robinson, 2000) and the re-engineering and redesigning of these business processes to match customer's expectations in the new economy (Earl, 2000). It includes additional aspects of business such as e-business infrastructure, customer relationship management, business intelligence and supply chain management (IBM, 2004). It embraces the broad range of supply chain processes including sales and customer service and support, purchasing, order processing, tracking, production planning and scheduling, inventory management and transportation planning (Cagliano, Caniato & Spina, 2003). Moreover, the focus of e-business is more strategic and is more concerned with the impact of the Internet on profitability rather than just gross revenues (Amit & Zott, 2001; Kalakota & Robinson, 2000)

Having studied the literature in this field extensively, there obviously appears to still be widespread confusion over the exact definitions of e-commerce and e-business. Even accepting the definitions that distinguish between e-commerce and e-business, e-business can still be considered a very broad and all embracing phenomenon (Van der Wiele, 2002; Deise et al, 2000; E-Business Research Network, 2004). This is probably partly attributed to the fact that e-business is being researched from a variety of different perspectives and disciplines including, but not restricted to, marketing, supply chain management, information systems and computing etc. It has also received the attention of researchers in so many different forms including e-business strategies, impact of e-business on business processes, technical requirements and

architectures to enable e-business, electronic payment systems, the application of new technologies, economic and legal issues, internet-based security systems, e-business systems analysis and design, impact of inter-organisational applications on business relationships etc (Gebauer & Shaw, 2002).

Clearly, this research is related to e-business but it is only one small area of an ever developing field. The researcher has chosen to focus on the aspect of e-business that is concerned with the role of IRT in supply chains and supply chain management (SCM). A supply chain is a well-established concept for considering key activities that an organization can perform or manage with the intention of adding value for the customer as products and services move from conception to delivery to the customer (Porter, 1980). The main reason for this aspect of e-business being selected for further research is the fact that it is a growing area of e-business that is pertinent to the success of organisations in international marketplaces and consequently one that is receiving increasing attention. The mounting importance of the field has been compounded by many factors including the advancements in the international business environment, developments in inter-organisational relationships, the increasing complexity of supply chains and the proliferation of IRT. These various factors will be discussed.

Firstly, the international business environment has become much more competitive as organisations are increasingly becoming global (Day, 2003; Van der Aalst, 2002). Customers are demanding faster response times along with shorter product cycle times and greater customisation of products. Secondly, organisations are entering these global marketplaces by increasingly forming alliances, partnerships and mergers with other organisations (Cohen & Mankin, 2002; Speier, Harvey & Palmer, 1998) and outsourcing aspects of their supply chains (Manchester, 2003; Thomas, 2003). Consequently organisations are finding that it is no longer enough to manage their own organisations and that they have to extend SCM to other organisations in the SCN. They must also be involved in the management of the network of all upstream organisations that provide inputs (directly or indirectly) as well as the network of downstream organisations responsible for delivery and after-market service of the product to the end customer (Handfield & Nichols, 1999). The actions of other network members will have an impact on the value and costs of the end product or

service offering. More than ever, the common supply chain extends across organisational boundaries (Ayers, 2002; Speier, Harvey & Palmer, 1998). This has brought the issue of business to business relationships more and more to the forefront.

Thirdly, organisation's supply chains have been impacted by the dramatic advancements in the international business environment as they are placing increasing pressure on supply chains to become more dynamic and responsive. In the last decade, SCM has moved from being a low-profile, ancillary concern to a recognised strategic component with tangible, positive impact on the organisation's bottom line (Lancioni, Schau & Smith, 2003). SCM is currently taking centre stage in business planning. Moreover, organisational supply chains are more complex and expensive to run than ever before (Thomas, 2003). This is partly attributed to the level of globalisation and the increase in outsourcing etc (Martin & Towill, 2002). A Forrester report confirmed this, with 68% of companies stating that their supply chains had become more complex in the last three years, while 64% said that their supply chains had become more geographically dispersed. The emphasis on supply chains in the future will be agility – the ability of the supply chain to react quickly to changes in market demand (Martin & Towill, 2002).

Fourthly, despite developments in international marketplaces and the complexity of supply chains, the advances in technology have enabled supply chains and SCM to be maintained and in many cases enhanced. The global nature of organisations means that technological linkages are more practical for supply chain communication. Moreover, as the economy moves more and more towards information-based products and services, supply chain operations are increasingly suited to electronic communications (Goddard, 1992; Rayport & Sviokla, 1995). As Handy (1995) outlines, "more and more of our economic activity is a churning of information, ideas and intelligence". Rather than face to face communication other communication channels like IRT are coming to the forefront.

Prior to the development of the Internet, supply chain linkages were expensive and technically challenging (Garica-Dastugue & Lambert, 2003). The proliferation of new telecommunications and IT such as the client/server concept, the Internet, intranets and the www has made real-time on-line communication through the supply chain a

reality and has seen the automation and integration of many internal supply chain processes. On-line enterprise Resource Planning (ERP) systems and SCM systems have emerged linked to backend database management systems. Early adopters of e-business applications have typically focused on areas such as procurement and self service applications and on improved cost reductions and administrative efficiencies (Ash & Burn, 2003). However, more mature users are focusing on strategic advantage and are generating this through an evolutionary model of organisational change (Farhoomand & Wigand, 2003).

Moreover, organisations are moving towards integrating business processes with external business partners (Ash & Burn, 2003). The focus of e-business is moving towards making 'the key business processes of an organisation available over the Internet (Ash & Burn, 2003) and about electronic interactions between organisations. In fact it is "often both pragmatically and analytically unfruitful to separate inter-organisational and intra-organisational business processes" (Zwass, 1996). Until recently organisations focused primarily on their direct customers and internal functions and placed little emphasis on linkages with other organisations. With the increase in partnerships and outsourcing and greater customer demands, organisations need to focus on strengthening relationships within its supply chains and collaborating more closely with other organisations. This has led to developments in inter-organisational systems as well. Subsequently, B2B e-commerce is closely related to other IS research such as the study of EDI, inter-organisational information systems (IOS) and electronic markets (Gebauer & Shaw, 2002).

In conclusion, this IS research is particularly concerned with the field of e-business and it is focusing on the field of e-business from a supply chain and a SCM perspective. In studying the role of IRT in supply chains a number of key areas and developments have been highlighted in this section. These areas have touched on intra-organisational and inter-organisational supply chain processes and activities, intra-organisational and inter-organisational linkages, the importance of information and relationships.

1.3 RESEARCH AIM & OBJECTIVES

The principle aim of this thesis is to explore the emerging role of IRT in SCNs. Particular areas of interest that required further research are identified throughout chapter 2 and 3 and led to the formulation of the key aims and objectives. Five key objectives have been identified in Figure 1.1 that embraces the main aspects of this field of research.

OBJECTIVE 1	To critically evaluate the role of IRT in supply chain processes and activities.
OBJECTIVE 2	To investigate the impact of IRT on intra-organisational and inter-organisational linkages within and between supply chain processes.
OBJECTIVE 3	To analyse the uptake of IRT for developing relationships at different points of the SCNs.
OBJECTIVE 4	To investigate how effectively IRT is being applied to SCN information sharing.
OBJECTIVE 5	To evaluate the benefits and limitations in applying IRT across SCNs.

Figure 1.1: Research Objectives

The objectives involve exploring and analysing the impact of IRT on supply chain processes and activities in the SCN, the linkages within and between supply chain processes, the development and opportunities for relationships and information sharing in the SCN and the overall benefits and limitations in applying IRT to SCNs.

Taking these aims and objectives into account, a conceptual framework has been established in Figure 1.2. Robson defines a conceptual framework as covering 'the main features' of the research design and their 'presumed relationships'. This framework illustrates that the empirical research will focus on a focal organisation although the research needs to take the other members of the SCN into account.

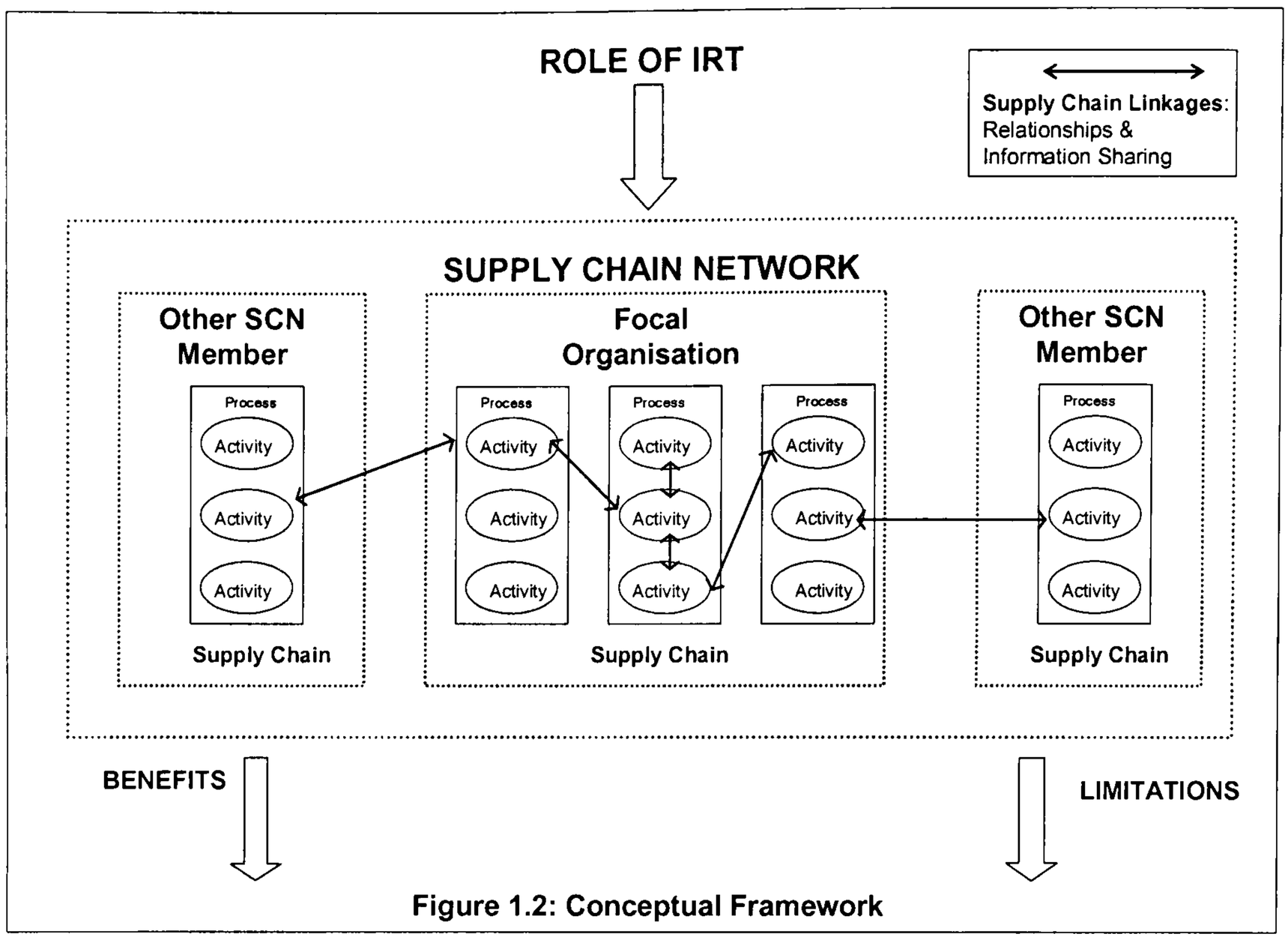


Figure 1.2: Conceptual Framework

Each organisation in the SCN has its own supply chain which is made up of a number of supply chain processes and activities. Although each organisation is only shown to have a limited number of processes on the diagram for simplicity reasons, it is likely they will have a varying number of key supply chain processes and a different number of supply chain activities within each of the supply chain processes. Furthermore, the supply chain processes may not be conducted in sequential order; they may be conducted in parallel.

The supply chain processes and activities within an individual organisation and between different organisations will be linked in different ways. Again for simplicity reasons only some of the potential supply chain linkages have been displayed. These are illustrated on the diagram by a double arrow-headed line. Many more different linkages may exist between the supply chains of different organisations, the different supply chain processes within supply chains and between the supply chain activities within these processes. These supply chain linkages will be particularly concerned with people involved in building relationships across the SCN and the information that is shared. Overall, the research will examine the benefits and limitations in applying IRT to the different elements of the SCN.

Other aspects of the scope of the research also need to be more clearly defined. In undertaking the aims and objectives outlined, the research examines the IRT that are available to organisations from a business perspective. The different technologies are considered in terms of the key features they have, how they could be used in organisational activities, their benefits and their limitations. The research does not study the technology from a technical perspective e.g. architecture, protocols, security etc.

Secondly, in studying the role of IRT in supply chain processes and activities, general research is undertaken on the common supply chain processes that many organisations are involved in. The research does not, however, concentrate on specific supply chain processes such as purchasing, ordering or logistics. Therefore specific journals such as the Journal of Purchasing and Supply Management or the European Journal of Purchasing were not pursued.

The research also embraces the way in which IRT can be used in intra-organisational and inter-organisational linkages across the SCN in terms of boosting performance, coordination, integration, efficiency and effectiveness. The research does not concentrate on pure SCN issues such as SCN policy making and the influence of policy maker's influence on power and control.

The SCN linkages explore softer issues in SCN linkages such as information sharing and relationships. Information is examined in terms of its use in supply chain processes and SCNs and embraces issues such as the content and types of information that is shared, the actual synthesis and personalisation of information, information overload and hoarding etc. Relationships are explored in terms of issues such as deepening and broadening relationships, closeness, trust, identity and conflict and are considered in the context of partnerships, teams and inter-personal relationships.

Finally, the benefits of IRT in SCNs are explored from more of a qualitative perspective rather than an economic perspective. Furthermore, the limitations will not target areas such as international cross-cultural communication. The research involves global organisations but it was not practically feasible to investigate the non-UK based sites. Therefore, this aspect of communication could not be adequately

explored. Acknowledgement is however generally given to the impact that culture may have on Internet-related communication channels.

The objectives, conceptual framework and boundaries have been taken and conceptualised in terms of a comprehensive research strategy. The next section describes the research strategy underpinning the research.

1.4 RESEARCH STRATEGY

The research strategy that was deemed most suitable for accomplishing these research aims and objectives involved the researcher taking an interpretive, qualitative stance and employing a case study strategy. A qualitative stance was taken for a number of reasons. Firstly, there has clearly been a growing interest in the application of qualitative research in IS (Markus & Lee, 1999) and this is largely due to the fact that qualitative research enables the researcher to study organisational, social, political and cultural phenomena that are not possible using quantitative research (Myers & Avison, 2002). It allows the researcher to understand the meaning and dynamics of the phenomena in context-specific settings (Walsham, 1995a) and the process whereby IS influence their context and the context influences IS (Walsham, 1993). An interpretive approach will focus on the full complexity of human sense making as the situation and experiences emerge.

A case study strategy was selected as an all encompassing method that allows a detailed investigation into the holistic and meaningful dynamics within natural organisational settings. Multiple case studies have been conducted with 7 different large organisations in order to enable cross-case analysis and the development of rich theoretical frameworks (Benbasat et al, 1987). A range of data collection methods have been adopted including semi-structured interviews, informal conversations, e-mail correspondence, www, corporate websites, corporate reports, strategy documents, newsletters, organisational charts, internal surveys, presentation, demonstrations etc. to provide stronger substantiation of constructs and hypothesis (Eisenhardt, 1989). For practical reasons, each case study focused on particular supply chain processes in organisations' SCNs.

Data analysis was undertaken in conjunction with the data collection (Glaser & Straus, 1967) and after the data collection. The analysis was conducted using principles of hermeneutics (Gadamer, 1976; Klien & Myers, 1999) and methods for identifying and extracting key themes from multiple case studies (Eisendhardt, 1989; Holliday, 2002). The primary unit of analysis across the case studies was the SCN. There were however a number of sub-units of analysis including supply chains, supply chain processes, linkages, information sharing and relationships, which are related back to the SCN. Analytical generalisations, rather than statistical generalisations, have been made by generating, expanding and generalising theoretical frameworks. These analytical generalisations are one of the main components of the original contributions that are outlined in the following section.

1.5 ORIGINAL CONTRIBUTION & SIGNIFICANCE OF STUDY

This research fits into an area of research that has only really emerged in the last five years, namely e-business. In particular it is focusing on supply chains and SCM. At the start of the thesis, the existing research on the role of IRT in SCN and supply chains was very limited and little empirical studies had been carried out. The thesis aimed to contribute knowledge and understanding to an under developed field. Several issues were explored including an evaluation of the role of IRT in intra-organisational and inter-organisational supply chain processes and activities, supply chain linkages, supply chain relationships and supply chain information sharing.

The thesis was informed by a wide range of literature and a comprehensive empirical research. The literature review involved a review of literature that embraced fields such as; e-business, supply chains, information and communication technologies, media choice, information management, virtual relationships and virtual teams. As indicated in the previous section the empirical work was concerned with qualitative orientated case studies based on seven large organisations using semi-structured interviews and a range of other data collection methods.

The key contributions that this thesis has made are an in-depth literature review and a unique empirical study on the role of IRT in SCNs. Moreover, the thesis has provided a comprehensive analysis that has presented a thorough set of findings. The findings illustrate that IRT is being used as a key communication channel in large organisations, and they are being extended to enhance enabling, operational and strategic chain processes, provide more advanced supply chain linkages and information sharing and strengthen SCN relationships. Four main themes have emerged from the study's findings. These include: integration, visibility and information sharing; flexibility; personalisation; channel selection. The findings confirm that IRT can improve the performance of SCNs through providing a more co-ordinated and coherent SCN. There are a range of benefits that have been identified.

However, the findings also demonstrate that IRT are not always the most appropriate communication channel for certain aspects of SCNs and in certain situations. Many factors that hamper the effective use of IRT have been identified and many limitations of the technology have been outlined.

1.6 STRUCTURE OF THESIS

This chapter provided a brief introduction and contextualised the field of work studied. It supplied an overview of the research rationale and focus, the research aims and objectives, the research strategy and the original contribution and significance of the study. The rest of the chapters encompass all issues, developments and outcomes arising from the study.

The structure of the thesis is as follows. Chapter 2 and 3 will explore and synthesise the literature in this area of work. The literature review is all about gathering vague ideas, structured ideas, understanding relationships between issues, identifying gaps in the literature, recognising questions that need further investigation, providing partial answers, and building up a direction for further research.

Chapter 2 is devoted to assessing the development and impact of IRT in an organisational context. This involves providing a brief overview of organisational communication channels, an in-depth analysis of the different IRT and a

comprehensive evaluation of the various theories for explaining media choice. Chapter 3 presents an overview of organisational supply chains, SCM and supply chain processes. These are considered in relation to the overall SCN and the importance of supply chain linkages is outlined. The chapter then goes on to investigate the role of IRT in SCNs by focusing on inter-organisational and intra-organisational supply chain processes, relationships and information sharing. It concludes by identifying the main aims and objectives of the empirical research.

The research strategy is outlined and explained in Chapter 4. This entails justifying the underlying philosophy, positioning this research in relation to other current IS research, detailing the overall design of the case study approach, as well as summarising the actual empirical case studies conducted and closing with an overview of the techniques adopted for tackling the analysis of the case studies.

The findings of the empirical research are drawn together in chapter 5, 6 and 7. Chapter 5 focuses on the importance of IRT (and in particular intranets) as a key communication channel for enhancing supply chain processes and activities. A number of factors that affect the suitability of the technology are identified including the type of supply chain process (strategic, operational or enabling) and the nature of each of the activities within these processes.

Chapter 6 illustrates some key opportunities and limitations emerging in applying IRT to internal and external supply chain linkages and interactions. In particular, it uses the empirical results to demonstrate how IRT has provided an infrastructure that streamlines and provides greater integration of SCN linkages and information, thus leading to more relevant, visible and useful information available to all the people involved in the supply chain processes. In addition, it has provided opportunities for greater scope and flexibility in the supply chain linkages between the supply chains of different organisations involved in a SCN. The chapter will also provide guidance which types of information are suited to which types of IRT.

Similarly Chapter 7 presents ways in which IRT has been used in the case studies for developing relationships across the SCN. In particular, it has been used for widening and strengthening virtual relationships with key partners and teams of people that

have been formed for the purpose of working collectively on supply chain activities and tasks. Also the case studies highlight a number of factors that appear to limit the suitability of certain types of electronic communication channels for developing relationships.

Chapter 8 reflects on the research as a whole and synthesises the overall research findings. Key contributions and recommendations are highlighted, the implications of the research are reflected upon and the limitations of the research are presented. Then the chapter reflects on the achievement of the original research aims and objectives and finally the future impact of technology on SCNs are discussed.

Chapter 2:

Developments in Internet Related Technologies in an Organisational Context

2.1 INTRODUCTION

The next two chapters will critically evaluate the literature and explore issues in the field of IRT and SCNs. The key purpose of this chapter is to begin by examining the development of IRT as a communication channel within an organisational context. The chapter will commence with an overview of organisational communication and explore the impact that effective communication can have on organisational performance. Organisational communication will be broken down into 2 main components: content and channel. A number of issues and factors surrounding these two aspects of communication will be discussed. In particular, recent developments in communication channels that revolve around the Internet will be highlighted.

The main focus of the chapter will be on Internet-related organisational communication channels. This will embrace a discussion surrounding the Internet, www, intranets, extranets, Internet access and the various tools and technologies such as e-mail and video-conferencing that can be supported. The pros and cons of each of these IRT will be discussed. Various dimensions will be highlighted for comparing and evaluating different communication channels and technologies. These will include the level of interactivity, the number of cues, the amount of adaptiveness and the level of formality. These will be discussed in terms of a well recognised theory: Media Richness Theory. The key components of the theory will be reviewed and an ever-increasing amount of contradictory evidence against the theory will be examined. Many other dimensions including organisational, social and situational factors that clearly impact media choice as well will be discussed. MRT on its own will not adequately explain the suitability of IRT as a communication channel in different situations. Overall, its usefulness in evaluating IRT communication channels will be considered. The chapter will close by summarising a couple of key areas for research.

2.2 ORGANISATIONAL COMMUNICATION

Communication involves creating and interpreting messages or displays (Fisher, 1993). It involves some form of shared meaning amongst two or more people through verbal and non-verbal transactions (Daniels, 1997) and embraces a range of elements

including a sender, receiver, encoding, decoding, channel, message, noise and feedback (Fisher, 1993). Communication is at the very essence of organisations and is central to their daily operations (Yates & Orlikowski, 1992). There are various goals of organisational communication that have been identified such as: reaching an understanding; coordinating action; managing relationships and strategically influencing others (Habermaas, 1998; Te'eni, 2001). A mutual understanding is reached when the receiver comprehends the communication and acts according to the sender's wishes. Coordinating action involves managing the interdependent actions of various employees (Te'eni, 2001). Relationships are managed by using communication to preserve or strengthen relationships through evolving interactions (Goldhaber, 1993). Behaviour and attitudes may be influenced to conform to the sender's wishes (Te'eni, 2001). The patterns of interaction between organisational employees will emerge from and shape the nature and actions of the organisation and events within it.

Organisational communication is probably even more important in the information age. Rather than the focus being on the physical relocation of fixed capital the focus has moved onto the mobility of information capital (Goddard, 1992; Harvey, 1989). Instead of bringing an end to the communication problems in organisations the information age has actually increased them and placed an even bigger emphasis on communication. Actions are much more dependent on the right information being communicated to the right people and although much more information is readily available this only increases the need to make the communication of this information more effective. Organisational communication plays an important role in the success or failure of organisations and research findings illustrate that effective communication systems are correlated to a high overall organisational performance (Goldhaber, 1993; Meyer, 2002; Te'eni, 2001).

The convergence of computing and telecommunication innovations and the demand for faster and better forms of interaction are visibly influencing the nature of organisational communication. Organisations are facing increasing pressure to move quickly to cut expenses, improve customer satisfaction, and be more responsive to ever changing requirements and they are turning to technology to facilitate change (Greif & Millen, 2003). Technological progress is bringing about a massive increase

in interactive capability by providing new ways to enhance productivity, new ways to configure business, new ways to serve customers and new ways to organise (Butler et al, 1997). Many organisations are taking advantage of developments and are using IRT for communicating across their core supply chain processes. Firms recognise that e-business can assist with numerous objectives such as enriching the dialogue with customers, streamlining internal business processes and developing deeper relationships with key suppliers (Daniel & Wilson, 2003; Kaplan & Sawney, 2000).

The remainder of this section will summarise issues and developments in two of the key elements of organisational communication which are the communication content and the communication channel. Then the chapter will analyse the developments in IRT and the role it is playing as a communication channel in organisational communication and key operations.

2.2.1 CONTENT OF COMMUNICATION

The content of communication is a term that characterises the configuration and style of the information that is communicated (Te'eni, 2001). There are numerous attributes of content that need to be given due consideration. Firstly, thought must be given to the types of cues and media types that should be included in the message. These could be text (e.g. spoken or written words), numbers, verbal cues (e.g. tone of voice, variously positioned pauses), non-verbal cues (e.g. glances, expressions, gestures, postures, positionings) (Daft & Lengel, 1986; Zack, 1993) or other media types such as audio, touch, images or videos. Multimedia has enabled the integration of text, numbers, audio, image, and video in digital formats (Kampas, 2000).

Secondly, message size corresponds to the number of words or sentences that the message contains (Daft & Lengel, 1986). Developments in technology have obviously dramatically advanced the amount of information that can be digitally transmitted between people and the message size is now being considered in terms of megabytes and gigabytes. The transmission of digital real time video is now a viable option although there are still some limitations in resolution etc. Despite this, careful consideration should still be given to how much information is actually put into a

message to ensure that the key message is clear and understood. Sometimes too much information dilutes the main message.

A further attribute is the degree of message organisation which is the extent to which the message is systematically ordered to support mutual understanding (Te'eni, 2001). A highly organised message may be characterised with clearly distinguishable elements and/or clearly allocated tasks between sender and receivers. Familiar or standard languages and formats will make the organisation of a message easier to understand and will require less effort (Mulgan, 1991).

Finally the message can have different degrees of formality which is denoted by the interactive closure towards some organisationally accepted representation of action (Te'eni, 2001). Tied to these last two points is the genre of a message. Genre is a literacy and rhetorical concept that characterises communication by structural, linguistic and substantive conventions (Yates & Orlikowski, 1992). A genre has an identifiable format and established practice. Examples of genre are business letters, reports, memos or informal personal notes.

2.2.2 CHANNEL OF COMMUNICATION

A further key element of the communication process is the communication channel. Communication channels enable messages to be transmitted between two or more people. It is important that communication channels are appropriate for the nature and content of communication. Organisations in today's environment have a diverse range of channels available.

The human race has innovated, applied and adapted different technologies for communicating and disseminating information throughout the ages. The history of communication channels can be traced back to early forms of written language and the clay tablet of Mesopotamia (Innis, 1950; Kampas, 2000). At that time, there were many economic considerations facing empires and effective government of large areas depended to a large extent on the efficiency of communication. Therefore, communication channels and media had to be carefully selected and investments

cautiously made. A main issue concerning the effectiveness of communication centred on the media's suitability to disseminate information over distance and time (Innis, 1951). Durable media such as clay was appropriate for disseminating information over time but was impractical for travelling distances due to its weight. Lighter media tended to be less robust but more easily transported. Consequently, empires had to consider these factors when they invested in communication channels.

In the Egyptian and Graeco-Roman world, papyrus was introduced. In contrast to clay tablets, it was light although fragile and was only produced in restricted areas. Parchment was later developed and was both durable and more widely available. Paper was the next main media to impact the West and this was introduced from China. This facilitated the growth of credit through using documents for insurance and bills of exchange. In the days before widespread literacy, the stained-glass windows, altarpieces and sculptures of a Gothic cathedral constituted an enormously capital-intensive medium for communicating information. Information did not come to people; people had to go to the information. The development of machinery to manufacture and print paper, enabled mass production, leading to improved speed and reduced costs. When technology advanced in the form of printing, books, newspapers and magazines could communicate much the same narrative through a far less capital -intensive means.

The nineteenth century saw inventions such as the electronic telegraph, fax machine and telephone. As less physically intensive media became more widespread, the dissemination of information became less tied to economics. Television broadcasting was developed in the 20th century, permitting relatively cheap, widespread but unidirectional communication, as were transistors which enabled the miniaturisation of electronic devices.

Rapid developments in communication channels have occurred over the last 50 years. This has been mainly attributed to the convergence of information systems and telecommunications. Although the commercialisation of computers began in the 1950s, computers only really became significant in the mid to late 60s with the development of the mainframe computer and were largely used for batch processing (Butler et al, 1997; Somogyi & Galliers, 2003). During the 70s, minicomputers of

increasing power and sophistication took the centre stage and were used for a variety of business applications that were not feasible, nor economic in a mainframe environment (Ward & Peppard, 2002). The early 80s dawned the personal computer along with a variety of hardware and software and end user computing escalated (Ward & Peppard, 2002). Personal computers have steadily improved in processing speeds, memory and storage capacity.

Developments in telecommunications have also taken place in parallel. It was only after telecommunications undertook radical change in the 70s that organisations began using public and private wide area networks (WANs) to communicate between computers. They were mainly used for specialist functions such air travel reservation and banking (Bocij et al, 2003). After the introduction of the PC in the 80s, organisations realised the benefits of using PC Local Area Networks (LANs) for sharing files and printing and these were superseded by PC WANs. By the 1990s, LANs connected to WANs had led to connectivity levels similar to the world-wide telephone system. Furthermore, organisations realised the benefits of using the Client Server architecture over LANs and WANs. In the mid 1990s, Internet-based networks started to be used as the basis for business applications. Information could flow between head offices, regional offices, departments, work groups, customers and suppliers and individuals all around the world. The main reason originally for the upsurge in the usage of Internet technology was to increase access to information assets and publish information cost-effectively. However, the effects of this communication technology are looking to be much more profound. Networking allows people to communicate with each other via e-mail, to share plans, and blueprints over group software, and to work collaboratively across the globe (Butler et al, 1997).

2.3 INTERNET-RELATED TECHNOLOGIES

A key challenge for any organisation is making sure that the necessary links are in place to facilitate effective and efficient communication. Information needs to be communicated in a timely fashion and relationships allowed to foster. As a channel of communication, the Internet opens up a range of potential opportunities. This research

aims to analyse the opportunities and developments that have arisen and those that may be embraced in the future. In order to undertake this analysis, it is important to understand the scope, the pros and cons and any issues surrounding the technology. This will involve investigating the Internet, the World Wide Web, the deployment of the technology for building intranets and extranets, comparing the different methods of accessing the Internet and the implications this has and also by discussing the different tools and technologies that can be supported by the Internet. Finally, this section will clearly define the scope of the term Internet-related technologies which will be referred to throughout the remainder of the thesis.

2.3.1 INTERNET & WWW

The Internet represents one of the most successful examples of the benefits of sustained investment and commitment to research and development of information infrastructure (Leiner, 2003). The origins of the Internet can be traced back to a US military project commissioned by the US Department of Defence in 1969 (Leiner, 2003; Whitely, 2000; Bocij et al, 2003; Kalakota & Whinston, 1997). The project was called ARPANET (Advanced Research Projects Agency Network) and was established to develop a national communication system for the USA military that would maintain communications integrity in the event of national emergency.

In the 70s a key protocol was invented: Transmission Control Protocol/InternetProtocol (TCP/IP). This determined how electronic messages were packaged, addressed and sent over the network and also enabled various networks to link to the ARPANET, which soon came to be called the Internet. During the 80s the Internet was pursued primarily for technical, academic and scientific research. In 1985, the National Science Foundation began a program to establish Internet access across the US and created a backbone called NSFNET. Further developments led to commercialisation of the Internet in the early 90s (Li, 2003). By the 1990s, the Internet experienced explosive growth and by mid-1994, the Internet had connected an estimated two million computers in more than 100 countries (internet.com).

Essentially the Internet is a network of networks "made up of many separate but interconnected networks belonging to commercial, educational and government organisations, and Internet Service Providers" (Begg & Connolly, 2002; Kalakota & Whinston, 1997). The Internet reaches people worldwide, it is cost effective to access, it supports different operating systems and networks which reduces the investment required by organisations and its client/server configuration enables information, file, database, application and printer resources to be shared. The Internet is all at once a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location (Leiner, 2003).

Ever since commercialisation of the Internet in 1991, the growth in traffic and subscribers has been phenomenal. Businesses initially appreciated the potential of the Internet for transacting with customers through e-commerce especially in the fields of retailing, publishing and entertainment. A more recent drive has been in e-business. Early adopters of e-business applications typically focused on self service applications and internal processes and on improved cost reductions and administrative efficiencies (Ash & Burn, 2003). More mature users are now widening efforts to higher level operational and strategic processes. The focus has shifted to gaining strategic advantage through an evolutionary model of organisational change (Farhoomand & Wigand, 2003). Moreover, organisations are now recognising the benefits that can be sought through deploying the technology in business to business communication and have begun concentrating their efforts on integrating inter-organisational supply chain processes with external business partners (Ash & Burn, 2003). Organisations are realising that e-business may be able to assist in greater levels of integration and information sharing and help develop deeper relationships with key customers and suppliers (Kaplan & Sawhney, 2000).

One of the main drivers that have led to such an uptake in commercial and business usage of the Internet is the World Wide Web (www), A global information sharing architecture that provides a 'point and click' means of exploring the immense volume of pages of information residing on other computers on different networks connected to the Internet (Berners-Lee et al, 2000). The Internet was totally transformed by the www and was the main thrust behind its commercial success.

The interface of the www is very user friendly with a simple graphical interface that is easy to navigate and use and content on web sites and pages can be easily developed and enhanced (Stefansson, 2002). Therefore, employees can easily learn how to use the web and access information with little or no formal training. The www can also be enhanced by programming languages such as Java, to provide more advanced publishing, multimedia and interactivity. Rather than web pages simply being static pages, they can be developed to include more sophisticated interaction and to make the contents of web pages more dynamic. Facilities such as scrolling messages and data input forms can be added into web pages and web pages can be programmed to respond to user's requests and provide interaction.

There are a number of limitations with the Internet and the www that organisations need to appreciate as well. Lack of bandwidth has been a problem in the past and can still be a problem. It takes a lot of transmission capacity, or bandwidth to transmit graphics, audio and videos. Consequently the speed, reliability and the quality of the Internet and the www are far from satisfactory for many users. The problem is exacerbated by the increasing number of users of the internet.

Also, the www does not support senses such as touch, taste and smell. For example, it is not possible to examine, touch or test physical products or get hands on help in using or repairing them (Porter, 2001). However, there are developments underway in the area of virtual reality and augmented reality which are aimed at advancing online multi-sensory engagement. These technologies are being advanced to enable a fuller engagement with physical products and a more rewarding social interaction between people (Luciano, Banerjee & Mehrotra, 2001).

The Internet and the www additionally raise issues regarding identity and trust (Dalton, 2003). An identity of a person is built up of many characteristics such as appearance, voice, scent, personality, position in organisation etc. A person's identity may be threatened if organisations shift to using electronic channels of communication as primary means of communication. Many characteristics of a person's identity are hidden through communicating through Internet-related technologies. An employee could be in e-mail contact with another employee and be

unaware of many aspects of the other employee's identity. A person's identity is also more open to fraud over the Internet whereby one person uses another person's identity to undertake transactions (Groves, 2002). Organisations need to protect against identity theft or fraud. Identifier authentification technologies such as face to face recognition, retina scans, fingerprint authentification, voice/speech verification and hand-writing analysis are being implemented to protect employees and customers (Groves, 2002).

2.3.2 INTRANETS & EXTRANETS

At the commencement of this research, much of the current literature had focused on the Internet, its commercialisation and the increase in e-commerce. Bernard (1998) argued that the business model represented by the www use at that time was lopsided. WWW models had focused mainly on customers and had tended to ignore the other people involved in making organisations successful – employees and business partners. This is where intranets and extranets have a part to play.

Increasingly, organisations are using Internet-based technologies on their internal networks to build corporate communication networks called intranets. An intranet is a private communication system that exists solely within the network boundaries of an organization (Bernard, 1998; Chaffey, 2002; Curry & Stancich, 2000; Turban et al, 2000). Only authorised employees are able to access it and it is often for communicating sensitive proprietary information.

An intranet normally has a central home page with menus and links for users to easily browse through functional, departmental, team and individual web pages. Organisations began by introducing intranets to distribute general company information and departmental web pages. They were then developed to carry out internal functions such as human resources, financial analysis, and sales force automation (Kraemer & Dedrick, 2002). Internal automation has provided many benefits such as reportedly cutting administration time for human resource departments by 50% (Thomas, 2003). Attention is increasingly being focused on the potential value of intranets in large organisations in terms of rapid transmission of up-

to-date information, improved communication flows, knowledge enhancement, sharing of best practice in context and encouragement of innovation (Curry & Stancich, 2000). In many cases, intranets have been developed to support and transform operational and strategic supply chain processes and advanced to include linkages between different organisational systems.

More recently, organisations are extending the communication on the Intranet to external bodies such as suppliers, customers or business partners. In doing this, they are extending their intranet to an extranet. "Extranets provide secured connectivity between corporation's intranets and the intranets of its business partners, materials, suppliers, financial services, government, and customers" (Turban et al, 2000, pp243). Organisations are realising the benefits of using extranets to enable other organisations controlled access to company information, documents and for using it to build collaborations across organisational boundaries.

In conjunction intranets and extranets are being developed for e-business purposes and in particular to support SCM operations and intra-organisational and inter-organisational supply chain processes. Intranets and extranets are being used in managing major components of supply chains such as transportation, purchasing, inventory management, customer service, production scheduling, warehousing and vendor relations (Lancioni, Smith & Olivia, 2000).

Like the Internet and www, there are a number of issues regarding intranets and extranets as well. The first main set of issues is information-related and these are of great concern to organisations. Any information on the intranet or extranet must be maintained and kept up-to-date as organisational systems are only as good as their content (Mansell-Lewis, 1997). A close eye must also be kept on the volume and relevance of the information published as information overload can also be a problem (Curry & Stancich, 2000). A further obstacle with intranets and extranets is the variation in the quality of the information that is available and the fact that many documents are not stored with meta-information such as the author, the time of creation, expiration date etc. Without this information, decision-makers will have doubts and concerns about the quality and accuracy of information that is being used and will lack confidence in using it to tackle problems and decisions. One method of

minimising the problem would be to have corporate policies and procedures in place that enforce appropriate tagging of documents and ensure certain standards are adhered to. Finally, many employers wrongly assume that by putting information on the intranet, employees have read and understood the information. Unfortunately this is rarely the case and Diffley (2003) recommends that organisations need to use the intranet more creatively by making the most out of interactive technologies such as chat rooms and videoconferencing etc. to check for understanding and of course organisations should not forget the power of talking face-to-face.

Security is still a major issue for communicating and transacting over intranets and extranets as well. As organisations increasingly use the Internet and other related technologies for their day-to-day operations, they are exposing revenue, profit, brand, assets, reputation and processes to potentially damaging electronically assisted crime. Firewalls are a security measure set up to prevent unauthorised external access which are configured to only permit authorised user's access and grant different degrees of controlled access to applications, information and resources. Although almost every site offers firewalls and encryption, there are still doubts over the robustness and level of security that they offer. Therefore, the development of robust and secure electronic security platforms will take centre stage as more and more goods and services of substantial amounts are being transacted.

A final issue surrounding intranets and extranets that will be raised just now is regarding the scalability of these organisational systems. If organisations are going to implement these types of networks using Internet technology then they need to be confident that their organisational systems are scalable. While the Internet may run smoothly using the current level of users, organisations need to be prepared for what may happen if too many users connect to the Internet. They need to consider if the channel of communication will be able to cope with more users and still provide an acceptable level of service in terms of speed and capacity etc.

Finally, although clear distinctions have been made in this section between intranets and extranets, it should be noted that the term 'intranet' is often used loosely to refer to an extranet (Bocij et al, 2003). This was the case, in fact, in most of the interviews

conducted with representatives from different organisations and are described in Chapter 4.

2.3.3 INTERNET ACCESS

There are different ways of accessing the Internet and www for large, medium and small-sized organisations, people working off-site and residential users. The different methods vary in their bandwidth, transmission rate, reliability, level of security and amount of flexibility. For example, the bandwidth will affect how quickly and effectively organisations can communicate using the Internet and also the quantity and complexity of the information that can be communicated. The flexibility will affect employee's ability to communicate from different locations and the timing of the communication. Theses various issues are discussed under the following headings: wired networks, wireless networks and mobile devices.

Wired Networks:

The Internet backbone is a high speed communication link that enables Internet communication internationally and nationally (Bocij, 2003). Larger Internet service Providers (ISPs) are connected to the major international and national backbones which are in turn connected to smaller ISPs. Many large organisations are the ISP. The different sites of large organisations would be connected through routers and wide area connections, forming a WAN, and individual sites would be wired up using LANs. Client PCs within medium and smaller business and homes are connected to the Internet via local ISPs. Modems are the traditional way for connecting their computers to WANs. They are often characterised as having narrow bandwidth and slow transmission rates.

In 1999, the Economist magazine (January, 23rd 1999, p73) noted that broadband technologies were considered the future of the Internet. Broadband is a high-speed connection that offers quicker access, faster transmission rates and support complex multimedia applications and databases that earlier connections struggled to handle efficiently and effectively (BT Broadband). The development of broadband

technologies will offer the opportunity for even more applications of the Internet to emerge.

There are numerous broadband options available to larger organisations. The most common type of broadband connection for large and medium sized businesses is T-carrier lines (Copeland, 2000). T-carrier lines offer superior speeds for broad connectivity. Unfortunately, smaller businesses would probably find this method of connection too expensive.

Numerous broadband technologies have been developed for smaller sized business and home users as well. These broadband technologies come in many different forms and it is still a little unclear which technology will dominate the marketplace. These include Integrated Services Digital Network (ISDN), Asymmetric Digital Subscriber Lines (ADSL) and cable. Cable has also been recently made available in the UK connecting to the Internet over one channel of a cable television system. Overall, ADSL and cable modems can deliver speeds many times those of conventional modems or ISDN links. They also provide a full time connection which means time is not wasted dialling up. ADSL is more expensive though than cable and less widely available. The infrastructure of broadband is developing rapidly but quite differently in the United States in comparison to Europe. In the US, cable has a clear advantage with 70% of residential users already subscribing to cable. In Europe, though, it varies considerably from one country to another. A technology that predominates in one country may hardly even exist in another (Beardsley, Raghunath & Wilshire, 2000).

Finally, fibre optic cabling is also being invested in. Although it has been implemented in many main cities a lot of investment is required in the infrastructure to reach company premises and it is seen as a longer term solution (Minoli, 1997).

Wireless Networks:

Wireless networks have emerged more recently as a method of connecting to the Internet and are maturing very quickly. They are a very flexible means of accessing the Internet as they require no physical wired connections. A non-exhaustive list of different types of wireless technology consists of wireless WANs, wireless LANs,

wireless Personal Area Networks (PANs) (InterForum, 2002) and Satellite and Paging networks.

Global System for Mobile Communications (GSM), Global Packet Radio Service (GPRS) and Universal Mobile Telecommunications Systems (UMTS) (2G, 2.5G and 3G respectively) are all Wireless WANs. They allow people to access the Internet wherever they are, whenever they need (InterForum, 2002). GSM is the de facto standard for the digital mobile telephone system in Europe. It has a low bandwidth and is slower than standard modems. GPRS is much quicker than GSM and supports Short Messaging Service (SMS). UMTS offers high speed broadband Internet access and the transmission of text, digitised voice, video and multimedia. Although, UMTS is likely to become more widespread in the next few years, it is still unclear how widely available it will be and at what cost.

WiFi is a wireless replacement and complementary technology for existing Local area Networks (InterForum, 2002). Electromagnetic waves transmit and receive data over the air, minimising the need for wired connections. It is being used in organisations to provide Internet and intranet access and in public places such as airports, hotels and conference centres. Bluetooth is a technology that is the de facto standard for enabling wireless PANs, It provides low-cost, short range wireless communication between devices in close proximity. For example a laptop could communicate with a printer using Bluetooth.

Other trends in wireless networks include satellite and paging networks. They have high levels of coverage but low bandwidth restrictions. In addition, they only allow one-way communication. There are numerous developments in wireless networks and further growth is anticipated. In 2002, there were around 200 million current users which was anticipated to grow to one billion subscribers (Malladi & Agrawal, 2002).

Mobile Devices:

Alongside the developments in wireless networks, there have been an increasing number of different mobile devices available. Mobile devices such as laptops have been around for accessing the Internet for a number of years. More recently though smaller devices such as personal digital assistants (PDAs) were introduced for

accessing the Internet via wireless connections. These are small portable handheld devices (often referred to as palm top computers) that provide computing and information storage and retrieval capabilities (Interforum, 2001). They are used for storage of phone numbers, diaries, notebook memos, and used for synchronisation between desktop applications (Chescher & Kaura, 1998). Furthermore, in 1999, a new wave of mobile phones was introduced called Wireless Application Protocol (WAP) phones. The WAP provides a platform for delivering and formatting information to suit the smaller screens of devices such as mobile phones. Other mobile devices are Smartphones which are more sophisticated mobile phones that have special computer-enabled features, such as in-built address books (Interforum, 2000).

In conjunction, wireless networks and mobile devices provide easy access to the Internet, www, corporate intranets and extranets and personal information such as e-mail and calendars etc. Mobile devices and wireless networks are becoming popular due to the flexibility and freedom they offer in terms of enabling employees to communicate from many more different places at convenient times. They are one of the factors that have lead to the emerging trend in mobile computing or nomadic computing (Varshney & Vetter, 2000; Chescher & Kaura, 1998).

On the downside, the channel capacity available in wireless systems is typically much lower than what is available in wired networks and noise and interference can have a greater impact (Varshney & Vetter, 2000). Furthermore, issues such as security are only exacerbated in wireless and mobile communications etc. However, developments in Internet access will continue to focus on improving bandwidth and strive to improve the flexibility, reliability and quality of Internet access.

2.3.4 OTHER TOOLS AND TECHNOLOGIES

There are many other tools and technologies that have been developed with Internet technology as the supporting platform to further enhance communication and the provision of information. These can be used in conjunction with intranets and extranets as well. Each of these tools and technologies has their own sets of pros and cons for organisational communication and many of these will be discussed.

Electronic Mail: The most prominent application is e-mail (Electronic Mail). Nowadays, even fairly basic e-mail applications have features for composing messages, forwarding messages, filing messages, creating mail groups and attaching files to messages. Full featured e-mail software like Microsoft Exchange and Netscape Messenger have additional features such as remote user access and message filtering can be used to categorise and prioritise e-mail.

However, there are problems with e-mail. One of the main problems is e-mail overload which subsequently causes logjams in corporate IT systems (Bentley, 2003). Potential solutions to this problem may be to invest in e-mail management and archiving systems or limit the size of storage allowed for employee's mailboxes. A further problem with e-mail is the disruption caused by e-mails constantly interrupting employees (Jackson, Dawson & Wilson, 2003). These interruptions can affect the work outcomes and emotions of employees and consequently organisational performance. A number of methods may be employed to try and reduce the effect of e-mail interruptions. These could include educating employees about the negative effects of interrupts on organisational performance, changing how often the software checks for incoming e-mail, changing the method of incoming e-mail notification etc. Overall, organisations need to look at e-mail best practice and how to use e-mail as an efficient business tool. Moreover, the ability to monitor e-mail provides organisations with the opportunity to look at ways to improve their communication practices (Jackson, Dawson & Wilson, 2003).

Search Engines, Portals & Software Agent Technology: There are also a number of regularly used tools for improving the efficiency of searching for information on the www. As there is such an abundance of information available on the web, it can be very difficult and time consuming to find relevant information. This often leads to abandoned search goals which can result in costly and inefficient practice for organisations. Firstly, search engines focus searches and filtering specific information thus saving employee time and limiting the amount of items returned for a particular search. Secondly, portals act as a gateway to information and services available on the Internet (Chaffey, 2002). The first page that users are presented with when they connect to the web aggregates the information and facilities that are available. It has

been likened to a 'one stop location', a 'means for focusing the activities of the user', a 'launchpad for users of the web' and compared to the front page of a newspaper or magazine (Lawrence et al, 2000). Netscape, Yahoo, Excite and MSN are current, typical examples of broadly targeted portals available to public users of the Internet. There are also many different industry specific portals and community specific portals. More recently, organisations are using portals to customise and distribute information to employees. An organisational portal may include search engines, categorisation of information, news sources, links to internal and external sites and the ability to personalise the page.

Software agent technology has also been developed as a more sophisticated solution to saving time when searching for information using internet technology. The user can delegate information retrieval and extraction tasks to software agents which can help manage information tasks and enable users to work on something else. Software agents learn the user's preferences from previous web history and by the user establishing certain categories of information before the agent does the search to ensure appropriate information is retrieved. Devlin, Scott and Mulvenna (1999) identified a number of characteristics that agents should have including being able to collaborate with the user, ask questions, and be flexible enough to adapt to the user's preferences and changes in the environment. In order for the technology to provide successful information retrievals it is essential that the agents understand the user's perspective and the types of information that they would find valuable (Trillo, 1997). Furthermore, although some people might value the same information they may value it when it is presented in a different format or level of summary or depth. In order to present the information in the right way a detailed understanding of the user or decision-maker will need to be attained.

In well-structured decision making scenarios such as day trading, travel booking or commodity shopping, agents generally act quicker and are more aware of changes and resource limitations than humans. However, the concept of an agent trying to grasp psychological patterns and social conventions usually associated with human information searching is still an open research issue (Maass & Muller, 2003). Clearly developments still need to be made in agents before they can wholly substitute human information searching.

Collaboration Tools: There are a variety of different types of tools and technologies that support intra-organisational and inter-organisational collaboration. GroupWare is software that encompasses many collaborative tools designed to facilitate the work of groups. For example, groupware products such as Lotus Notes, Groupwise and Netscape Communicator support communication and collaboration through a collection of software such as e-mail, bulletin boards, discussion groups, audio and video conferencing, group meetings, group calendaring and scheduling, document management and workflow etc. The different types of software can be used to communicate, cooperate, coordinate, solve problems, compete, or negotiate" (usability first, 2002).

Calendaring applications allow sharing of diaries, scheduling of activities and coordination among people. Typical features include detecting schedule conflict, finding meeting times that will suit a variety of people or locating people. Teleconferencing allows the transmission of audio data over a telephone or network connection while video conferencing allows two or more people to communication using live video. Often they are enhanced by using them in conjunction with shared whiteboard applications which allow two or more people from different locations to view and draw on a shared drawing surface as they are talking. They can indicate where each person is drawing or pointing, by showing telepointers, which are colour-coded or labelled to identify each person (usability first, 2002).

Multinational organisations such as GlaxoSmithKline use videoconferencing to make global organisational announcements. This allows employees from 57 sites across 31 countries to participate and interact. Gray (2003) argues that videoconferencing humanises an increasingly distributed workplace. However, it should be noted that the images of people in video conferencing may not be as clear as in face to face communication and cues such as body movements and facial expressions may be visually impaired. This is turn may still impact areas such as identity and trust.

Other collaborative tools include workflow management system. These are systems that allow documents to be routed through organisations via a relatively fixed process. The Workflow Management Coalition defined Workflow Management as:

> **"The automation of a business process, in whole or part during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules"**

Workflow management systems can provide facilities for developing forms, assigning tasks and privileges, routing forms and monitoring tasks. They are regularly used to support business processes e.g. submitting holiday requests, raising purchase orders, processing customer complaints etc.

Groupware applications are becoming progressively more diverse and at the same time other types of applications are being enhanced with Groupware facilities. Consequently, it is more and more difficult to categorise applications. Overall, though, collaborative technology enables groups to share ideas, have threaded discussions and develop documents through a series of interactions. However, although collaborative technology overcomes the technical issues regarding communication and collaboration between groups of people, for the technology to actually work, people need to collaborate. Top management support and training is vital for people to adapt to this different kind of working environment (Gunnlaugsdottir, 2003).

Database Management Systems, Data Mining & Data Warehousing: The www can also be used as a platform for providing users with an interface to database management systems (DBMS). The www can act as a front-end to hide the complexity and sophistication of the DBMS and the DBMS is likely to be linked to other organisational systems. Databases are necessary to store structured data types, increase the speed and flexibility of inquiries and to include complex data types. There are a number of DBMS integration products on the marketplace. However, often web-based database applications operate slower than traditional non-web-based database applications. There is still not the same level of experience and development tools and bandwidth will restrict the performance and speed of the database.

A number of changes in the business environment have also driven the uptake of data mining and data warehousing. With organisations operating in increasingly

competitive and global business environments, many markets are becoming saturated, customers can access more information and organisations are finding it more difficult to differentiate themselves. Therefore, organisations are seeking to extract new information using data mining and data warehousing.

The amount of information available to organisations has dramatically expanded due to the increased amount of automation. Information can be gathered on online through customer service complaints, surveys, customer e-mails, newsgroups, credit card transactions, discount coupons, visits to websites, and users' behaviour on the Internet etc. making it easier to build data warehouses. The data warehouses can then be analysed using data mining techniques that will explore, analysis, by automatic or semiautomatic means, large quantities of data in order to discover meaningful patterns and rules (Berry and Linoff, 1997). The new information can inform business decisions and be applied to gain business value. Organisations need to use appropriate technology such as data warehousing and data mining to stay ahead of their competitors (Alshawi, Saez-Pujol & Irani, 2003). Moreover, data warehousing and data mining is even more important in industries where supply chains are intellectually or information-based rather than physically-based e.g. R & D supply chains in the pharmaceutical industry (Crowley, 1997).

Enterprise Resource Planning & Supply Chain Management Systems: Enterprise Resource Planning (ERP) systems were first introduced in the 90s as a follow up to Materials Requirements Planning systems and Manufacturing Resource Planning systems. ERP systems are multi-application systems that integrate the various business operations of an organisation e.g. sales, finance, manufacturing, distribution etc. At the core of an ERP system is a DBMS that collects data from and resources data to the different modular components. ERP systems have been profoundly influenced and transformed by the Internet (Ash & Burn, 2003). As well as interfacing infrastructure linking an organisation's intranet to ERP systems, the Internet serves to extend the original value proposition of ERP, by breaking down institutional barriers and rendering cross-organisational boundaries almost obsolete (Ash & Burn, 2003). Organisation's suppliers and customers are being provided with controlled access to ERP systems.

Key advantages of ERP systems are their capacity to automate and integrate business processes, share a broader scope of real-time data, enabling better decisions, reduce duplication of data and enforce consistent practices across the entire enterprise (Heizer & Render, 2001; Waller, 2003; Wisner, Keong Leong & Tan, 2004). There are however various concerns regarding ERP systems including their compatibility with other existing systems, cost, installation time, the logic it enforces on organisational strategies and the generic processes that can be imposed (James & Wolf, 2000; Johnston, 2002; Waller, 2003).

Other organisations are opting for SCM software instead. This provides solutions to particular functional areas or problems and can be divided into horizontal and vertical categories (Kalakota & Whinston, 1997). Horizontal applications include financial, manufacturing, logistics, marketing and human resources etc. They have generic functionality and can be applied across all industries. In contrast vertical applications automate tasks that are specific to particular industries. Dominant players in the SCM software markets are SAP (www.sap.com), Oracle (www.oracle.com), Peoplesoft (www.peoplesoft.com) and Baan (www.baan.com).

Electronic Data Interchange & Electronic Funds Transfer: Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT) are two technologies that have been used extensively for inter-organisational transactions and have both been around since the 70s.

EDI, in particular, involves the electronic interchange of business documents from one computer to another in a standard format between trading partners (Kaefer & Bendoly, 2000; Stefansson, 2002) and overcomes the problems associated with manual flows such as high process time, low data accuracy, high labour requirements and increased uncertainty due to mailing and processing delays. It is being used in a range of industries such as automobiles, consumer goods, transport, chemicals, electronics, health, construction and tourism (Morris, Tasliyan & Wood, 2003). Common documents that are transmitted via EDI include purchase orders, request for quotation, invoice, bill of lading etc (Emmelhainz,1990).

Traditionally, technologies such as EDI and EFT were used on secure private networks such as Value Added Networks (VANs). Larger organisations have been using EDI technology to communicate business data but they often experience problems in communicating with smaller organisations. This is because the smaller organisations do not have the resources or technology to implement EDI and consequently they risk being excluded from the supply chain (Stefansson, 2002). Often, as well, it is the organisations in the strongest position in the supply chain that provide the driving force in the implementation of EDI. Generally, EDIs are seen to increase organisation's control over suppliers, binding them together through regularised forms of information exchange (Morris, Tasliyan & Wood, 2003).

More recently, organisations have started to use the Internet as a channel for EDI and EFT as it can be implemented at lower costs. The Internet does open up new perspectives for small and medium sized organisations by making electronic business more affordable (Kaefer & Bednoly, 2000). The Internet also supports and enhances EDI in a number of additional ways including the ability to send e-mails with EDI, by enabling the direct input of information from Internet pages for EDI information exchange and by being able to map the contents of an EDI message to a text file or an Internet site for use by non-EDI-established partners and vice versa (Stefansson, 2002). The latter option could be particularly useful for smaller and medium-sized organisations in the supply chain.

However, the widespread use of EDI can mean that inter-organisational linkages become restricted to technical information and inter-organisational relationships may become depersonalised (Morris, Tasliyan & Wood, 2003). Consequently, Noyce (2002) argues that the use of EDI needs to be supplemented by additional 'humanising' forms of contact if relationships are to be maintained in their existing forms. EDI may also lead to a shift in labour intensive inter-organisational business transactions to capital intensive processes which in the long term may ultimately erode the position of less skilled workers and facilitate downsizing (Morris, Tasliyan & Wood, 2003).

2.3.5 SUMMARY OF INTERNET-RELATED TECHNOLOGIES

In conclusion, there is obviously a wide array of tools and technologies available that can be used with Internet technology as a supporting platform. The growth in the different types of tools and technologies has been rapid over the last decade and the collection discussed is by no means exhaustive. Many other tools have been developed such bulletin boards, discussion groups, decision support systems, expert systems etc. Collectively, these types of technologies have continued to impact the success of E-Commerce and E-Business (Van der Aalst, 2002). If organisations are planning on using Internet technology as a key communication tool, they need to fully understand the pros and cons of each of these different types of technologies as well.

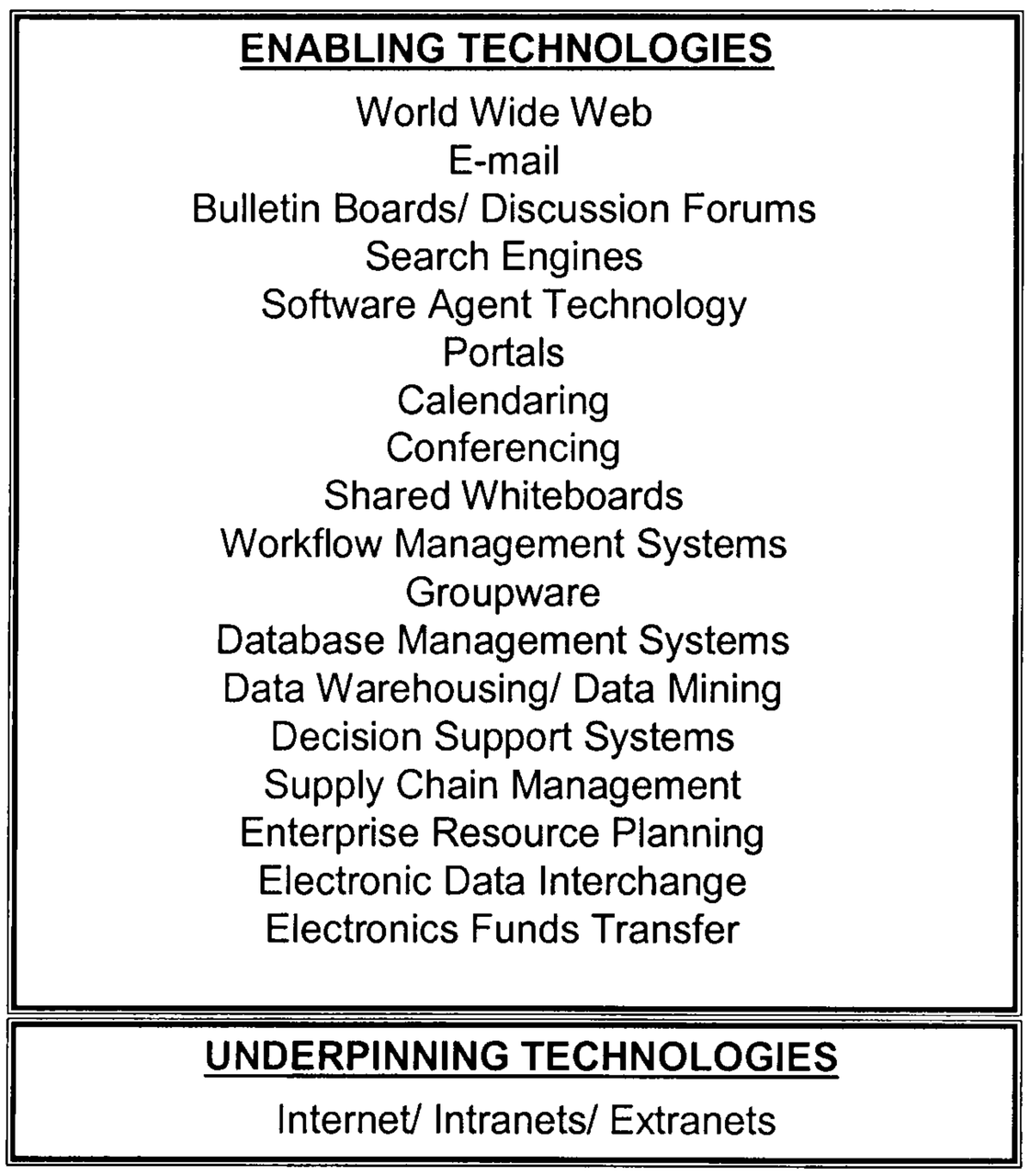


Figure 2.1: Internet-related Technologies

The different technologies discussed throughout section 2.3 will be collectively referred to as Internet-related technologies (IRT). The underpinning technologies include the internet, www, intranet and extranets and these support a broad range of tools and technologies that can be classified as 'enabling technologies'. These are all illustrated on Figure 2.1.

2.4 ASSESSING ORGANISATONAL COMMUNICATION CHANNELS

As discussed, there are a variety of organisational communication channels available nowadays. In particular, there are a diverse spectrum of IRT. However, the effectiveness and the features and facilities provided by these different communication channels can vary considerably. Organisations and employees need to strategically select appropriate communication channels for particular tasks and situations so that the communication is as effective as possible and is more likely to enhance organisational performance. In order to do this, a clearer understanding of the benefits and limitations of different types of communication channels is necessary and an appreciation of the various dimensions that may impact the appropriateness of particular communication channels is required.

2.4.1 DIMENSIONS FOR ASSESSING CHANNELS

A number of important dimensions that communication channels are generally compared on have already been mentioned in previous sections such as cost, availability, accessibility, reach, limits on message length and so on. In the early 80s and 90s, the most common aspects that communication channels have been compared and contrasted on are dimensions such as the level of interactivity or immediacy of feedback, the number of information cues they can communicate, their ability to adapt and their perceived formality. The section will be mainly devoted to these dimensions. It will finish with a summary of some other dimensions that Webster (1998) highlighted and that should be taken into consideration as well.

Level of Interactivity: The level of interactivity or the immediacy of feedback can be defined as the "the extent to which a medium enables users to give rapid feedback on the communications they receive" (Daft & Lengel, 1986). For communication to be successful, the sender and receiver must mutually agree that the receiver has understood the message (Dennis & Kinney, 1998). There are two fundamental types of feedback: sequential and simultaneous (Li, 1997). The difference between the two revolves around the response time. In sequential communication, a message is created and sent to a receiver in one time period and the receiver interprets and responds to the message in another time period. In simultaneous communication the message is communicated and interpreted by the receiver and feedback is communicated back to

the sender in one time period. The different types of enabling technology may be categorised depending on whether they enable sequential and/or simultaneous communication. Technology allowing sequential communication is often referred to as synchronous technology. This could include e-mail, newsgroups, bulletin boards, calendars etc. Technology enabling simultaneous communication is asynchronous technology and can embrace teleconferencing, videoconferencing, shared whiteboard etc.

Feedback is important for a number of significant reasons. Most importantly, it improves the effectiveness of communication because it enables the sender to recognise the extent to which the receiver understands the message and allows them to adjust the message presentation accordingly (Dennis & Kinney, 1998). Moreover, there is evidence to suggest that immediate feedback is advantageous as it minimises the time required to achieve understanding, reduces the number of words that are necessary to communicate messages and improves the accuracy of communication (Dennis and Kinney, 1998). High interactivity implies that the sender controls the pace of the communication while low interactivity places the control with the receiver (Te'eni, 2001). For example e-mails allow receivers of e-mail communication to control the pace that they receive the communication and the timing of their response (Rice & Gattiker, 2001). Interactivity can also be a liability. Interactivity is spontaneous and unpredictable and can lead to interruptions such as general 'chit chat' (Te'eni, 2001).

Number of Information Cues: Multiplicity of information cues refers to the number of ways in which information can be communicated, such as text, numbers, verbal cues or nonverbal cues (Daft & Lengel, 1986; Zack, 1993). Dennis & Kinney (1998) highlighted several reasons for using multiple cues to enhance communication and understanding of messages. Amongst these is the ability of verbal and non-verbal cues to add information beyond the words themselves when a message is transmitted. For example, verbal and non-verbal cues are often used to emphasise important points, to show doubt or uncertainty, to display acceptance, invoke dominance etc.

Also on a positive note, multiple cues can minimise the time required to achieve understanding. Empirical studies have routinely found the increase in information cues, to decrease the length of time required to make decisions. Although contradictory research has shown no clear evidence of less cues increasing decision time and diminishing decision quality (Dennis & Kinney, 1998). Therefore, the effects of cues on task performance are still a little unclear.

The removal of verbal and nonverbal cues can have negative implications. The lack of social presence can lead to 'depersonalisation'. Consequently, people can become more self-centred and antisocial, making decisions based on facts rather than personalities and this can have a major impact on the level of social facilitation (Dennis & Kinney, 1998).

Level of Adaptiveness: A further dimension that is commonly used to evaluate communication channels is its level of personalisation or adaptiveness. This refers to the channels ability to personalise a message or adapt a message to a particular receiver (Daft & Lengel, 1986). Bulletin boards can be ineffective in supporting personalisation while e-mail has greater potential for enabling personalisation by allowing senders to insert a name or names and face to face communication has the highest potential for personalisation.

Level of Formalisation: Finally, channels of communication have been characterised as being formal or informal (Ahuja & Carley, 1998; Daniels et al, 1997). Formal communication channels are less interactive and impersonal and have been likened to media such as reports and structured meetings. Informal communication channels are more personal, peer-oriented and interactive. They have been associated with face to face communication in relaxed settings such as coffee lounges and often coupled with 'grapevine communication'. Although certain communication channels may be more suited to different levels of formality, the perceived level of formality may vary for different organisations (Te'eni, 2001). For example, a statement such as "face to face communication is used to convey informality" may not be true in an organisation that uses e-mail as its standard means of communication. On the contrary, face to face communication may symbolise a very formal event. All of these complex and diverse

issues must be taken into account when determining the most appropriate means for effective communication.

To complete this section, some further dimensions that influence media choice will be summarised. These include how many recipients are also using the medium routinely i.e. critical mass, the scope of the information flows enabled by the channel i.e. one-to-one, one-to-few, one-to-many, few-to-few or many-to-many, the physical distance between the communication partners and the compatibility of the task to the technology. If the communication partners are not co-located, then electronic mail may provide faster feedback than attempting to schedule a face to face meeting. It can even just be simple things like the use of computer-mediated communication such as e-mail takes longer to transmit than face to face interaction as it normally takes longer to type it than to speak. In this way, it can be regarded as a 'delay cost' or a 'production cost' (Dennis & Kinney, 1998). Also privacy concerns will potentially influence their channel choice (e.g. perceived possibility of being viewed or monitored).In conclusion, there are a vast amount of factors that will influence the choice of communication channels and it is likely to vary depending on the situation.

2.4.2 MEDIA RICHNESS THEORY

A comprehensive mixture of theories has been developed to explain the effects of communication media (Fulk and Boyd, 1991; Webster, 1998). Attention will be given to one particularly widely known and tested theory: media richness theory (Daft & Lengel, 1984; Daft & Lengel, 1986). Originally media richness theory was a theory of media use and argued under what conditions media would be most effective (i.e. how managers should use media). However, the first empirical test of media richness theory (Daft et al, 1987) studied media choice not media use and virtually all subsequent studies have followed suit and examined the conditions influencing media choice rather than the actual performance effects of media use (Dennis & Kinney, 1998, p258).

In the traditional perspective of media richness theory (MRT), communication media vary in their capacity to process rich information (Daft & Lengel, 1984; Daft & Lengel, 1986). Media richness refers to the ability of different media to convey

messages that communicate rich information. Media are assessed on a continuum that goes from leaner media through to richer media. They are measured on their capacity for permitting instant feedback, the number of cues and channels they use, personalisation and language variety e.g. text or numbers. Face to face communication is seen as the richest medium as multiple cues are provided through body language and tone of voice and the message content is expressed in natural body language. Media that are regarded as low in richness have fewer cues and feedback is restricted. The assumption is that e-mail is low in media richness.

MRT also proposed that rich media were useful for facilitating equivocal issues while media of low richness were more appropriate for issues with low equivocality (Daft & Lengel, 1986). Equivocality refers to the level of uncertainty or ambiguity. When messages are more complex, there is more ambiguity in the situation, a greater potential for misinterpretation or more differences in the recipient's frames of reference, a richer medium is recommended. Richer media, the theory claimed, enables users to communicate more quickly and to better understand ambiguous or equivocal messages and, therefore, lead to better performance. In contrast, leaner media are better for tasks with low equivocality because too much rich media provides communicators with too much information (Dennis & Kinney, 1998).

2.4.3 CONTRADICTORY EVIDENCE

Recent research has shown that MRT cannot fully explain empirical findings regarding the use of communication technology and due to a number of conceptual and empirical weaknesses in MRT many recent studies have in fact contradicted the theory (Yates & Orlikowoski; 1992, Lee, 1994a). Subsequently, researcher's opinions seem to be shifting away from MRT in the direction of social definition theories (Ngwenyama & Lee, 1997). Some of the contradictory findings of IS researchers will be highlighted.

MRT suggests that e-mail is a very lean communication media. However, Lee (1994) provides an account of how richness occurs in communication that uses electronic mail. Central to his findings is the concept that richness is not an inherent property of electronic mail but an emergent property of the interaction between the

communication medium and its organisational context. The appropriate medium for conducting a task depends on more than just the medium. The best medium will be influenced by the organisational context and will emerge over time. A medium could readily support rich communication in one organisational context but only support lean communication in another. The most appropriate media in a particular organisation also depends on people's familiarity and existing skills with media, their willingness and opportunity to use it, the support provided and the how interactively they explore innovative uses for it.

Markus (1994) found that managers perceived various media in ways that were relatively consistent with MRT, but that they used e-mail more and also differently than the theory predicted. In particular, effective senior managers were found to use e-mail heavily and this included using it for equivocal tasks. The results suggested to her that the adoption, use and consequences of media in organisations can be powerfully shaped by social processes such as sponsorship by key members of the organisation, socialisation and social perceptions (Markus, 1994, pp523). Future empirical research, she suggests, should focus more on the collective use of communication media and the social construction of perceptions of media characteristics rather than the individual use and perception.

Other studies have concurred that communication is more a function of the context, setting and timing rather than the characteristics of the media. Zack & McKenny (1995) discovered groups use communication technology in a way that was consistent with existing social norms and structure in the functional unit. Palmer & Speier (1998) found that social structure and social context influenced the adoption and adaptation of communication media and its effectiveness. Yates & Orlikowski (1992) also propose that media choice will come from the social context.

Culture also impacts the use and effectiveness of different communication channels. It will influence the way that people perceive things i.e. the internal process by which they select, evaluate and organise stimuli from the external environment and the way that they respond to stimuli (Samover & Porter, 1988, pp24.). It will impact verbal communication in terms of the language that is used. Non-verbal communications will be influenced in terms of things like touch. For example, in Thailand people do not

touch in public whereas in German men and woman shake hands at the start of any social encounter. People from different cultures can also use space differently within interpersonal communication i.e. the distance that they leave between people or the physical orientation of the people when they engage in conversation.

Tricker (1999) undertook a study into the effect of culture on organisational communication in an IT context. The finding highlighted that individual, organisational and national culture affects organisational communication. (Tricker, 1999). Firstly, people have developed their own individual cultural that has inevitably been affected by family, education, business experience etc. This will influence their perceptions and interpretations of organisational information and the resultant outcome. Secondly, culture will have developed at an organisational and group level and will impact the business strategy, structure, assumptions about the way business is done, information processes etc. which will affect the expectations, behaviours, and decisions of the individuals. Lastly, Tricker highlighted the impact of cultural differences at a state level, in terms of political, social and economic aspects, which again influences organisations and in turn individuals. Furthermore, the various studies demonstrated that culture influences the use of information (and consequently the development of information systems and the successful application of IT) at the levels of the individual, the organisations and the state. It will affect what information people will value and how they interpret information that is communicated.

As organisations increasingly globalise their operations, the issue of culture will become even more prominent. Inter-cultural communication is more likely, involving communication from a member of one culture with a member of another culture. The different cultures of communicating partners may limit the use of communication technologies. For example, audioconferencing may not always be an appropriate medium when communication involves people from different cultures. Researchers speculate that in multi-cultural communication contexts, ambiguity and misinterpretation may result from taking a message out of a visual communication channel (Wiseman & Shuter, 1994). While, other research indicates that videoconferencing is particularly useful when high levels of interactivity are required but human proximity may be irreplaceable in multi-cultural contexts (Wiseman & Shuter, 1994).

Yates and Orliwoski (1992) also target the failure of MRT due to its disregard for any notion of communication genre. The concept of genre has many implications as it can influence a wide range of organisational phenomena e.g. power, impressions. Their research recommended that genre should be taken into account as it will also influence the media that will be chosen for communicating. Certain genre will be associated with particular medium e.g. a memo could be e-mailed or sent through the post.

El-Shinnawy & Markus (1997) explored how people in organisations choose among new media such as e-mail and voice mail. Again, the researchers deemed MRT too restrictive to explain the richness of people's media use behaviour. They offer a number of alternative explanations for people's choice of media. Firstly, MRT assumes that all 4 elements are of equal importance in the richness construct. In fact, people may rank or weight these differently. A further important explanation was the selection and use of media may depend on other media features such as filing and retrieval capabilities. For example, e-mail has a number of documentation storage, search and retrieval capabilities. Finally, users may choose media for reasons that are unrelated to their ability to handle message equivocality. For example, it may be on the basis of their communication role, personal reasons, task-related, or for social or organisational factors such as travel demands, social pressure from colleagues or do with the number of people that can access the technology or have the skills to use it.

Dennis & Kinney (1998) found no results at all to support the central proposition of MRT. While subjects were able to recognise differences in media richness, the media itself appeared to have no significant effect on decision quality, consensus and communication satisfaction. The only aspect of performance that media richness impacted was time. Richer media supported quicker decisions. They suggest that MRT may be a useful theory for 'old' media such as letters or memo, whose levels of feedback and cues are far below those of 'new media'. The new lean media may be just rich enough to enable users to successfully communicate for moderately equivocal tasks.

Evans and Wurster (2000) consider the process of deciding on the media's suitability to communicate information as a trade-off between richness and reach. Reach being the number of people that the information can be communicated to. Until recently it has been possible to share rich information with a very small number of people and less rich information with a large number of people. For example, face to face communication can only be conducted with a small number of people while a newspaper may reach many people but only contains lean information. Overall, the trade off between richness and reach has often resulted in information being channelled. The authors suggest that this continual trade-off between richness and reach generates "asymmetries of information". That is differences in the knowledge among people. Therefore, to date, communicating rich information has required proximity or dedicated channels and the cost or physical constraints of these channels has limited the number of people who can access the information. Evans & Wurster (2000) are suggesting that digital developments will make it possible to blow up economic links between rich information and communication media and predict that the channelling of information will cease. Digital networks make it possible for a very large amount of people to exchange very rich information. These are very radical proposals and perhaps a little optimistic.

There is evidently an increasing amount of contradictory evidence piling up against MRT. There is such a broad range of traditional and new channels of communications and media available now that media choice has become more and more of an issue. Although current research may be informed by MRT to an extent, clearly a more up-to-date theory needs to be developed. A new theory needs to reflect alternative explanations to media choice and these are likely to include organisational, social, and situational factors. Attempts to explore newer technologies have been limited to only a few 'newer' media including e-mail, voice mail and videoconferencing (El-Shinnawy & Markus, 1997; Lee, 1994a; Webster, 1998) Future theories need to explore the range of IRT identified in section 2.3 and any other technologies that are being applied in organisations today. In the absence of a new tried and tested theory, Dennis and Kinney (1998) advise that communication channels should be examined in light of the type of communication that is required e.g. if high feedback is needed to rapidly converge on a decision, then the use of media providing high feedback should improve performance.

Although inconclusive, the various dimensions for evaluating communication channels and the explanations for the uptake of different communication channels that have been highlighted throughout this section will go some way in assisting an organisations' understanding of the most effective communication channels in different situations. In particular it will provide a basis for investigating the benefits and limitation in using IRT for organisational communication and in evaluating its suitability in different situations.

2.5 SUMMARY

Organisations are becoming increasingly dispersed as they enter global marketplaces, products have become more information based and competitive international business environments have placed increasing pressure on organisations to be more efficient and collaborate and pool specialised organisational knowledge. These situational circumstances have lead organisations into using information and communication technologies as a primary means of communication as well as organisations seeking communication channels that will improve organisational performance. Developments in technology have been vast in the last decade and this has mainly been due to the convergence of computing and telecommunications. Advances in these fields have led to the deployment of the Internet, www, intranets and extranets and many other tools and technologies that can support synchronous and/or asynchronous communication. The research to date surrounding the Internet, until recently, has focused on e-commerce communication and its use in areas such as retail and entertainment. The research on the role of IRT in e-business intra-organisational and inter-organisational communication has been slower to emerge.

There are various factors that may be used to assess the role of communication channels. A number of factors have been highlighted through MRT including the level of interactivity, the number of information cues and the level of adaptibility. This chapter has however, highlighted some of the inadequacies of MRT and has recognised that the research will have to look beyond these factors for determining the suitability of IRT as a communication channel. Other factors may include, for example, the type of people that are involved in the communication, the message that

is to be communicated, the task that the communication is about, the location of the communication partners, the context the communication is taking place, the cultural background off the communicating partners and so on.

As the majority of intra-organisational and inter-organisational communication revolves around the supply chain, it is this area of the organisation that the thesis will now focus on. Consequently, the proceeding chapter will review the existing literature on organisation's supply chains, explore any inroads that IRT has had on supply chains to date and identify the key areas of supply chains and IRT that need further investigation. In doing this it will seek to identify the opportunities and possibilities opened up by applying the technology to supply chains and the barriers that it may impose. It will explore the benefits and downsides and assess the usefulness of IRT as a communication channel in supply chains. Only then, will organisations be in a better position to evaluate whether it is a suitable communication channel or not.

Chapter 3:

Virtual Supply Chain Networks

3.1 INTRODUCTION

This research is focusing on the aspect of e-business that is concerned with the role of IRT in supply chains and supply chain management (SCM). A number of factors have increased the importance of this particular field including advancements in competition in international business environments (Day, 2003; Van der Aalst, 2002) the increasing complexity of supply chains (Martin & Towill, 2002; Thomas, 2003) and the many developments in information and communication technologies discussed in the previous chapter. Supply chains have become a fundamental aspect of business improvement initiatives (Poirier & Bauer, 2001) and have moved from being an ancillary concern to a major strategic component of organisational strategies (Lancioni, Schau & Smith, 2003).

This chapter is divided into four main sections. The first section (section 3.2) will provide a comprehensive discussion and evaluation of the current literature on supply chains, SCM and supply chain networks (SCN). The next three sections (section 3.3 through to section 3.5) will concentrate on the development of IRT in SCNs. Section 3.3 will firstly focus on the role of IRT in business SCN transactions. This will be studied in terms of the uptake of IRT in supply chain processes, activities, intra-organisational and inter-organisational linkages. A variety of intranet and extranet applications will be explored along with a number of on-line inter-organisational industry initiatives and the section will close with a brief discussion of some of the challenges of virtual SCNs.

Section 3.4 and section 3.5 will explore the application of IRT to two key components of SCNs including supply chain relationships and supply chain information sharing. Section 3.4 will begin by evaluating the literature on SCN relationships, the uptake of IRT for SCN relationships and discuss the challenges of virtual SCN relationships. In a similar fashion, section 3.5 will synthesise the literature on SCNs and information sharing, discuss the uptake of IRT for SCN information sharing and finally present the challenges of virtual information sharing. Finally, the chapter will close with section 3.6 which will summarise the key areas that require greater research and provide a description of the conceptual framework that underpins the empirical research.

3.2 SUPPLY CHAINS & SUPPLY CHAIN NETWORKS

This section will set the scene for the chapter by providing a review of the literature on supply chains, SCM and SCNs. It will begin by discussing supply chains and SCM. Supply chains are regarded as embracing all the stages involved in creating and delivering products and services while SCM entails managing and integrating the different stages across the supply chain. The main components of the supply chain are then discussed including supply chain processes, sub-processes, activities and tasks. Various supply chain models will be assessed for applicability including Porter's value chain model (1985), the Global Supply Chain Forum's model (2003), two alternative models proposed by Stabell & Fjeldstad (1998) and the revised value chain model offered by Deise et al (2000). The importance of not just considering an organisation's supply chain independently of other organisation supply chain member's supply chains will be stressed. A more coherent and all encompassing SCN focus will be proposed. SCM should actually embrace the interrelations between the different organisational supply chains involved in the creation and delivery of end products or services. Finally this section will discuss the different linkages that exist between different supply chain processes and activities within organisational supply chains and between processes and activities across different organisational supply chains.

3.2.1 SUPPLY CHAIN & SUPPLY CHAIN MANAGEMENT

The supply chain is an important aspect of any strategy. Handfield & Nichols (1999) suggest that the supply chain encompasses all activities associated with the flow and transformation of goods from the raw materials stage (extraction), right through to the end user, as well as the associated information flows. Poirier and Bauer (2001) indicate that a supply chain refers to those business processes that create and deliver a product or service, from concept through development and manufacturing or conversion, into a market for consumption. Clearly, the supply chain involves many

complex stages from conceiving a product or service idea right through to providing product or service maintenance. The actual processes and activities that are involved at each stage of the supply chain will be expanded on in the next part of this section.

The various stages need to be somehow managed by organisations and this has given rise to the term SCM. SCM was originally introduced by consultants in the early 1980s and has subsequently become widely used. However, despite its huge uptake there has been a great deal of confusion regarding exactly what SCM involves and some people have used SCM as a synonym for logistics or logistics that includes customers and suppliers (Lambert, Cooper & Pagh, 1998; Coxton, Garcia-Dastugue & Lambert, 2001). This has been largely attributed to the fact that the logistics field had a huge influence on the growth of SCM. Due to the uncertainty surrounding the term SCM, the Council of Logistics Management announced a modified definition in October 1998 of logistics which explicitly declares that logistics management is only a part of SCM.

> **Logistics Management is that part of the Supply Chain Process that plans, implements, and controls the efficient and effective forward and reverse flow and storage of goods, services, and related information between the point of origin to the point of consumption in order to meet customer requirements.**

The understanding of SCM has been re conceptualised from integrating logistics across the supply chain to the current understanding of integrating and managing all key business processes across the supply chain (Lambert & Cooper, 2000). SCM has been described as the integration of supply chain activities through implementing supply chain relationships, to achieve a sustainable competitive advantage (Handfield & Nichols, 1999) while the Global Supply Chain Forum (2003) define SCM as "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". Undoubtedly, a key aspect of SCM entails the effective integration of key business processes, activities and information and as Handfield and Nichols (1999) recognise it requires building supply chain relationships. Although there is still

some remaining misunderstanding, there has been an increasing awareness that SCM is much more than logistics.

SCM has also been influenced by marketing research in terms of marketing channels (Cooper et al, 1997; Lambert & Cooper, 2000; Croxton, Garcia-Dastugue & Lambert, 2001). In particular, the marketing channels literature has contributed to identifying members of supply chain channels and discussed the need for channel coordination. However, most marketing channels researchers neglected the importance of a total supply chain perspective that embraced suppliers and only focused on the channels, activities and flows between the focal organisation and the end customer.

3.2.2 SUPPLY CHAIN PROCESSES AND ACTIVITIES

Key components of supply chains are supply chain processes and supply chain activities. Peppard and Rowland (1995) classified a supply chain process as a "continuous and regular action or succession of actions, taking place or carried out in a definite manner, and leading to the accomplishment of some result; a continuous operation or series of operations". While Davenport (1993) specified a process was a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action. More recently, Hammer (2002) distinguished them as organised groups of related activities that work together to create a result of value to customers.

A number of key words can be drawn from these definitions. Hammer (2002) considers 'organised' and 'together' to be the most important aspects. All the activities of a business process must work together and be aligned for the common purpose of serving customer needs. The people involved in the process must therefore work as a team instead of narrowly focusing on individual tasks and protecting turf (Hammer, 2002). Moreover, supply chain processes produce some kind of end result. They end at a point when a satisfactory outcome is delivered (i.e. when value has been delivered to the next partner in the chain) (Ward & Peppard, 2002).

A supply chain process can vary in terms of its scale or scope (Peppard & Rowland, 1995). The scale of a supply chain process can range from a very simple set of tasks to a very complex set of interrelated activities. The scope of a supply chain process is concerned with the extent to which a supply chain process crosses organisational boundaries. A process with a narrow scope usually exists within a single department or function and a process with a broader scope is likely to cross a number of different functions or perhaps a number of different organisations.

Examples of supply chain processes are customer relationship management, product development and post-sales support. Supply chain processes can be broken down into sub-processes and these sub-processes can be broken down into supply chain activities and so on until they reach the level of individual tasks. The nature of supply chain processes is such that almost every activity that goes on in the organisation can be construed as a process (Ward & Peppard, 2002). Therefore, supply chain processes need to be identified based on their strategic importance. Generally, organisations find it effective to identify five to ten major supply chain processes. For example, another common key supply chain process is order fulfilment. Order fulfilment represents all the activities from the time a customer places an order until the customer has received shipment and paid. It transcends functional boundaries and integrates customer service, logistics, finance and even manufacturing to serve a common goal. Other top-level processes are similarly broadly encompassing (Hammer, 2002).

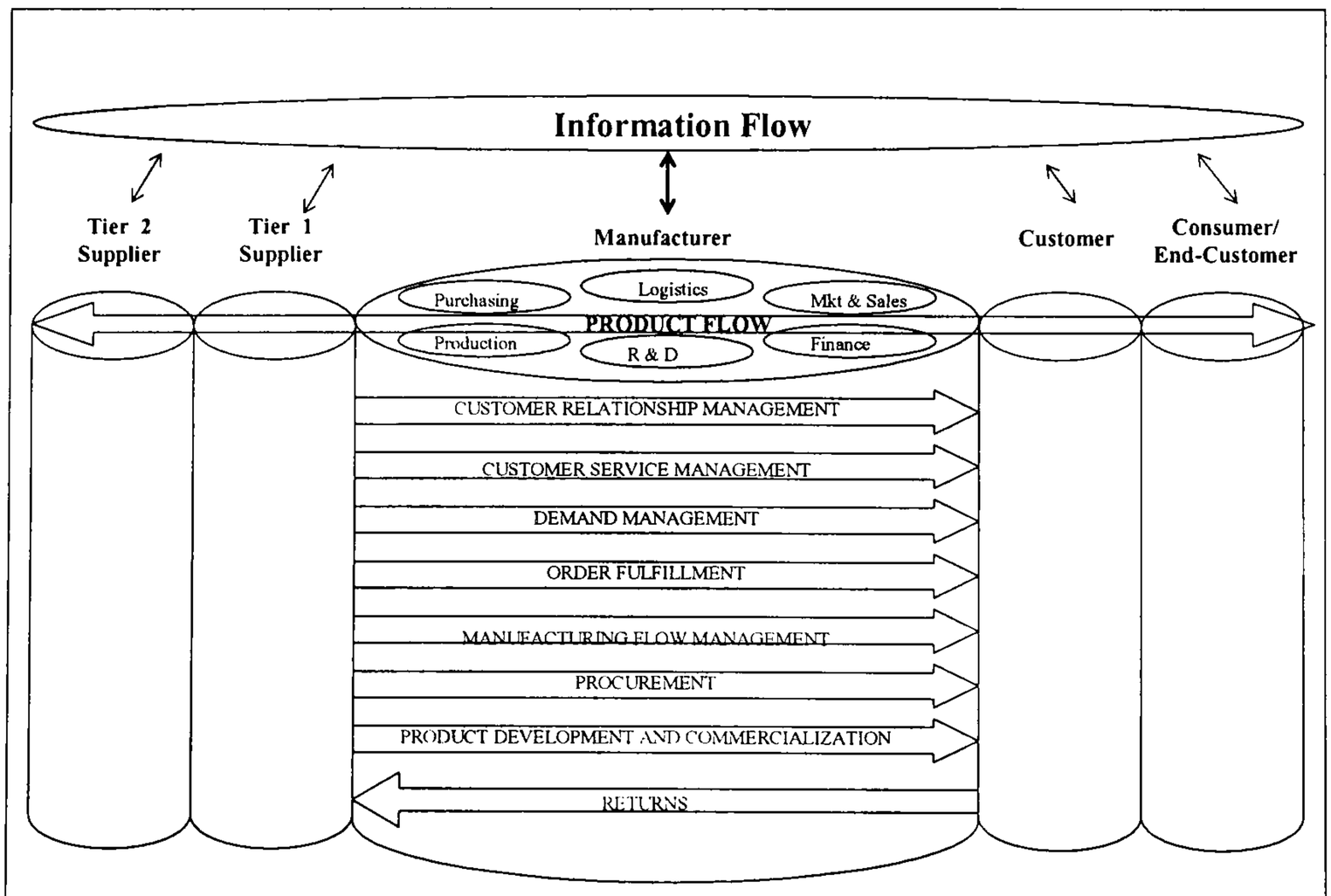


Figure 3.1: Supply Chain Processes, Source: Lambert & Cooper, 2000

As very little SCM or BPR research provides definite guidelines on what processes, sub-processes and activities actually are, the Global Supply Chain Forum identified eight key processes that make up the core of SCM, based on a manufacturing company. These are illustrated on figure 3.1 as customer relationship management, customer service management, demand management, order fulfilment, manufacturing flow management, procurement, product development and commercialisation and returns[1].

The eight key business processes run the length of the supply chain and cut across organisations and organisational functional silos within each organisation. Functional silos include marketing, finance, research and development, production, purchasing and logistics. An entire process will not be contained within one function. Their perspective of SCM focuses on supply chain processes inside organisations and across organisation's rather than the functional expertise of organisations.

Peppard and Rowland (1995) distinguish between supply chain processes as strategic, operational and enabling. Strategic processes are those processes by which the organisation plans for and develops its future such as strategy planning, product/service development and new process development. Operational processes are those by which the organisation carries out its regular day-to-day functions, such as winning the customer, satisfying the customer, cash and treasury management and financial reporting. Enabling processes are those which enable strategic and operational processes to be carried out, such as human resource management, management accounting and information systems management.

Croxton, Garcia-Dastugue and Lambert (2001) recognise, though, that the key supply chain processes can have a strategic and an operational element to them. The strategic portion consists of the establishment and strategic management of each process and provides a blueprint for implementation. For example, at the strategic level, customer relationship management involves sub processes such as reviewing corporate and marketing strategies to identify customer segments that are key to the organisation's

[1] Croxton, Garcia-Dastugue & Lambert (2001) provide a detailed description of the sub-processes and activities that comprise each of these supply chain processes.

success and identifying criteria for categorising customers. The operational portion is the actualisation of the process once it has been established. At an operational level, the customer relationship management process may involve sub-processes such as implementing product and service agreements.

Overall, supply chains involve a complex range of supply chain processes, sub-processes, activities and tasks. Organisations should carefully manage, design and execute their end to end business processes (Hammer, 2002). Supply chain activities should be thought of, designed and performed in a process context and employees should be developed to recognise that their individual activities are part of something larger, that align around customers and common goals.

3.2.3 VALUE CHAIN MODEL

The supply chain is often referred to as a value chain as each stage in the supply chain adds value to the product or service before passing it on. Porter introduced the generic value chain model in 1985 which is essentially concerned with the supply chain activities of an organisation and is set in the context of a traditional manufacturing firm. The value chain model is displayed in figure 3.2

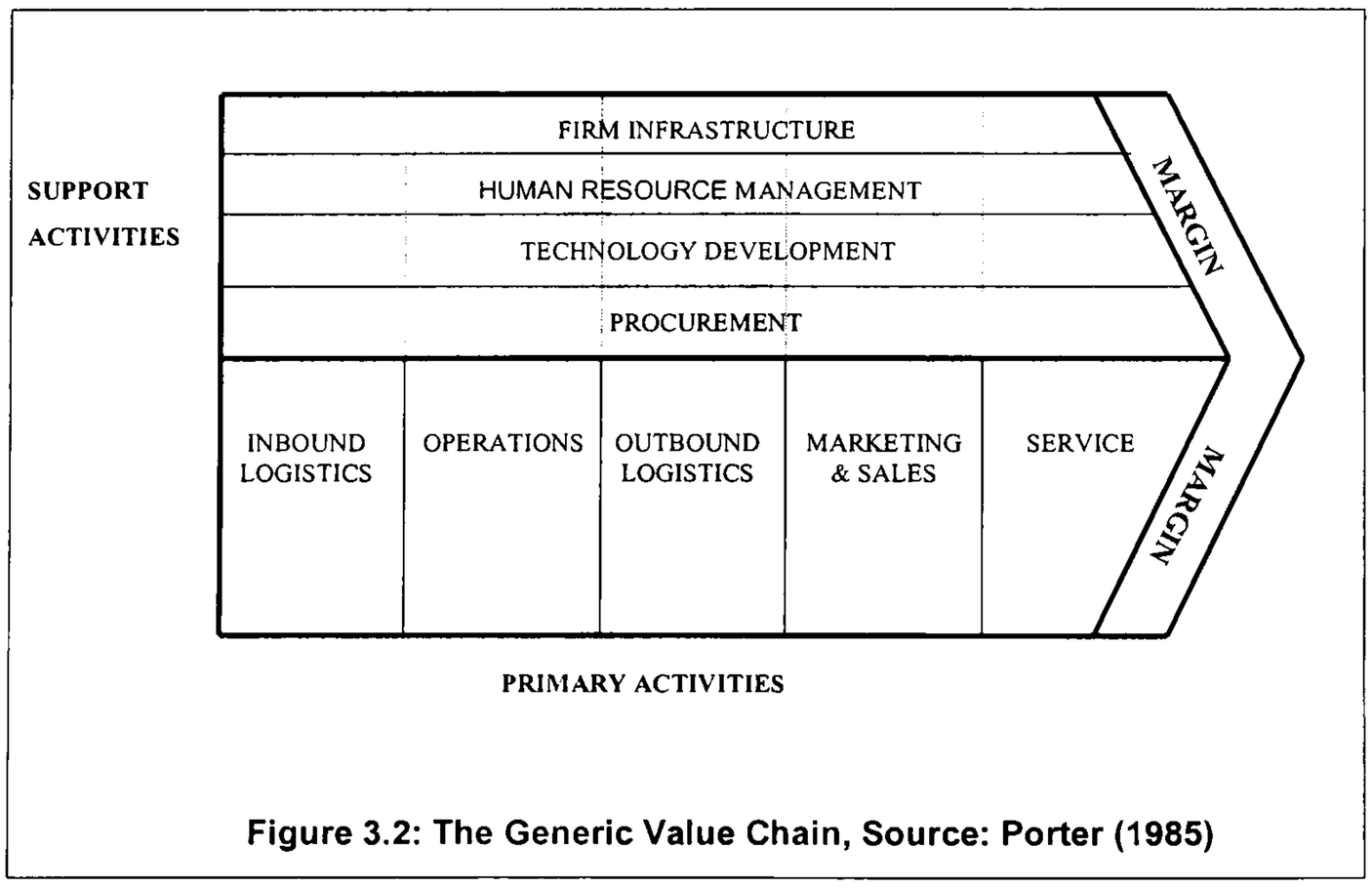


Figure 3.2: The Generic Value Chain, Source: Porter (1985)

The model represents a way of conceptualising the activities that are needed in order to provide a product or service to a customer (Ensign, 2001). Chains of activities throughout the value chain are likened to supply chain processes. Every organisation is a collection of activities that are performed to design, produce, market, deliver, and

support its product (Porter, 1985). The value chain depicts the way in which a product gains both value and costs as it moves through the value chain activities contributing to the resultant profit margin.

Primary activities are listed along the bottom of the value chain and they are involved in the actual creation, sale and transfer of the product to the buyer as well as after-sales assistance. Porter has divided the primary activities into five generic categories: inbound logistics, operations, outbound logistics, marketing and sales and service.

Primary activities are supported by support activities. These have been split into four categories including procurement, technology development, human resource management and firm infrastructure. These activities control and develop the organisation over time and add value indirectly, through the success of the primary activities. The types of activities that are involved in each of these generic categories are outlined in Figure 3.3.

FIRM INFRASTRUCTURE e.g. General Management, Planning, Finance/Accounts, Quality Management
HUMAN RESOURCE MANAGEMENT e.g. Recruiting, Hiring, Training
TECHNOLOGICAL DEVELOPMENT e.g. Component design, Process engineering, Technology selection
PROCUREMENT (Activities associated with purchasing all the inputs for the value chain apart from inputs used directly in the product) e.g. Qualifying new suppliers, Monitoring supplier performance
INBOUND LOGISTICS (Activities associated with receiving, storing and disseminating inputs to the product) e.g. Material handling, Warehousing, Inventory Control, Vehicle Scheduling, Returns to Suppliers
OPERATIONS (Activities associated with transforming inputs into the final product form) e.g. Machining, Packaging, Assembly, Testing
OUTBOUND LOGISTICS (Activities associated with collecting, storing and physically distributing the product to buyers.) e.g. Finished Goods Warehousing, Material Handling, Delivery Vehicle Operation, Order Processing
MARKETING AND SALES (Activities associated with providing a means by which buyers can purchase the product and inducing them to do so) e.g. Advertising, Promotion, Channel Selection, Channels Relations, Pricing
SERVICE (Activities associated with providing service to enhance or maintain the value of the product) e.g. Installation, Repair, Training, Parts supply

Figure 3.3: Value Chain Activities, Source: Porter (1985)

The performance of each activity can have knock on effects on the overall organisational costs and differentiation. All of the activities can be analysed and any performance deficits can be addressed to improve product quality, customer service and/or price competitiveness.

Different organisations may of course have used different names for their activities and may also have categorised their activities differently as well. The categorisation of activities will require judgement and probably depend on how it is used within the organisation (Porter, 1985). For example, order processing may be classed as part of outbound logistics in one organisation but as marketing in another organisation or it may be part of both. One of the organisations described later in the thesis, in case E, placed order processing between these two activities. While order processing is undoubtedly related to outbound logistics, it is very much wrapped up in the marketing and sales of their products as well. Training is another example. It could be regarded as part of the HR activity or as part of Technological Development.

Although the value chain model is a well founded theory that is commonly referred to and will probably continue to be, it has come under recent criticism for a number of reasons. A common criticism is the visual layout of the model which tends to give the impression that organisations should be analysed in terms of functions rather than processes leading to functional-orientated organisations instead of process-oriented organisations.

In many cases functional-oriented organisations inhibit the effective operation of business processes, by placing barriers at functional boundaries and preventing the timely and smooth flow of information (Peppard & Rowland, 1995). While an organisation's functional structure is typically a slice-in-time view of responsibilities and reporting relationships, a process structure is a dynamic view of how the organisation delivers value (Davenport, 1993). Senior management need to see through the surface structure of their organisation to the underlying purpose: the delivery of value to customers in a way that creates profits for shareholder. Process enterprises are the organisational form in a world of constant change (Hammer & Stanton, 1999).

3.2.4 ALTERNATIVE VALUE CHAIN MODELS

There are a number of other reasons that the value chain model has come under criticism in recent years and that researchers are questioning its validity in certain

circumstances. Firstly, the value chain essentially delivers value from transforming raw materials into products and according to Porter (1985) the overall value creating logic of the value chain with its genetic categories of activities is valid in all industries. However, although the model may be suited to traditional manufacturing organisations, it has come under scrutiny for being weak in describing service organisations such as educational institutions, insurance providers or estate agents where there is no physical product as such (Stabell & Fjeldstad, 1998; Ward & Peppard, 2002). Furthermore, it assumes that an organisations value chain is a one-way chain that involves pushing products to the customer and fails to highlight the importance of understanding customer needs through market research and responsiveness through new product development (Chaffey, 2002; Deise et al, 2000). Furthermore, it is proving to be inadequate in describing organisations that are primarily based on IRTs.

Consequently, alternative value chain models have been emerging. Stabell & Fjeldstad (1998) suggest that the value chain model should only be one of three generic value configurations. They introduce a further two value configuration models: value shops and value networks. The value shop model has been designed for organisations that focus on delivering value by resolving unique customer problems e.g. hospitals, service firms, educational institutions. Although standard activities may be used to solve the problems, activities and resources will be applied appropriately to each exclusive customer problem. The value shop is presented in figure 3.4. The primary activities that this model embraces are very intensive. They include understanding the problem, generating alternative solutions to the problem, choosing among alternative problem solutions, implementing the chosen solution and measuring and evaluating the implementation.

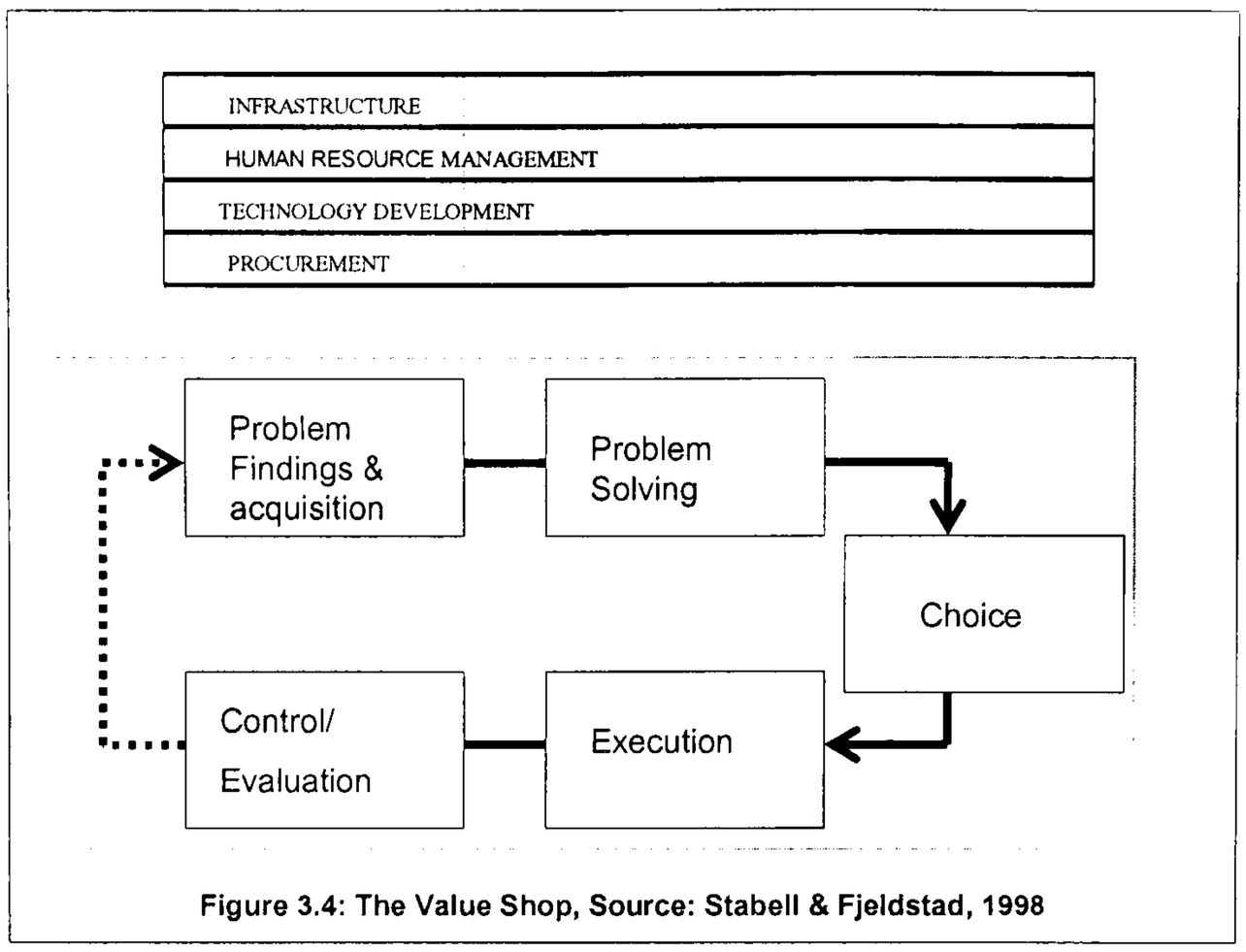


Figure 3.4: The Value Shop, Source: Stabell & Fjeldstad, 1998

For example, a consultant in a hospital would collect information about the patient through records, tests and examinations. They would use this information to generate potential treatment plans, choose a plan, treat the patient and then monitor the patient's progress and update customer records. Similarly an IT consultancy firm would primarily create value through these main activities.

The value network model, illustrated on figure 3.5, is more suitable for organisations that create value by providing a network service to link clients and customers with the purpose of facilitating network relationships e.g. telephone companies, transportation companies, insurance companies and banks.

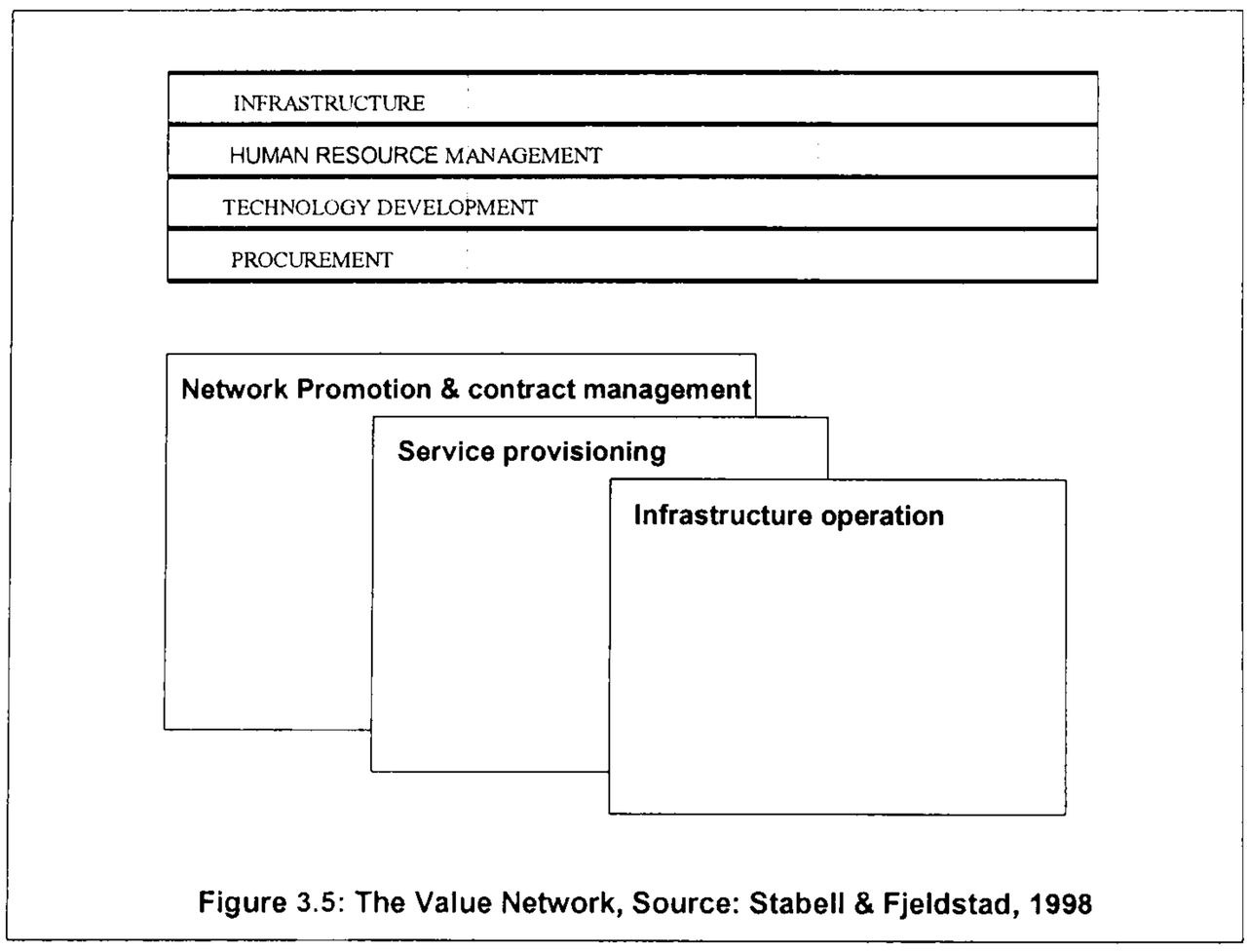


Figure 3.5: The Value Network, Source: Stabell & Fjeldstad, 1998

This model has three distinct primary activities: network promotion and contract management; service provisioning and infrastructure operation. Network promotion

and contract management involves activities associated with inviting customers to join the network, selecting customers that are allowed to join and terminating customer contracts that govern the service provision and charging. Service provisioning are those activities associated with providing a network service and billing for value received. Finally, the infrastructure operation involves activities aimed at maintaining and running a physical and information infrastructure. The three activities overlap to show the concurrent interactivity relationship across the primary activities.

The example provided by Stabell & Fjeldstad (1998) is that of a retail banking firm. The retail banking firm is involved in network promotion and contract management in that they promote sales and services, undertake risk evaluation, set up and monitor contracts. Contracts cover the relationship between customers (depositors and lenders). The other primary activities are service provisioning which entails depositing and withdrawing funds, transferring funds, maintaining account balances and calculating interest and infrastructure operations which is the physical infrastructure for storing and transmitting operations e.g. branch offices, automated tellers, IT systems. Whether or not the models proposed by Stabell and Fjeldstad will be adopted by academics and practitioners remains to be seen but the value chain model definitely needs developed to embrace the different types of industries and organisations.

Deise et al (2000) have taken a different tact and focused on revising the original value chain model to take into account the pervasiveness of IS and IT in supply chains. Their revised model is displayed in figure 3.6.

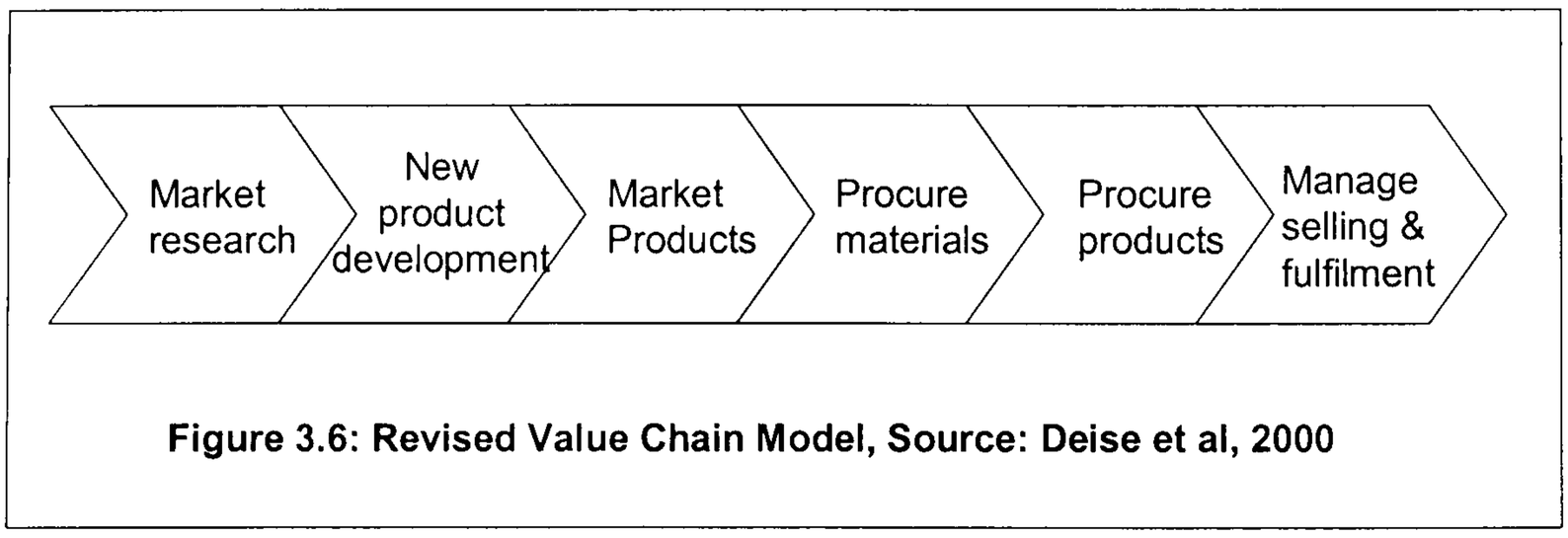


Figure 3.6: Revised Value Chain Model, Source: Deise et al, 2000

They recommend that the primary activities of an organisation should begin with the marketing research process before developing through new product development,

marketing research, procurement of materials, building products and managing, selling and delivering products. The premise of their arguments is that so much early market research is now possible with the availability of real time information through internet, intranets and extranets etc. Again the value chain model needs to be brought into line with the impact that information and communication technologies are having on what organisation's core activities are and the order of these activities.

In conclusion, the alternative value chains have been developed to more accurately identify relevant supply chain processes and activities for different types of organisations and different industries and are aimed at reflecting the order of supply chain activities more accurately.

3.2.5 SUPPLY CHAIN NETWORKS

The supply chain of an organisation must also be understood as part of a larger 'system' of related supply chains (Handfield & Nichols, 1999; Porter, 1985; Ward & Peppard, 2002). Organisations are increasingly linking up with other organisations through mergers, acquisitions, strategic alliances, collaborations or outsourcing to generate new products or products more quickly, increase organisational size, access other organisation's core competencies or new markets, enhance the organisation's position in an existing market or decrease organisational risk (Speier, Harvey & Palmer, 1998; Cohen & Mankin, 2002). In particular, the outsourcing of supply chain execution functions is being favoured in a wide range of industry sectors (Manchester, 2003). A survey in December 2002 found that around a half of the businesses polled used outsourcing at some point in their supply chain and noted that the trend was growing (Manchester, 2003). Some successful outsourcing pioneers, such as Nike, outsource virtually the entire supply chain, leaving them free to concentrate on product development and global marketing campaigns.

Therefore, inputs that are used in an organisation's supply chain may pass through the supply chains of many suppliers or manufacturers on their way to the organisation and outputs from an organisation may pass through many distributors, retailers or customer's supply chains before it reaches the final customer. Furthermore, the organisation's supply chain may interact with the supply chains of competitors or 3rd

party logistic providers. The actions of those other parties will have a significant impact on what the organisation does and how it does it (Ward & Peppard, 2002).

The increasing use of arrangements such as outsourcing has only served to accelerate the need to coordinate inter-organisational supply chain processes as organisations become more dependent on suppliers (Auguste et al, 2002). Consequently, SCM is not just about managing an organisation's supply chain but it is about managing the supply chains of all the organisations involved in delivering the end product or service to the end customer (Lambert & Cooper, 2000). Strictly speaking the supply chain is not a chain of businesses one-to-one B2B relationships, but a network of businesses and relationships. Increasingly SCM is being taken to mean the management of relationships across different supply chains.

SCM requires the company to take an external view, as well as an internal view of its business environment, and collaboratively identify the vital supply chain processes that will differentiate the SCN in the eyes of the most desired business customers and consumers (Poirier & Bauer, 2001). The external supply chain involving an organisation and its strategic and non-strategic partners have been given a variety of names including industry value chains, value systems (Ward & Peppard, 2002), external value chain, value streams (Porter, 1985) and value networks (Chaffey, 2002). For the purpose of this thesis the external supply chain will be referred to as the Supply Chain Network (SCN). SCNs will vary in terms of their horizontal length i.e. number of tiers of suppliers or customers and also their vertical structure i.e. the number of customers and suppliers at each tier (Lambert & Cooper, 2000). Furthermore, most organisations participate in more than one SCN.

The objective of SCM is to create the most value for the entire SCN, including the end customer. Successful SCM involves the coordination of activities within the organisation and with other members of the SCN. Consequently, supply chain process integration and reengineering initiatives should be aimed at boosting total process efficiency and effectiveness across the whole SCN (Croxton, Garcia-Dastugue & Lambert, 2001).

3.2.6 INTRA & INTER-ORGANISATIONAL LINKAGES

Although supply chain processes and activities are the building blocks of supply chains and SCNs, they are not just a collection of independent processes and activities but a system of interdependent processes and activities (Porter, 1985). A number of linkages exist between different supply chain processes and activities within an organisation and between different organisations. Linkages represent a relationship between the way that one supply chain activity is performed and the cost or performance of another (Ensign, 2001; Porter, 1985). Identifying linkages is a process of searching for ways in which supply chain processes and activities affect or are affected by others (Ensign, 2001).

An intra-organisational linkage is a relationship that occurs between activities within the business unit of an organisation or between different business units of the same organisation. Intra-organisational linkages are likely to be numerous. As highlighted by Porter (1985), product design can affect the manufacturing cost of a product, an interactive ordering system may reduce the salesperson time required per buyer, procurement can affect manufacturing cost and the quality of inspection may affect the level of after sales service required.

An inter-organisational linkage is one that describes an interrelationship between the business unit of an organisation and the business unit of an external organisation. For example the way a supplier's activities are performed affect the cost or performance of an organisation's activities. Until recently organisations focused primarily on their direct customers and internal functions and placed little emphasis on linkages with other organisations in its SCNs. However, the implementation of SCM should involve identifying the supply network members with whom it is critical to link, the processes to be linked with each of these key members, and the type/level of integration that applies to each process link (Croxton, Garcia-Dastugue & Lambert, 2001).

Inter-organisational linkages enable different organisational members of a SCN to come into contact with an organisation's supply chain at different points. Porter refers to these as contact points (Porter, 1985). For example, a supplier may have different contact points with an organisation in a typical procurement process. Suppliers may

come into contact at the buying stage, with the warehouse when the product is delivered, with accounts at the payment stage and they may have further contact with the organisation if there are any faults with the product and the product has to be returned. The different value chain models should help identify appropriate intra-organisational and inter-organisational linkages between supply chain processes and activities.

Since they are many linkages and interdependencies among activities, the ability to coordinate interrelationships is critical in achieving competitive advantage. The structure of activities within and between companies is a critical cornerstone of creating unique and superior supply chain performance (Lambert & Cooper, 2000). There are three basic strategies for achieving competitive advantage that are well recognised: cost leadership, differentiation and focus. Cost leadership involves the organisation leading a sustainable cost advantage over competitors while differentiation sees the organisation differentiating their product offering substantially from competitors in a way that is appealing to the customer. A focus strategy homes in on a market niche that embraces buyers with distinctive preferences or requirements.

Intra-organisational and inter-organisational linkages can lead to competitive advantage in two ways: optimisation and coordination (Porter, 1985). For example, if an organisation optimises its material specifications, it may be able to reduce service costs. Alternatively, if activities are coordinated in outbound logistics, this may lead to on-time delivery. Integration can increase an organisations capacity to implement strategies e.g. respond quickly, reduce costs (Ensign, 2001) and as Ward & Peppard (2002) indicated, some activities only add value if they are effectively integrated across primary and support parts of the chain. These are often information intensive activities such as forecasting, estimating demand, planning capacity, scheduling resources and pricing. The ability to identify existing linkages as well as to develop potential ones is crucial to competitive advantage (Ensign, 2001). However, the drivers for developing linkages are situational. They will differ for different SCN members and organisations will need to determine which linkages are critical and/or beneficial to integrate and manage across the supply chain (Lambert & Cooper, 2000).

The level of integration required will be different for different business processes and will vary over time.

Intra-organisational and inter-organisational linkages are increasingly being achieved through electronic channels such as the Internet, intranet and extranets and organisations are designing strategies that employ IS for coordination and optimisation thus leading to cost leadership, differentiation or focus and achieving a competitive advantage. As IRT is creeping into SCNs more and more, the rest of the chapter is going to focus on the application of IRT to SCNs. This will include the various elements of the SCN that have been discussed throughout this section including supply chains, SCM, supply chain processes, supply chain activities, intra-organisational and inter-organisational linkages.

3.3 APPLICATION OF IRT TO SUPPLY CHAIN NETWORKS

As outlined, the rest of the chapter will concentrate on the role of IRT in SCNs. As marketplaces are more competitive, complex, volatile and difficult to predict (Martin & Towill, 2002), organisations are increasingly looking for ways in which technology can be applied to manage their SCNs more efficiently. More efficient SCNs could make the difference between profit and loss. The investigation into the role of IRT in SCNs will be divided into three main sections. This section will lead the discussion by investigating the general role of IRT in the SCN. It will begin by studying developments in the deployment of technology in organisational supply chains, the role of intranets and extranets in supply chain processes and linkages, developments in Internet-based SCN business platforms and finally look at some of the challenges facing organisations using IRT in supply chain operations. The sections following this will concentrate on other key elements of SCNs including supply chain relationships and supply chain information sharing.

3.3.1 DEVELOPMENTS IN SUPPLY CHAIN NETWORKS

Business process re-engineering (BPR) was a major technique that emerged in the 90s, for organisations aiming to analysis, redesign and improve the operational effectiveness of their entire supply chain with particular emphasis on customer satisfaction, competitive advantage and cost reduction (Galliers & Swan, 1999). It sought to achieve improvements in performance by redesigning the processes through which an organisation operates, maximising their value-added content and minimising everything else (Peppard & Rowland, 1995). BPR employs all kinds of tools and techniques such as ICTs, Total Quality Management (TQM), Just in Time (JIT) and Electronic Point of Sale (EPOS) data sharing systems etc.

The focus on improving supply chain processes and activities has taken off even more in recent years. SCM practitioners and academics are considering how IRTs are transforming SCNs from an e-business perspective. IRT can potentially be used to streamline and integrate processes and activities in the supply chain. The proliferation of new telecommunications and IT such as the client/server concept, the Internet, intranets and the www has made real-time on-line communication throughout the supply chain a reality and has seen the automation and integration of many internal processes. On-line ERP systems and SCM systems have emerged linked to backend DBMS.

More and more, ICTs are being used to serve inter-organisational collaboration and inter-organisational processes. Early inter-organisational applications based on IRT were identified by Li and Williams (1999) and Benjamin and Wigand (1995). Applications, however, have become more advanced. Organisations are now developing more sophisticated inter-organisational infrastructures by using IRT to develop extranets, EDI and portals accessible to other organisations and integrating internal and external processes and systems. Some organisations are using IRT as their main means of communication in inter-organisational relationships.

The proliferation of IRT has given rise to a new type of organisation emerging called a 'virtual organisation'. Venkatraman and Henderson (1998) describe virtuality as

"the ability of the organisation to consistently obtain and coordinate critical competences through its design of value-adding business processes and governing mechanisms involving external and internal constituency to deliver differential, superior value in the marketplace". Virtual organisations are based on electronic webs of communication that enable a more fluid organisational structure that can adapt depending on SCN requirements. One of the main building blocks of a virtual organisation are 'virtual teams' (Jarvenpaa & Shaw, 1998). Virtual teams allow teams to be formed across and between organisations using electronic channels and for the skills and expertise of different employees to be leveraged as and when required to accomplish supply chain tasks and disbanded when no longer needed.

Virtual linkages also allow opportunities for enhancing existing inter-organisational SCN linkages and for sourcing new SCN inter-organisational linkages. IRTs support more rapid product production, increase in organisational size and access to core competencies while decreasing organisational risk. Venkatraman and Henderson (1998) suggest that the core competencies of different organisations can be combined to provide an enhanced customer product or service. Other organisations may have additional expertise to provide a product or service, further knowledge of a local culture or area or access to extra marketing channels. IRT can be used to co-ordinated these critical competences into a comprehensive package (Sieber & Griese, 1998).

Various authors have argued that the availability and cheapness of IRT provides the capability for dynamic switching, easily forming and disbanding linkages, continuously changing interfaces and maintaining low switching costs (Davidow & Malone, 1993; Mowshowitz, 1994; Mowshowitz, 1997; Speier, Hervey & Palmer, 1998). New information, changes in strategy or shifts in the marketplace may mean organisations could benefit from changing inter-organisational linkages. IRTs can help organisations be more flexible by making linkages easier to change as they do not have to invest in dedicated channels of communication nor do they have to physically relocate. Benefits can be realized by speeding up communication with customers and suppliers, improving service levels and reducing logistic costs (Lancioni, Smith & Oliva, 2000).

3.3.2 INRANETS, EXTRANETS, SUPPLY CHAIN PROCESSES & LINKAGES

By incorporating IRT into corporate networks, organisations have the potential to change the way they conduct their supply chains. Earl (2000) indicates that organisations commonly go through six stages of development in their intranet. The first couple of stages normally involve building a corporate home page and then developing it into an intranet for internal communication.

Sun Microsystems Inc. was one of the earliest organisations to introduce an intranet that allowed communication between corporate headquarters and divisions in 1995. Bernard (1998) describes some of the features of their intranet at that time which is continually growing. It provided information on different aspects of the business including information on 'what's new' like recent press releases or other announcements, information on the different locations and buildings in the organisation, on human resource issues such as employee benefits, on internal and external training course offerings, on sales and marketing and about the organisation's products etc. Sites such as sales and marketing were integrated to databases. Other organisations such as British Petroleum use their intranet to disseminate careers training information, Texaco uses theirs a lot for video-conferencing and Ford Motor Co uses it to link their design centres around the world.

The third stage involved in intranet development is normally for the purpose of e-commerce i.e. buying and selling on-line and the fourth stage surrounds e-business i.e. re-engineering the supply chain processes across the supply chain. Organisations are increasingly facing the challenge of e-business and they are designing intranets and extranets to support and transform supply chain processes (Cagliano, Caniato & Spina, 2003; Lancioni, Smith & Oliva, 2000). Although, many organisations are now realising that the fourth stage should actually happen before the third stage. Operational processes and systems need to be in place before organisations commit to any other significant investment. Supply chain processes need to be synchronised with the demands and expectations of e-commerce (Earl, 2000).

A few surveys have been conducted on the implementation of IRT for supply chain processes. Lancioni, Smith and Oliva (2000) conducted an investigation with firms that are members of the Council of Logistics Management into how IRT were being used for managing the major processes of supply chains including customer service, purchasing/ procurement, transportation, inventory management, order processing, productions scheduling and relations with vendors. Their findings illustrated that the most popular use of IRT with these firms was the management of transport e.g. scheduling pickups and drop-offs, monitoring on-time arrivals of carriers and managing claim status and processing communication with carriers on overall performance. The second most popular use of IRT in supply chains was order processing e.g. communicating with customers or order status and out-of-stocks etc (Lancioni, Smith & Oliva, 2000). The results of their survey were probably influenced, though, by the types of firms that are members of the Council of Logistics Management and the supply chain processes that are most important to them.

Cagliano, Caniato & Spina (2003) had slightly contradictory results when they explored the adoption of IRT in supply chain processes by using a large sample of European manufacturing firms. They divided supply chain processes into three main categories: e-commerce (sales, customer service & support), e-procurement (purchasing activities), e-operations (order processing, tracking, production planning & scheduling, inventory management, transportation planning). Their findings illustrated that the adoption of the Internet is higher in e-commerce processes, followed by e-procurement and least in e-operations. Only the most advanced organisations had adopted the Internet in all of the areas.

Other literature is emerging that describes the role of IRT in a number of different supply chain processes such as customer relationship marketing (Ryals & Knox, 2001; Walsh & Godfrey, 2000), customer service (Barnes, Mieczkowska & Hinton, 2003; Poirier & Bauer, 2001), marketing (Barlow, Siddiqui & Mannion, 2004), logistics (Farhoomand, Ng and Conley, 2003; Lasserre, 2004; Loebbecke & Powell, 1998), procurement (Presutti, 2003; Roche, 2001; Subramaniam & Shaw, 2002) and ordering (Lancioni, Smith & Oliva, 2000) etc.

Practical examples and statistics are also continually appearing. For example, an early legendary extranet transportation application is Federal Express's shipment tracking service. FedEx is the largest express transportation company in the world with about 30% of the market share and annual revenue in excess of $19 billion (Farhoomand, Ng & Conley, 2003). They were one of the first organisations to make their intranet system accessible to customers for arranging delivery of goods and tracking the progress of goods to their destination.

At the crux of their system is a transportation logistics system called the Customers, Operations, Service, Master Online System (COSMOS). The system works in concert with the Global Operations Control Centre (GOC) which houses huge wall-screens that track weather patterns and the real time movement of FedEx trucks and aircrafts (Farhoomand, Ng & Conley, 2003). Originally, FedEx's customers phoned the call centre to request tracking information. By enabling customer access, transaction costs have been cut from $25 to 25 cents (Bocij et al, 2003).

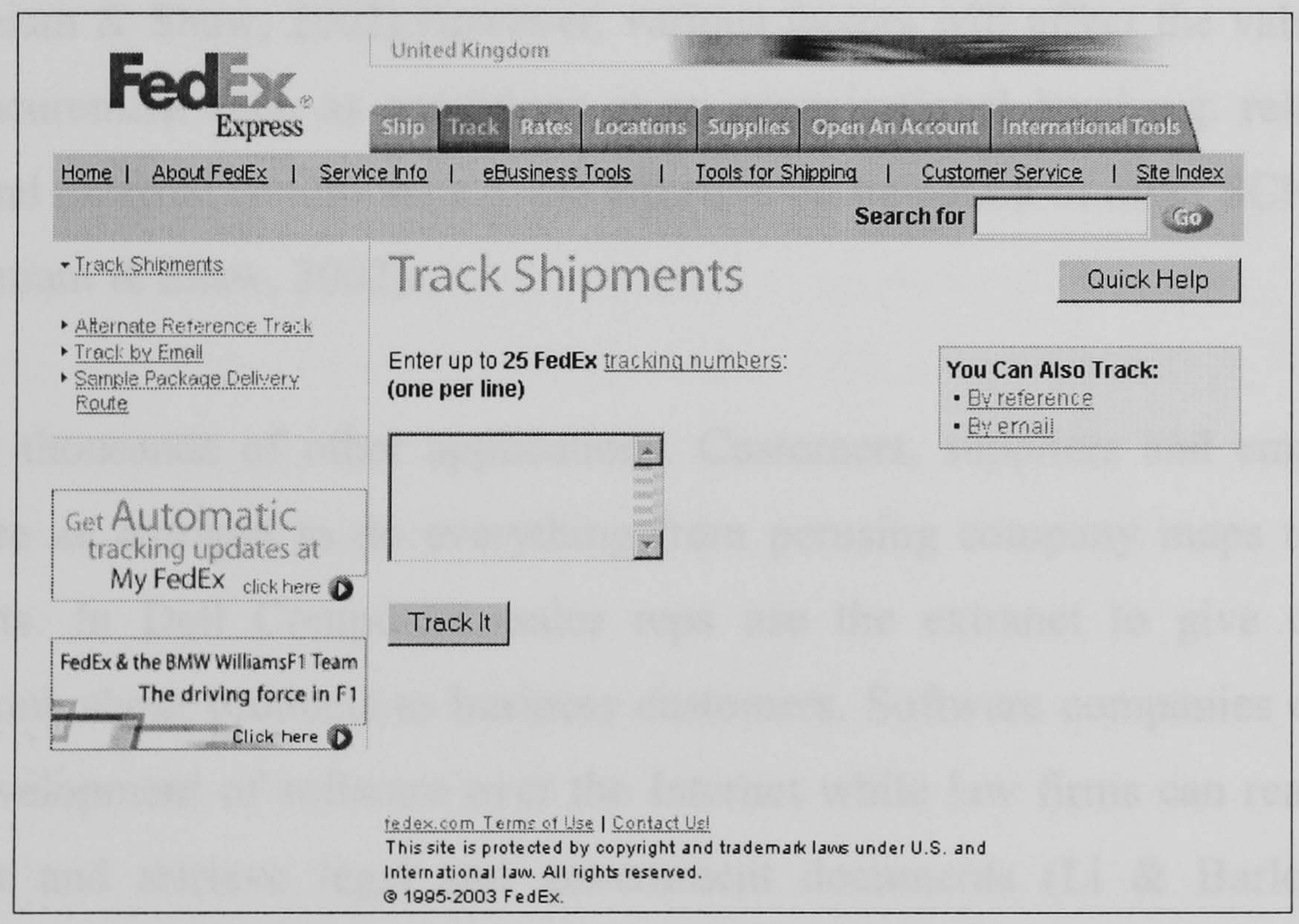


Figure 3.1: Federal Express web site for tracking shipments,
Source: http://fedex.com/gb/tracking/

The Fed Ex site available to customers for tracking shipments is presented in Figure 3.1. Customers log onto the Fed Ex web page, type in their package tracking number, and the delivery and/or scan information will be displayed. Customer service

interaction is made possible via various front end applications, web forms and linkages to the back-end systems.

E-Procurement is another e-business field that has grown astronomically in recent years. It facilitates corporate buying using IRT and can involve the direct or indirect purchasing of goods and services. The Gartner Group estimated that online procurement in the B2B market would jump from $75 billion in 2000 to $3.17 trillion in 2004 (Roche, 2001). The potential impact on competitiveness and profitability is enormous because business to business procurement involves the largest cost for an organisation, with many organisations spending 50 to 60 percent of their revenue on goods and services (Kalakota & Robinson, 1999; Presutti, 2003).

The SCM and e-procurement literature is rich with estimates of the benefits of e-procurement (Presutti, 2003). Benefits such as material cost reduction, reductions in purchasing labour costs, reduced inventory levels, more accurate corporate-wide purchasing reporting, improved strategic sourcing, enhanced search capabilities, faster processing etc. have been quoted (Ariba, 2004; Pressuti, 2003; Roche, 2001; Subramaniam & Shaw, 2002).However, various factors will affect the value of web-based procurement such as conditions at an organisational level e.g. relevant staff training and external conditions e.g. the effective participation of other SCN members (Subramaniam & Shaw, 2002).

There are thousands of other applications. Customers, suppliers and employees of Boeing use an extranet to do everything from perusing company maps to ordering plane parts. In Dell Computers, sales reps use the extranet to give customised presentations about products to business customers. Software companies collaborate on the development of software over the Internet while law firms can readily use it search for and retrieve legal and government documents (Li & Barlow, 2000). Intranets and Extranets offer securer communication channels than the whole Internet.

Lancioni, Schau & Smith (2003) conducted a later study that found that the adoption of IRT for SCM increasingly moving away from merely the indiscriminate use of IRT for supply chain processes towards more focused, strategic applications and the development of precise and measurable goals. Other literature has also indicated that

the focus on the role of IRT in supply chains is moving towards more strategic processes and evolutionary models of organisational change (Ash & Burn, 2003; Farhoomand & Wigand, 2003). Organisations also need to focus on using IRT to support and transform the intra-organisational and inter-organisational linkages between supply chain processes and activities. As indicated in the evaluation of the 'Supply Chain Network' literature competitive advantage can be gained by manipulating the linkages to achieve better optimisation or coordination (Ensign, 2001).

The fifth stage of Earl's (2000) stage model in E-Business involves management to be entrepreneurial in their decision making, analysing the on-line supply chain-related information that is readily available and communicating decisions back across the organisation on-line. At the 6th and final stage, organisations will have successfully negotiated the journey of e-business. Electronic supply chains will become the norm and the 'e' will eventually be dropped from the E-business.

3.3.3 INTERNET-BASED INDUSTRY CONSORTIUMS

A number of industry consortiums have also used the Internet to set up SCN business platforms that support inter-organisational supply chain processes. The electronic marketplaces make the exchange of information between all those involved in the supply chain much more fluid and improve the efficiency of the SCN (Lambert & Cooper, 2000). A few of these industry initiatives will be highlighted. Each of them has been driven by slightly different concerns.

A major initiative has developed within the car manufacturing industry. DaimlerChrysler, Ford Motor Company and General Motors lead the developments and since then numerous other companies have joined forces. They were involved in establishing Covisint which is based on Automotive Network Exchange (ANX). It is a central hub where the manufacturers and suppliers can do business on a single, secure, global business environment and provides a suite of tools including procurement (catalogues, auctions etc), collaboration, supply chain, quality and portal facilities (Covisint, 2002). One of its major goals was to develop a highly secure and reliable extranet that members could exchange large volumes of design data. By 2001, the

Covisint platform already received more than 60% of inter-supplier exchanges for the entire industry (Hauguel & Jackson, 2001).

In the consumer-goods sector, Collaborative Planning Forecasting and Replenishment (CPFR) is the initiative of the consumer-packages goods manufacturers and the retailers that sell their products. The aim of this initiative is to integrate demand and supply side processes to improve efficiencies, increase sales, reduce fixed assets and working capital, and reduce inventory for the entire supply chain while satisfying customer needs (CPFR, 2001). A common infrastructure (UCC Net) has been developed to redefine the ways retailers and manufacturers can share scanner, inventory, forecast and order status information (Cross, 2000). Participants have included organizations such as Wal-Mart, Procter & Gamble, Gillette, Nestle etc.

A final initiative that will be mentioned is Rosettanet, an initiative of the high technology and electronics industry. It includes major Information Technology, Electronic Components, Semiconductor Manufacturing and Telecommunications companies working towards creating and implementing industry-wide, open e-business process standards (Rosettanet, 2002).An example of its use is the automated update of manufacturer's product information into online catalogues maintained by their distributors (Cross, 2000). Each of the initiatives mentioned have been driven by organisations in the relevant industry and they have been aimed at improving the efficiency of the SCN.

3.3.5 CHALLENGES OF VIRTUAL SUPPLY CHAIN PROCESSES & LINKAGES

Virtual SCNs are providing a fresh set of challenges. Firstly, virtual organisational forms are highlighting the need to fundamentally shift the orientation of the organisation from functional management to process management. Functional divisions are becoming blurred in virtual organisations while competitive marketplaces are forcing organisations to concentrate on what actually adds value to supply chains. Organisations should be assigning process owners to intra-organisational and inter-organisational processes. They should be in charge of

managing the process from start to finish and be responsible for ensuring that the people performing the process understand it, have the required tools and technologies and are following the specified design (Hammer, 2002). Careful management of supply chain processes will only be exaggerated in virtual organisations.

Secondly, the various types of supply chain processes, activities and tasks are likely to be suited to different types of IRT and require a different balance of communication channels. In support of Daft & Lengel's (1986) MRT theory, McGrath & Hollingshead (1993) propose that tasks differ in "how much they require the transmission of information that is more or less 'rich' in its contents". For example, tasks requiring groups to generate ideas may only require the transmission of specific ideas and not added emotion or viewpoints. Tasks such as resolving conflicts, on the other hand, may require rich information such as values, attitudes, expectations etc. Numerous flaws were highlighted surrounding MRT in chapter 2, but even if there are flaws in the theoretical reasoning, the different types of supply chain activities and tasks are likely to work better with different mixes of communication channels. Moreover, virtual organisations may find that they are very limited in which supply chain activities or tasks can be conducted face to face, if any. Overall, research needs to be conducted to gather more information on which supply chain processes, activities and tasks are suited to which forms of communication and in particular which types of IRT.

Thirdly, the use of IRT for intra-organisational and inter-organisational linkages requires more detailed examination. Benefits may be sought through using IRT in supply chain linkages such as lowering costs, increasing flexibility, greater coordination and sharing on-line information. However it could also have damaging affects as well such as a reduction in the level of loyalty between different employees involved in the supply chain linkages or less information being shared through on-line linkages resulting in less coordination.

In summary, the recent technological developments in SCNs have been outlined. The application of the internet, intranets and extranets to supply chain processes and activities and intra-organisational and inter-organisational linkages has been explored. There are clearly many aspects of SCNs that can be developed through using IRT.

Two key aspects that are crucial in supply chain linkages are the relationships that can be built between the people involved in the supply chain processes and the information that can be shared. Firstly, supply chain linkages involve building and developing relationships between employees of the same organisation or different organisations. The next section will examine this aspect of virtual SCNs. Secondly, supply chain linkages involve information exchanges between different supply chain activities, different organisational processes and between the processes of different organisations. Information flows can take place within an organisation's business unit, between business units and upstream and downstream between SCN members and partners (Rayport & Sviokla, 1995; Venkatraman & Henderson, 1998; Ward & Peppard, 2002). Section 3.5 will explore the role of IRT in SCN information sharing in more detail.

3.4 VIRTUAL SUPPLY CHAIN NETWORK RELATIONSHIPS

A key component of SCNs that is developing with the increased level of electronic communication is the relationships between people involved in the SCN. SCNs incorporate relationships between people involved in supply chain processes and activities across the same organisation and between different organisations. SCN relationships have become even more diverse and complex with the increase in globalisation, level of partnerships and outsourcing (Manchester, 2003; Thomas, 2003). This section will study the meaning of SCN relationships and the different types, then it will consider the impact of IRT on SCN relationships and finally it will outline some of the different challenges that virtual SCN relationships may pose.

3.4.1 SCNs AND RELATIONSHIPS

Firstly, it is important to establish what is meant by the term 'relationship'. The Oxford English Dictionary defines a relationship as "the way in which two or more people or things are connected" or "the way in which two or more people or groups behave towards each other". A variety of forces have led to a greater need for stronger relationships in SCNs. Firstly organisations need to work more closely together in order to streamline and improve the efficiency of the SCN. Secondly, organisations

have become more specialised as products and services have become more information oriented. Customers are demanding faster, more specialised responses and there is a greater requirement for employees to work together on complex tasks, pooling specialist expertise and dispersed resources (Lipnack & Stamps, 2000; Palmer & Speier, 1998; Townsend, DeMarie & Hendrickson, 1998, West et al, 1997).

Subsequently different types of relationships are increasingly being recognised in SCNs. Relationships between organisations can range from arm's length relationships (consisting of one-off exchanges between two organisations) to vertical integration of the two organisations. Partnerships are becoming increasingly common for strengthening SCN integration and competitive advantage and they lie somewhere in the middle of these two extremes. Partnering provides a way to leverage the unique skills and expertise of each partner and may also 'lock out' competitors (Lambert, Emmelhainz & Gardiner, 1996).

A partnership is more than just an arm-lengths relationship in that it involves some kind of joint commitment or joint operation. It is a tailored business relationship based on mutual trust, openness, shared risk and shared rewards. A partnership is not the same as a joint venture as it normally entails some degree of shared ownership. Partnerships in SCNs are attributed with involving close, highly interactive relationships between business organisations involving components such as joint planning, sharing of benefits and burdens, extendedness and trust, systematic operational information exchange, operating controls across firms and corporate culture bridge-building (Cooper et al, 1997). In reality, SCN partners can be placed on a "continuum of possible relationships" from arm's length to integrated operations. The more integrated the greater the degree of partnership elements. Companies may concentrate on one or more of these elements or some of each of them. It depends on whether it's a long term or short term relationship e.g. corporate culture does not need to be highly compatible with short term relationships. The duration, breadth, strength and closeness of the partnership will vary from case to case and probably over time.

Schultze (2002) distinguishes between long-terms and short-term inter-organisational relationships. Long-term relationships are characterised with having those elements of trust, norms/expectations, interdependence and reciprocity and require a shift in focus

from "the narrow economically rational goal of winning immediate gain and exploiting dependency to cultivating long-term cooperative ties" (Schultze, 2002). It is vital for organisations to develop long-term secure relationships with SCN members that are core to the functioning of the organisation or that they collaborate with as part of a strategic effort. These relationships are critical and/or beneficial.

Organisations also interact with a range of SCN members sporadically in short term relationships. Short-term relationships are characterised as being lean and used for sporadic transactions. They do not require the same level of human or social contact. These relationships can be kept at arm's length. For example, organisations may purchase materials from suppliers, use the services of logistic providers or customers may purchase a product from the organisation on a one off basis. These types of network members will sporadically change with little damaging effects to the organisation. Often it is not as black and white as long term or short term and it can be somewhere in the middle and the relationships may change over time. Overall, the type and closeness of relationship will vary at different points of the SCN. Managers will need to establish the appropriate level of relationship to different supply chain linkages.

Inter-organisational and intra-organisational relationships may also be established through forming teams. Teams are "small numbers of people with complimentary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable" (Katzenbach & Smith, 1994). Team decision making has become increasingly popular in today's organisations as team-based structures have the potential to produce high quality, innovative solutions to complex problems (Amason et al, 1995; Townsend, DeMarie & Hendrickson, 1998). Teams bring assets-adding knowledge and creativity, increase the understanding and acceptance of ideas, and improve commitment and motivation (Jehn & Mannix, 2001). A process-oriented organisation should involve people collectively working towards a common purpose of creating value as a team, rather than individuals focusing narrowly on individual tasks (Hammer, 2002). Working configurations need to be in harmony, rather than at war with core business processes (Hammer & Stanton, 1999).

In conclusion, the relationships that are being formed in SCNs are becoming increasingly diverse as organisations recognise the need to form different types of partnerships with other organisations in order to compete in the global business environments and also as people involved within organisations and between organisations in the SCN are increasingly having to work together as teams in order to create value for international customers.

3.4.2 VIRTUAL SCN RELATIONSHIPS

An area that needs more development and understanding is how IRT can be applied to relationships between people involved in SCNs. Virtual supply chain relationships are relationships that are built, managed and developing using ICTs. IRT are increasingly being used as the communication channel for strengthening relationships between globally dispersed organisations involved in the same SCN and spatially distributed employees.

Researchers such as Warkentin, Bapna & Sugumaran (2000) suggest that the advent of electronic business over the Internet has significantly increased the quantity and quality of inter-organisational relationships. The quantity has increased as virtual SCN linkages enable relationships to form and develop between organisations located globally around the world. It is now possible to develop relationships between organisations involved in different stages of the SCN and pursue inter-organisational relationships that were not possible before due to logistical reasons. The quality has increased as the advances in virtual inter-organisational information sharing have enabled closer relationships to develop that support more efficient collaboration and more efficiently serve the end customer (Skjott-Larsen, Kotzab & Grieger, 2003; Warkentin, Bapna & Sugumaran, 2000).

IRT is becoming a major choice of media for linking and developing teams of people as well. Teams operating primarily through information and communication technologies have been coined virtual teams. Virtual teams are teams of people who work interdependently with a shared purpose across space, time, and organization boundaries using technology to form and disband to address specific organisational goals (Jarvenpaa & Shaw, 1998; Lipnack & Stamps, 2000). The www provides intra-

organisational and inter-organisational teams with an open-information environment that allows team members to share documents instantly and to conference with any number of people in verbal or e-mail discussion (Robinson, 2002).

Virtual relationships are set apart from conventional relationships as they routinely cross boundaries and use an array of technologies to cope with opportunities and challenges of SCN processes and activities. Both conventional and virtual relationships may cross organisational boundaries, including internal functional boundaries and external inter-organisational boundaries. Virtual relationships may also cross geographical and cultural boundaries.

Relationships can be conducted with different degrees of virtualness. The degree of virtualness is determined by the depth and diversity of the boundaries that the communication and work deliverables must cross (Palmer & Speier, 1998). For example, people that are based at different locations and never physically meet are more virtual than people that meet face to face on a weekly basis and people that communicate in different time periods are more virtual than those that communicate in the same time period. The degree of virtualness will also be impingent on the level to which people share the same values and beliefs regarding how activities should be conducted. The difficulties and challenges are likely to be more intense, the higher the degree of virtualness. Taking these factors into account, the degree of virtualness can be placed on a continuum (Palmer & Speier, 1998). The resultant degree of virtualness is likely to influence the communication process between people and the communication channels that are used to develop and sustain the relationship.

There are obviously a vast amount of benefits to be realised by organisations that use a virtual approach for conducting business processes and activities and accomplishing goals. Business performance can be dramatically improved through virtual relationships in terms of increased geographical flexibility, improved response times, shortened cycle times, reduced costs for organisations, more satisfying working environment for workers, increased productivity increased innovation and leveraging of expertise (Li & Barlow, 2000; Lipnack & Stamps, 2000). In addition the increase in flexibility means that specialists may contribute to different partnerships and teams and join and leave them as and when required. Furthermore, accessible technologies

such as IRT have led to an increase in the level of teleworking (Li & Gillespie, 1994), telecommuting (Apgar, 1998) remote or mobile working (Davenport & Pearlson, 1998). Employees can have the flexibility to work on supply chain activities from home, using satellite offices or shared desk arrangements as relationships can be developed and information shared using IRT. Virtual relationships also pose threats and challenges to organisations. These are discussed in the next section.

3.4.3 CHALLENGES OF VIRTUAL SCN RELATIONSHIPS

Virtual relationships may have to cope with fresh difficulties and challenges by crossing organisational, geographical and time boundaries. Different departments and organisations may have different aims, structures and procedures which can complicate relationships. People based in different places may speak different languages or come from different cultures. Furthermore, time zones can be problematic when people require immediate responses or projects need simultaneous contribution. A customer in another country seven hours ahead, for example, may get frustrated if customer responses to queries or requests are delayed. Some definite groups of challenges are emerging including the management of virtual relationships, maintaining trust and identity, managing relational conflict and the need for social presence. These issues are discussed below.

Managing Virtual Relationships:

As organisations and employees involved in supply chain processes and activities are increasingly spatially distributed, managers will have to become accustomed to working with and managing people that they will not regularly see. IRT will not fully replicate physical presence and interactions and managers will have to cope with shortfalls. The managerial dilemma comes down to, 'How do you manage people whom you do not see?' Handy (1995) suggests that the basis of successful virtual management will be trust. Traditional managers that believe control and efficiency are closely linked will probably find it difficult to be comfortable and confident with such an arrangement. However, if the efficiencies and benefits of virtual organisations are to be realised the organisation will need to be based more on trust than on control.

For managers, this may mean letting go of some of the power of position, physical presence and prestige that is commonly associated with traditional office environments.

It is possible that dysfunctions such as low commitment, role overload, role ambiguity, absenteeism and social loafing may be exaggerated in a virtual context (O'Hara-Devereaux & Johansen, 1994). Marucca (1998) suggested that a more rigorous management approach is required for virtual collaborations and teams. He recommends that at the early stages, managers need to clearly define the challenges, goals and purpose, assign team leaders, set levels of accountability, formal review schedules, regular interactions and periodic face to face meetings.

Challenges such as agreeing common goals may be even more profound in inter-organisational relationships. There is an even greater interplay of personal, organisational and collaborative goals that may act as a blocking factor in successful inter-organisational collaboration (Eden, 1996). It is an untidy process agreeing on common goals and remaining on path especially when people are dispersed. If there are no clear guidelines and monitoring methods, problems may escalate more quickly and out of control with managers not even realising. Therefore these issues must be emphasised, communicated and tracked with even greater precision and clarity in a virtual environment.

As for managing virtual teams, authors such as Lipnack and Stamps (1997, 2000) suggest that it takes more than one team leader for virtual team environments to be successful. Although there may be one formal leader, multiple leaders should informally emerge in successful, healthy virtual teams. At least a task leader and social leader should surface in small groups. Task leadership is oriented towards expertise and decisions that generate productivity. Social leadership arises from interactions that generate group cohesion. Virtual teams are often dealing with complex issues and problems and invariably require more leadership than conventional teams.

Trust and Identity:

The issues of trust and identity are crucial for the effective formation and functioning of virtual partnerships and teams working together on business processes. Identity plays a critical role in understanding communication content and interactions and trust is an important enabler of co-operative human action. Yet as discussed in chapter 2, many of the basic cues about a person's identity, e.g. about their personality or their social role, can become ambiguous when people are separated by spatial and temporal barriers. Furthermore, a greater degree of virtualness can make it more difficult to build trust, cohesiveness and strong bonding. Amason et al (1995) identified attributes of coherent teams as focused activities, creativity, integration, and open communication. Overall, these important elements of SCN relationships can be even harder to achieve in virtual SCNs. This can be made even worse if the people involved have no past, shared experiences or expectation of a future association.

In particular, Jarvenpaa and Leidner (1998) conducted a study about the creation and maintenance of relationships in virtual team working. They highlighted a number of key issues that were necessary for effective virtual relationships. These included the importance of having good first 'on-line impressions' between members of the relationship as it appeared to set the tone for future interactions. Social communication at the early stages was mainly used to build trust e.g. exchanging greetings, names, interests etc. However, once the relationship was underway, other types of trust emerged e.g. action based trust. Much of the communication between the people will rally around activities or problems. However, it is still important that social communication is maintained to continually develop social relationships and solidarity in these relationships. In the longer term, trust was greater in relationships that developed set patterns of communication and responded promptly to each other.

Other authors, such as Handy (1995), advocate that trust is only possible if there is some face to face contact between members of the relationship. Face to face relationships have the benefits of social interactions which can contribute to familiarity, trust and a sense of group cohesiveness. Face to face contact may only occur every six months but it helps to build stronger relationships and identity that can then be taken to a virtual environment. The research findings of Hildreth et al (1999) also emphasised the importance of face to face contact for encouraging trust and

identity between virtual relationships and for fuelling effective communication. Face to face contact initiated the relationship and set the basis for a stronger bond between members which was necessary for members to go the "extra half mile" for each other. The members then met each six months and although momentum tended to slow down at the end of the six months, it tended to pick up again after each physical meeting.

However, Jarvenpaa & Leidner (1998, 1999) contradicted this by discussing a case where trust occurred in a completely virtual but temporary relationship. They exhibited a form of 'swift trust' (fragile and temporal) which is a concept developed by Meyerson, Weick and Kramer (1996). In a temporary relationship, the members have not worked together and do not expect to work together again and they don't have time to develop trust in a gradual and cumulative fashion (Jarvenpaa, Knoll & Leidner, 1998). In this type of setting, "there is less emphasis on feeling, commitment, and exchange and more on action, ….. and heavy absorption in the task" (Meyerson, Weick & Kramer, 1996, pp191).

Conflict:

Another aspect of SCN relationships that poses a challenge is the management of conflict. Conflict is a natural element of any partnership or team formation and those established across SCNs are no exception. Conflict is defined as "an expressed struggle between at least two interdependent parties who perceive incompatible goals, scarce rewards, and interference from the other party in achieving their goals" (Hocker & Wilmott, 1985). It is an awareness of the parties involved of discrepancies, incompatible wishes, or irreconcilable desires (Boulding, 1963).

Traditional organisational theory took the pragmatic approach of avoiding conflict. Conflict was treated as an enemy to effective collaboration and organisational performance (De Dreu & Van de Vliert, 1997). It lead to disagreement, undermined cohesiveness and prevented collaborators from reaching decisions. The emergent view is that conflict is both an enemy and a friend on the "perpetual expedition to organizational efficiency and effectiveness" (De Dreu & Van de Vliert, 1997). By members challenging one another's thinking, it can in fact develop a more complete and richer understanding of the options available in conducting activities, and

ultimately make the kinds of effective decisions necessary in today's competitive environments (Eisenhardt, Kahwajy & Bourgeois, 1997). Contemporary research in the field of organisational conflict has revealed three common types of conflict: 'relationship conflict' or 'affective conflict', 'cognitive conflict' or 'task conflict' and 'process conflict' (Jehn & Mannix, 2001) and these will need to be considered in a SCN environment.

Relationship Conflict tends to arise from disagreements over personalised, individually oriented matters (Amason et al, 1995). It triggers dislike, distrust, annoyance, hostility, cynicism, apathy, frustration, irritation and other intense interpersonal negative emotions among people (Jehn & Mannix, 2001). Much theory suggests that relationship conflict may undermine cohesiveness and prevents members from reaching a consensus. It prevents team members from engaging in the kinds of activities that are critical to team effectiveness, the commitment to the team is eroded, lower quality decisions are made and there is less commitment to implementing decisions (Amason et al, 1995).

Cognitive conflict is task-oriented and relevant to differences in opinion or ideas surrounding a supply chain task. The literature suggests that in many occasions cognitive conflict can enhance team performance. By bringing different ideas, opinions and perspective to the table, it encourages innovative thinking and promotes creative solutions to problems that otherwise might seem insurmountable (Amason et al, 1995). It improves decision quality because the synthesis that emerges from the conflict is generally superior to the individual perspectives themselves.

The last type of conflict that was only recently identified is process conflict. It focuses on an awareness of controversies about aspects of how task accomplishment will proceed and the delegation of resources. This type of conflict is likely to be even more profound in inter-organisational top management teams that are establishing the ground rules for a supply chain process or activity to proceed.

Conflict can be either beneficial or detrimental depending on the type of conflict and the situation. Effective partnerships and teams are those that successfully harness these different types of conflict. Researchers such as Jehn and Mannix (2001) have

focused on the stages of an activity that these different types of conflict should be encouraged or suppressed. These will be explored in more detail in chapter 7. Most research on conflict though has appeared to focus on traditional organisational working configurations. Very little research has studied the patterns and impact of conflict in virtual organisations. Conflict will still exist in virtual SCN relationships and will probably need even more careful management before it spirals out of control and is detrimental to the effectiveness of the output. Therefore relationship, cognitive and process conflict will need to be addressed in this virtual context.

Social Presence Theory:

The challenges of using IRT for developing and enhancing SCN relationships may vary depending on the type of activity or task that is being conducted. Social presence theory contends that performance will improve when a medium's ability to transmit social presence is matched to the social needs of the task (Christie, 1985). Tasks can be more task-oriented e.g. problem solving, decision making, information exchange (McGrath, 1984) or they can be more person-oriented or relationship-oriented e.g. praising a subordinate, explaining how to do something etc (Dennis & Kinney, 1998). The theory predicts that task-oriented activities can be carried out equally well using any medium but that media conveying low social presence will be unsatisfactory for tasks requiring high personal involvement (Dennis & Kinney, 1998). Therefore, if relationship tasks are conducted virtually, social difficulties may arise due to the lack of face to face contact and lead to a reduction in trust, lack of social involvement, reduction in identity and overall people being more wary of what they communicate and less enthusiastic.

Furthermore, SCN partnerships may perceive a lack of permanency, reliability and consistency in virtual forms (Mowshowitz, 1997). As a result, they may be reluctant to develop linkages and relationships with the organisation. Alternatively, they may be unused to this way of working and may require guidance. It may be useful to begin with a lesser degree of virtualness and gradually build it up. Some studies have actually found though that even the process of setting up electronic links with organisations has stabilised and strengthened relationships between partners (Li & Williams, 2000). This is due to the close co-operation required for setting up technological links and solving problem areas.

In conclusion, relationships are clearly a vital aspect of SCN and there importance is increasing as the complexity of SCN multiplies. Moreover, electronic communication channels have massive implications for developing relationships. Further research is required on the development in the subsequent quantity and quality of SCN relationships. Developing effective SCN relationships is a challenging field which can be exacerbated by electronic communication channels. Areas of particular concern are managing virtual relationships, trust and identity, conflict and social presence.

3.5 VIRTUAL SUPPLY CHAIN NETWORK INFORMATION SHARING

A further component of SCNs that is being developed with the increase in electronic communication is the level of information sharing. SCNs require many different intra-organisational and inter-organisational supply chain process-related and activity-related information flows. As products become more information based and organisations are increasingly communicating using ICTs, there is an increasing pressure on organisations to carefully consider how they can manipulate these information flows to achieve optimisation and coordination and subsequently competitive advantage. This section will focus on SCN information sharing. It will begin by examining what information is and the importance of information to SCNs, then the impact that IRT is having on SCN information sharing to date and finally it will outline a number of key challenges of virtual information sharing information.

3.5.1 SCNs AND INFORMATION SHARING

The terms data, information and knowledge are often used interchangeably. This section will begin by distinguishing between them. Data can be defined as "the observing of raw facts or quantifiable entities" (Davenport, 1997). Information is data that has been stored, analysed, compared, calculated or worked on to produce a message in a form required by the user. It is endowed with relevance and purpose (Drucker, 1988). A meaning is attached to the data and consequently it changes the way the receiver perceives something. This could simply be by taking the data in a spreadsheet and transforming it into a chart.

Definitions of information are abundant. Braman (1989) attempted to categorise them into four main groups: information as a resource, as a commodity, as a perception of pattern, and as a constitutive force in society. Definitions regarding information as a resource concentrate on the uses of information. Other definitions consider information as a commodity as it goes through a production chain where it is created, processed, stored, transported and distributed etc. As it goes through each stage, the information gains in value. Further definitions of information consider the context in which the information is used in. Information is regarded as a perception of pattern. It has a past and a future, lies within a system of meaning and can be used to reduce uncertainty. Some definitions even go as far as to propose that information is a constitutive force in society as it is affected by its environment and affects other elements in the environment. Clearly there is no universally agreed definition.

It is generally accepted that knowledge is something broader, deeper and richer than information. Yet knowledge still also remains a broadly ill-defined term as well (Binney, 2001; Earl & Scott, 1999). Davenport and Prusack (1998) suggest that information can be considered knowledge when someone 'has given the information context, meaning and a particular interpretation'. Someone has added their own experience, insight and wisdom to it and considered its larger implications. Knowledge is closer than data or information to action and it is something that develops over time (Nonaka & Takeuchi, 1995).

Nonaka and Takeuchi (1995) distinguish between different types of knowledge as explicit or tacit. Explicit knowledge is more formal and systematic and can be readily captured, codified, recorded, preserved and distributed using numbers and words. Tacit knowledge is more deeply rooted in an individual's experiences, ideals and values. It is an insight or intuition that is much more subjective and more difficult to express and communicate. This softer type of knowledge is actually believed to be the most valuable yet it is often the most untapped (Earl & Scott, 1999; Von Krogh, Nonaka & Aben, 2001). Less face to face contact and grapevine communication is likely to lead to less natural dissemination of this tacit or softer type of knowledge. Therefore, establishing suitable methods of sharing knowledge could be even more challenging in virtual organisations.

For the remainder of the thesis the term information will generally be used unless the author explicitly needs to use the categorisations above to explain a particular issue. Overall, information is a key component of any supply chain. Information is used as an input for supply chain processes and activities and also as an output. The types of information used and produced will vary for different activities. Information needs to be exchanged internally between processes and activities of an organisation's supply chain and externally across different processes and activities in the overall SCN. Moreover, as products and services increasingly becoming informational and supply chain processes are conducted more and more electronically, the focus on information is even more pertinent. As organisations are striving to improve their efficiency, they should concentrate on ways in which the information flows up and down the SCN can be optimised and coordinated using IRT to gain strategic advantage.

3.5.2 VIRTUAL SCN INFORMATION SHARING

The upsurge of the Internet as a primary communication channel has massive implications for the way in which information will be communicated and shared across the SCN. Rather than organisations operating in traditional face to face SCNs, they are increasingly competing in virtual SCNs that revolve around information flows rather than physical interactions. Internally, organisations can use intranets and relevant technology such as ERP systems or groupware, and so on, to share information between processes and activities. While organisations can use extranets and facilities such as EDI and EFT etc. to share and leverage more in-depth information with other members of the SCN.

Rayport & Sviokla (1995) developed a value chain framework that is more appropriate for organisations competing in the virtual world. Organisations not only have to address physical value adding processes, now, but also virtual value adding processes. In the physical value chain the value adding steps are physical. Organisations operate in what Rayport and Sviokla refer to as, a marketplace. In the marketplace, the value-adding activities transform raw material into marketable products. Information is treated as a supporting element of the value adding process,

not as a source of value itself. In the virtual value chain the value adding steps are virtually performed through and with information. They refer to this new information world as the marketspace. Creating value in the marketspace involves five activities: **gathering, organising, selecting, synthesising and distributing information**.

Managing the two value chains poses new conceptual and tactical challenges for organisations. The principles that guide value creation and extraction across the two value chains are different. To be effective, organisations must fully exploit both value chains. Moreover, the two value chains must be managed distinctly but also in concert. In order to do this, the information value adding steps should be adopted in three stages. The first stage should involve organisations acquiring the ability to coordinate their physical operations more productively. Secondly, organisations will substitute physical value chain activities for virtual value chain activities. Finally, organisations might go further by drawing on information flows to deliver value to customers in new ways. In particular, it is these last two stages that the thesis is interested in exploring.

The effective application of these three stages could have massive implications for organisations' value chains. As organisations gather, organise, select, synthesise, and distribute information in the marketspace, they have the opportunity to "sense and respond" to customers' desires rather than simply make and sell products (Rayport & Sviokla, 1995, p85). The electronic links across the virtual value chain open up a source of information that organisations should be aiming to take advantage of. Organisations should employ methods to gather, manipulate and apply the information using virtual links to enhance products and services. Organisations best able to capture information and use it strategically are more likely to be successful.

Hagel & Sacconaghi (1996) suggest that organisations develop virtual information-capture strategies addressing issues such as targeting, capturing, leveraging and competing for information about consumers. For example, organisations can gather information for product development, by testing products on-line at an early stage and collecting feedback using on-line forms that filter directly into databases. Alternatively, they can use e-mail or the www to target potential or existing customers with information on product updates. IRT offers a new flexibility in that organisations

can reach customers at different times and at new locations that they could not reach before.

The information network is not all a one way street, however. Customers will have access to a more diverse information base as well. The information network gives them more up-to-date information on different products and prices and allows them to compare prices instantaneously. Also customers have the increased advantage of being able to track the stage that a product is at in the supply chain electronically. Overall, they have more freedom and visibility. This signals a shift of power from organisations to customers (Venkatraman & Henderson, 1998).

One organisation that took advantage of virtual information sharing is a supplier of a CASE (Computer Aided Software Engineering) tool supplier that provided high quality technical customer support (Li, 1997). As it is very costly and time-consuming to send specialists to customer premises in times of crisis, a more efficient and responsive method of supporting customers was proposed. They developed a process whereby the software tool support was provided remotely to client locations via an integrated multimedia platform. Direct user-expert interaction could be conducted over a distance using audio-visual capability. Customers requiring assistance could be sent sequences of commands directly. The setup served to maximise expert guidance as the time taken to travel to the customer could be used to serve other clients remotely. Overall, customer responsiveness is increased and downtime reduced. It is likely that the benefits of this kind of setup will vary depending on the type of product being handled and the content of the communication.

Virtual communities are also emerging (Wenger & Snyder, 2000). Some of these communities are formed by the organisations themselves or by SCN members. For example, they may be developed for the purpose of discussing and sharing information regarding the features, facilities and development of a product. They offer the organisation the opportunity to leverage first hand information from suppliers and customers. Although they can be seen as threatening as customers may discuss the quality of products and pass information on to each other that is not beneficial to the company. On balance, though, virtual communities should be seen as part of the value delivery system and organisations should encompass them in their

strategies (Venkatraman & Henderson, 1998). Furthermore, they can be used as a powerful vehicle for organisations to deepen and broaden relationships with customers (Hagel & Armstrong, 1997).

Clearly, if organisations wish to operate in the marketplace and the marketspace concurrently they will need to adapt and should not underestimate the task ahead of them. Rather than the agglomeration of physical entities, organisations are now dealing with a range of experiences linked together and communicated electronically (Li & Williams, 2000). The emphasis has shifted to managing and manipulating information flows over networks. Flows can be drawn on to deliver value to customers and suppliers in new ways.

Organisational strategies should evolve and respond to an ever-changing external environment and encompass virtuality where appropriate. It has been widely assumed that the Internet will replace all conventional ways of doing business. This is a vast exaggeration. The Internet may replace certain elements of physical value chains. In many cases though, the Internet will compliment them. In other cases virtual activities may even amplify the importance of traditional physical activities. For example, an increase in ordering on the net will make warehousing and shipping more important. Walgreens, the most successful pharmacy chain in the United States, introduced a web site that provides customers with extensive information and allows them to order prescriptions on-line. Instead of making company store's redundant, the web site has increased their value. 90% of the customers who place orders over the web, pick up their prescriptions at a nearby store rather than have them shipped to their homes (Porter, 2001).

The co-existance of the physical and electronic channels will certainly offer more choice for organisations to access markets and information in different ways. For example, banks and airline companies provide products and services using physical channels and electronic channels. It is uncertain how organisations will manage the physical and the electronic channel strategically. For example, organisations will need to decide if two separate strategies should be crafted for each channel or if they should be integrated into one. Most importantly, though, it needs to be investigated to

see if information created and available over electronic channels is applicable to physical channels and vice versa.

Rayport and Sviokla (1995) suggest that electronic links will be used to connect the supply side of the network with the demand side of the network and an organisation's performance can be optimized and efficiencies maximized if the demand for it's products and services are matched very closely to the supply of resources at all times (Ward & Peppard, 2002). Less variation in anticipated customer demand and actual customer demand should hopefully prevent various organisations at different stages of the SCN being subject to what is commonly referred to as the Bullwhip Effect. The Bullwhip Effect can give rise to a number of well known problems including the accumulation of excess inventories, inventory shortages, poor customer service, excess or insufficient capacity, inefficient production planning or higher costs (Machuca & Barajas, 2003). Metters (1997) stresses that 'a lack of inter-company communication combined with large time-lags between receipt and transmittal of information are at the root of the problem. The on-line exchange of information using tools and technologies such as EDI should substantially reduce the bullwhip effect (Machuca & Barajas, 2003)

Virtual information sharing has been examined in a conceptual fashion. More practical research needs to be conducted to see how the marketspace will specifically affect SCN information sharing. Further research is required to gain a detailed understanding of the types of information that will be exchanged virtually and how this information will be gathered, organized, selected, synthesized and distributed using IRT. Furthermore, it needs to be understood how this information will improve the efficiency of SCN processes and activities.

3.5.3 CHALLENGES OF VIRTUAL SCN INFORMATION SHARING

A range of IRT are available that are suitable for generating, capturing, organising and sharing virtual information. However, it is evident that technology on its own will not necessarily lead to a better, more productive information environment (Davenport, 1997). Even if an organisation invests in the technology it will not necessarily follow

that employees will share critical information. A number of personal, behavioural, cultural, organisational and technological barriers can challenge the effective sharing of virtual information between individuals, teams and organisations in the SCN. Some of these challenges will be considered.

Firstly, there are many personal and behavioural issues. Some employees are reluctant to share information, as they regard information as an asset, which strengthens their position within the organisation. By divulging information they consider it as threatening their position. This can have detrimental effects as 'hoarding information can weaken an organisation' (Markham, 1998/99) and when individual know-how is not converted into corporate know-how and individuals leave the organisation, this can lead to organisations suffering loss of knowledge of best practice in specific areas. Another reason for people keeping information to themselves is that they are unaware of the other people in the organisation that would benefit from its availability. This is due to a lack of understanding of other people, departments, teams and organisation's information needs. Furthermore, problems with sharing information arise from employees being unaware that the information exists somewhere else in the organisation and they end up reinventing the wheel or alternatively they simply find it just takes too much time trying to locate the information. Finally, the sharing of information does not always exist due to a lack of perceived time to share the information, a lack of information management skills and techniques or understanding of the potential of the technology.

For information management to be successful, a supportive information culture will need to be developed. Apgar (1998) emphasises that a change in culture needs to be led by management. Culture needs to move from this belief that information is power to 'sharing is power'. One approach, which may encourage information sharing, could be to introduce reward systems, promotions, praise or other incentives for an individual's capacity to share information and work with other people. Also individuals and departments should be involved in developing and building the information architecture. The more involved they are the more likely they will be committed to creating, sharing and using information flows.

Intra-organisational information flows are also more likely to be encouraged by having cross-functional teams. Team members will be forced to interact with each other and pool different information, knowledge and perspectives. In fact, many organisations, nowadays, fully support employees pursuing more diverse career paths that involve rotating between functions. Different roles will build on the individual's multiplicity of perspectives and usefulness to the organisation. It will also encourage sharing of information and knowledge from one department to another. Nonaka (1991) highlights a useful principle that Japanese companies employ which is redundancy – "the conscious overlapping of company information, business activities and managerial responsibilities". Although this is an unappealing term it essentially creates a 'common cognitive ground' that facilitates frequent dialogue and transfer of tacit knowledge. Techniques such as redundancy may improve employee's knowledge of the SCN and supply chain processes.

There are challenges ahead in inter-organisational information sharing. Chesbrough and Teece (1996) recommend that organisations are careful when deciding which information they will share with SCN members. Organisations need to be prepared to share information with other members of the SCN in order to coordinate the end product offering to customers. However, this may cause problems such as loss of ownership, reduction in control and most dangerously it can leave organisations vulnerable. Consequently, this is a challenge that needs to be met head on and treated with extreme caution.

Also, organisations need to have some kind of information management strategy and recognition of the business environment and the information which is critical to an organisation's success. It is important to understand how IRT and information management architecture can directly impact productivity, revenue and the company's competitive position. The information management strategy should revolve around the question, 'What do we want to do with information in this organisation?' It is very much affected by and inter-related to the business strategy and vice versa. A vision needs to be developed of where the organisation wants to go and a strategy of how the organisation will get there. Critical information and knowledge flows should be identified and any gaps highlighted and the information and knowledge management strategy should be crafted to address these issues.

There are also technological challenges in virtual information sharing. Firstly, organisations need to make sure that people have the necessary expertise to use the technology for information sharing and the insight to apply appropriate media for different types of SCN communication. It is also important that people receiving the information have the technical expertise as well.

Also further research is required to examine the types of information that work well with particular types of IRT. For example, the development of XML provides facilities for distributing more complex information and levels of detail like hierarchy. This may lead to more tacit information being shared. Furthermore, as described earlier, other technology like Java can be used to make web pages more dynamic and responsive to users' actions. Users are more likely to advance their knowledge through interacting with the information on the web pages. Binney (2001) made some inroads in attempting to categorise the suitability of different technologies and applications depending on the business problem that they were trying to solve. For example technologies such as video conferencing and bulletin boards are increasingly being associated with sharing ideas and information for innovation and creation.

Overall, there are a variety of reasons that information may not be shared. Even with the dramatic advancements in information and communications technology. These challenges must be addressed to encourage an environment that promotes sharing of information. Davenport (1997) suggests an all embracing approach to information management that does not just focus on the technology as the solution but emphasises the organisation's entire information environment. Technology is only one component of the information environment. Other components such as cultural, behavioural and political aspects must also be managed. Furthermore, it should not be assumed that all IRT will be suitable for all types of information sharing.

Virtual information sharing across the SCN is obviously an important aspect of the supply chain and SCM field that could provide organisations with substantial opportunities for competitive advantage while raising a whole new set of challenges. Research so far has been quite conceptual and the topic could benefit from more

detailed practical research on how organisations are actually using IRT to enhance information flows across the SCN between different organisations and within organisations and across intra-organisational and inter-organisational supply chain processes and activities.

3.6 SUMMARY

The main aim of this chapter was to explore the role of IRT in SCNs. The chapter reviewed the literature in four main sections. It began by synthesising the current literature on supply chains, SCM and SCNs. The key components of SCNs were discussed including supply chain processes and activities and the importance of intra-organisational and inter-organisational linkages were stressed. Various models for identifying these components were discussed. These included the Global Supply Chain Forum model (Lambert & Cooper, 2000), the Value Chain model (Porter, 1985), alternative Value Chain models (Stabell & Fjeldstad, 1998) and the Revised Value Chain model (Deise et al, 2000). Clearly there is not one model that adequately fits all SCNs. Therefore the various models will be selectively applied depending on the situation and the organisations that are studied. SCM involves understanding and managing an organisation's supply chain as part of a wider SCN. The increase in outsourcing and partnerships has meant that end products and services are more dependent on the other organisations in the SCN than ever before. Therefore this research will not just focus on individual organisations but also take other SCN members into account.

The next three sections provided the basis and direction for the overall aims and objectives of the research and the formulation of the conceptual framework. The overall aim of the research is to gain a more in-depth understanding of the role of IRT in SCNs. Five key objectives were also identified. The first objective of the research will be to focus on critically evaluating the role of IRT in supply chain processes and activities. The research will study inter-organisational supply chain processes that involve organisations across the SCN. The suitability of IRT for supporting different supply chain processes may vary and it also may change throughout the duration of

the process. Therefore the application of IRT to supply chain processes needs to be broken down and analysed in terms of activities and tasks.

The second objective will examine the role of IRT on intra-organisational and inter-organisational linkages across and between supply chain processes. It will involve investigating the depth and diversity of supply chain linkages and opportunities for achieving competitive advantage through optimisation and coordination. Opportunities for enabling new linkages to be formed across SCN and supply chains and potential factors that may limit supply chain linkages will be assessed.

Thirdly, research needs to be conducted to explore the uptake of IRT for developing relationships at different points of the SCN. As indicated in Section 3.4, further research is required to examine the developments in the quantity and quality of SCN relationships as a result of the proliferation of IRT. As IRT embraces such a wide range of tools and technologies, it is important to distinguish between which tools and technologies are suited to which aspects of building and developing relationships. Research must be conducted on changes in the development of virtual SCN relationships in terms of patterns of communication, frequency of interactions, levels of trust, the amount of conflict etc.

Fourthly, research is required to see how effectively IRT are being applied to SCN information sharing. Empirical research needs to be conducted to gather further knowledge of the types and the depth of supply chain information that is shared electronically, who the information is being shared with, how the information is being used and the effect it is having on the overall SCN and the end product or service offering. Furthermore, the barriers to effective information sharing need to be explored in more detail.

The fifth and final objective will concentrate on the benefits and limitations of IRT in the context of SCNs and in particular supply chain processes, activities, linkages, relationships and information sharing. Chapter 2 discussed the various pros and cons of using different types of IRT. It also explored MRT and a number of contradictory theories that identified many different dimensions that communication channels such as IRT are likely to be assessed on. In particular information surrounding these

dimensions from the empirical research will contribute to the achievement of this objective. This will provide a better overall insight into the appropriate application of IRT to SCNs.

A conceptual framework of the key objectives of this research has been formulated and is illustrated on figure 1.1 in the introductory chapter. To conclude, the research is exploring the overall role of IRT in SCNs. Specifically, it is researching the application of IRT to supply chain processes and activities, intra-organisational and inter-organisational linkages, the development of SCN relationships and SCN information sharing. Furthermore, it is examining the overall benefits and limitations in using IRT for SCNs.

Chapter 4 :

Research Strategy

4.1 INTRODUCTION

The overall purpose of this chapter is to outline the methodology underpinning the research, the rationale behind the research strategy and detail the research design. Section 4.2 and 4.3 begin the chapter by reviewing some common research philosophies and epistemologies, relating these to the developments in research in the IS field and positioning the underlying philosophy of this research in relation to other IS research.

Section 4.4 will present the overall research strategy that was adopted. This will involve a detailed account of the philosophical and practical reasons for selecting a case study approach and will substantiate the appropriateness and validity of the case study approach that was taken. It will also embrace the actual design of the case studies including details such as the unit of analysis, the number of cases, the time period of the cases, the data collection methods and tactics for alleviating traditional concerns surrounding case study research. It will also outline the main theories that underpinned the research strategy which will include a review of the SCN theories, Media Choice theories and will also introduce a higher level theory, Structuration theory.

Section 4.5 will provide details of the actual case studies. This will include details surrounding the selection of the case studies, the formation of the case study questions, the conduction of the case studies, an overview of each case study, a discussion of the issues that were taken into account when writing the case studies and finally how the case studies were analysed. The chapter will close with a description of the research output in section 4.6 and lastly a chapter summary.

4.2 RESEARCH PHILOSPHY

Researchers differ in their ways of 'seeing the world' and 'researching the world'. A research philosophy underpins the way in which data is collected and analysed about phenomena and is considered to govern the epistemology beliefs guiding a study. All research is based on some underlying assumptions about what constitutes 'valid' research and which research methods are appropriate (Myers & Avison, 2002).

Epistemology refers to the assumptions that researchers have about knowledge and how it can be obtained (Hirschheim & Klien, 1989).

The way in which data is collected and analysed is most regularly distinguished as quantitative and qualitative research. Quantitative research was originally developed in the natural sciences to study natural phenomena (Myers & Avison, 2002). This type of research is excellent for studying features of phenomena that are treated as independent, objective and discrete entities and as unchanging over the course of the study (Kaplan & Maxwell, 1994). They are regularly concerned with the empirical testing of theories. Quantitative research strategies traditionally include surveys, laboratory experiments, formal methods (e.g. ecomometrics) and numerical methods such a mathematical modelling.

Qualitative research was developed in the social sciences to enable researchers to study social and cultural phenomena (Myers & Avison, 2002). This type of research emerged from phenomenological and interpretive paradigms. It is inductive in nature and is helpful for understanding the meaning and context of phenomena over time in context-specific settings (Walsham, 1995a). Qualitative methods are more useful for studying issues that are not easily partitioned into discrete entities, or to examine dynamics of a process rather than its static characteristics (Kaplan & Maxwell, 1994). They are useful for developing explanations of the actual events and processes that lead to specific outcomes. Qualitative researchers assume that they do not know enough about the perspectives and situations of participants in the setting studied to be able to formulate meaningful hypotheses in advance and instead develop and test hypotheses during the process of data collection and analysis (Kaplan & Maxwell, 1994).

Examples of common qualitative research strategies are action research, case studies or ethnography. Data collection methods tend to include observation, fieldwork, interviews, questionnaires, documents and text, or the researcher's impressions or reactions. This particular research was essentially qualitative as the phenomena were studied in a context-specific setting. The research investigated the dynamics of the process and developed theory through the process of data collection and analysis, rather than testing theory.

However, the underlying philosophical assumptions are regarded as being more important than whether or not quantitative or qualitative research strategies are used. Orlikowski and Baroudi (1991) suggest three underlying 'paradigms' for IS research based on earlier work conducted by Chau (1986). The three paradigms differ in their beliefs about physical or social reality, beliefs about knowledge and beliefs about the relationship between knowledge and the empirical world (Orlikowski & Baroudi, 1991). The three epistemology categories that they have suggested are positivist, interpretive and critical.

A positivist epistemology is often associated with quantitative data collection methods. Phenomena are measured through objective measures (Easterby-Smith, Thorpe & Lowe, 2002; Gill & Johnson, 2002). Research can be classified as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing or the drawing of inferences about a phenomenon from a representative sample to a stated population (Orlikowski & Baroudi, 1991). Additionally, some descriptive data collection methods e.g. case study can also be classified as positivist, if it presents an objective, factual account of events.

The second category of epistemology is an interpretive epistemology which has received increasing attention. Unlike positivist assumptions, interpretive researchers do not regard the world as being comprised of a fixed constitution of objects, but rather as an emergent social process – as an extension of human consciousness and subjective experience (Orlikowski & Baroudi, 1991). Interpretive researchers assert that reality is a social product and hence incapable of being understood independent of the social actors. Knowledge of reality is gathered through social constructions such as language, consciousness, shared meanings, documents, tools and other artefacts (Klien & Myers, 1999). Interpretive research does not predefine dependent and independent variables, but focuses on the full complexity of human sense making as the situation emerges (Kaplan & Maxwell, 1994).

The third epistemology identified is critical research. Research can be classified as critical if the researcher attempts to critically evaluate and transform the social system under investigation (Orlikowski & Baroudi, 1991). Critical research focuses on the

oppositions, conflict and contradictions in contemporary society and seeks to eliminate the causes of alienation and domination (Myers, 1997). It is, however, recognized that human ability to improve conditions is constrained by various forms of social, cultural and political domination as well as natural laws and resource limitations (Klien & Myers, 1999).

The choice of a specific research method is independent of the underlying philosophical position adopted (Myers & Avison, 2002). Qualitative research can be positivist, interpretive or critical e.g. case study research can be positivist. Moreover, the three research epistemologies may be philosophically distinct but often in practice the distinctions are not always as clean cut. Some research is more difficult to classify than others.

4.3 INFORMATION SYSTEMS RESEARCH

The discipline which focuses on the development, use and impact of information technology in business and organisational settings is 'Information Systems' (IS) (Myers & Avison, 2002). This area of study only emerged in the 1960s, so it is relatively new. However, it has grown rapidly. Much of the early research in the field had a technical focus. In the 1980s, though, the focus shifted to management of IS. Then in the 1990s, the focus broadened considerably from the management of IS to the relationship between IS and the organisation as a whole (Myers & Avison, 2002). IS, as a field, has now expanded to include issues such as communication, and collaboration between people and organisations, inter-organisational systems, electronic commerce and the Internet.

A range of research traditions have not been evident in past IS research. Traditionally, the field of IS was regarded as residing within the province of technology and much IS research reflected a positivist orientation (Orlikowski & Baroudi, 1991). Research strategies have been primarily survey or lab-oriented. Increasingly, academics and practitioners have begun to realise that it is more appropriate to extend the focus of study to include behavioural and organizational considerations (Galliers & Land, 2002). Research interest has moved to issues such as how to improve the effectiveness of IS implementation in organisations or to assess the impact of information systems

on individuals and organisations. A number of researchers argue that the dominance of positivism and the lack of acknowledgement of the legitimacy of other research traditions, has often limited the areas of information systems that have been studied and has meant that some aspects of information system phenomena have been largely ignored (Galliers & Land, 2002; Orlikowski & Baroudi, 1991).

In general, there has been a shift in IS research away from technological to managerial and organisational issues (Benbasat, Goldstein & Mead, 1987; Myers, 1997). However, organisational, political and social contexts need to be understood to effectively explore these kinds of concerns. Unfortunately a lot of these issues are lost in quantitative research. Despite an almost hostile reaction to qualitative research in IS in the past (Markus & Lee, 1999), there has been a growing interest in the application of qualitative research in the IS field (Myers, 1997; Benbasat, Goldstein & Mead, 1987). Many researchers are now calling for greater diversity in the kinds of IS research approaches that are considered valid (Galliers & Land, 2002; Orlikowski & Baroudi, 1991). In particular, interpretive research has emerged as an important strand in IS. Overall, IS researchers should be more aware of the range of qualitative and quantitative research approaches and their philosophical biases. They then need to adopt a perspective that is compatible with their own research interests and predispositions, while remaining open to the possibility of other assumptions and interests (Orlikowksi & Baroudi, 1991).

The focus of this research was to look at the relationship between IRT and organisation's SCNs. To examine this concern, the organisational and social context needed to be understood. Therefore the underlying philosophy of the research essentially took an interpretive stance. The research aimed to gain an "understanding of the context of the information system, and the process whereby the information systems, influences and is influenced by its context" (Walsham, 1993). The research was contextualized and sought to gain an understanding and insight into different participant's perspectives on IRT and its role in SCNs and supply chains.

4.4 RESEARCH STRATEGY

The research strategy moves the research from the underlying philosophical assumptions to research design and data collection. This section outlines the research strategy that was adopted and discusses the theoretical frameworks that underpinned the research.

4.4.1 CASE STUDY STRATEGY

The area under investigation has been identified. The purpose of this section is to present, argue the validity of, and evaluate the case study strategy that was used to conduct the research study. Firstly, this section will begin with a definition of the case study strategy. Benbasat, Golstein and Mead (1987) argue that:

> **"A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used."**

Case studies consist of detailed investigations and allow research to be conducted in natural settings. The phenomenon is not isolated from its context (as in, say, laboratory research) but is of interest precisely because of its relation to its context (Hartley, 1994). A case study is researching a situation where the phenomenon and the context are entangled but this entanglement is pertinent to the study. Case studies can be concerned with the social context of organisations, groups, processes or individuals. A case study is not limited to a few variables like experiments. It is an all encompassing method that focuses on understanding the many dynamics present within particular settings.

A case study method was selected for a number of philosophical and practical reasons. There are many arguments for case study research being a viable IS research strategy. They "allow an investigation to retain the holistic and meaningful characteristics of real life events such as managerial processes" (Yin, 1994). Case studies are particularly appropriate for 'sticky' practice-based problems where the

experiences of the actors are important and the context of action is critical (Benbasat, Goldstein & Mead, 1987). This research traced the evolution of IRT as a communication channel in organisations and its applicability to SCNs and supply chain processes and consequently, considered the impact on intra-organisational and inter-organisational linkages, relationships and information sharing. The research needed to be contextualised, evolving and had to gather the subjective opinions of key actors in the SCN. Case studies are also appropriate for studying areas of research that few studies have been carried out. The nature of IS, is such that many areas are new and emerging and consequently research and theory are at there early, formative stages (Benbasat, Goldstein & Mead, 1987; Eisenhardt, 1989). Research on IRT and SCNs was still in its infancy and case studies could therefore be used to explore this new area of research and induce new theory.

There are also a number of practical reasons that case studies were the preferred option over other research approaches such as experiments or surveys. Experiments were not deemed practical as it would not be practical to control the key actors involved in the SCN. Also, the topic being studied required developments to be traced over time rather than on a one-off basis. Moreover, if a multiple set of experiments had been used, the nature of the research was such that it would have been extremely unlikely to find two organisations that exactly replicated each other. Although different organisations may use the technology for the purpose of enhancing the SCN, it is improbable that they would have exploited it in exactly the same way. Surveys, on the other hand, were quite limited for the nature of the topic. The topic included 'how' and 'why' questions e.g. how does IRT impact SCN linkages? why do they use it for sharing particular types of information? These issues were more explanatory and required an understanding of the nature and the complexity of the processes taking place. Surveys would of prevented adequate exploration of these issues. Overall, case studies use a wider array of techniques that are more suitable for exploring operational links over time rather than mere frequencies (Yin, 1994).

There are some key examples of case studies being used effectively in IS research. One of these will be highlighted. Markus (1983) shows the importance of organisational context in her well known case study research which explored the implementation of an information system. She examined the use of a 'production

planning and profit analysis system' in two manufacturing plants within the same division of an organisation. The system was readily accepted in one plant but was at first strongly rejected in the other (eventually it was put into use). Markus's research had to be carried out in a natural setting since it traced the evolution of the system's implementation from rejection to acceptance and the reasons for the switch. She was interested in answering a 'why' question. Markus proposed a 'distribution of power' model to explain the different reactions to the system. She also explained why one system was rejected at first, but was eventually accepted when the organisational conditions were changed, that had led to the initial rejection. Other research strategies would not have been able to as effectively study the research problem and explore the research questions.

A case study strategy has been argued as the most suitable approach to this research. Given that a case study strategy was pursued, a number of design issues needed to be addressed. The unit of analysis had to be defined, the number of cases and the time period of the cases had to be decided and the data collection methods that were to be used had to be determined.

Unit of Analysis: Every research should have a primary unit of analysis e.g. industry, organisation, process, group, project or individual. This is drawn from the identified research questions. It maintains the parameters of the research. It also helps if the researcher considers what generalisations are hoped to be made (Benbasat, Goldstein & Mead, 1987). For example, does the researcher hope to generalise to other organisation or other individuals? Moreover, there does not need to only be a single unit of analysis (i.e. holistic design) (Yin, 1994; Yin, 2003). There can be more than one unit of analysis. Within a case study strategy, subunits of analysis can be incorporated so that a more complex or embedded design is developed (Eisenhardt, 1989; Yin, 1994; Yin, 2003). The subunits can add significant value to the research and offer deeper and more extensive insights. However, it is vital that the subunits of analysis are related back to the original level of enquiry or unit of analysis. The primary unit of analysis for this research was the SCN. Subunits of analysis had to be explored such as supply chains, supply chain processes, supply chain linkages, information sharing and relationships between people in the SCN. These subunits were related back to the wider issue of the SCN.

Number of Cases: Another critical issue in the design of a case study strategy is whether it will involve single or multiple cases. Yin (2003) states that single case studies are appropriate if:

1. It represents a critical case in testing a well-formulated theory
2. It is an extreme or unique case
3. It is a representative or typical case
4. It is a revelatory case
5. It is being used as a longitudinal case

There are of course other situations that single case studies may be used. For example, a researcher may use it for exploratory purposes, before they conduct a multiple case study (Benbasat, Goldstein & Mead, 1987).

The evidence from multiple case studies is often found more compelling than single case studies (Yin, 2003). Multiple case studies are deemed to be more suitable when the intent of the research is description, theory building, or theory testing. They are not designed to follow 'sampling logic', like a questionnaire survey for example. Questionnaire surveys follow 'replication logic' and only with a certain amount of replications, will the original findings be considered robust and worthy of continued investigation (Yin, 2003). Multiple case studies allow for cross-case analysis (Benbasat, Goldstein & Mead, 1987) and the development of a rich theoretical framework. Overall, researchers need to distinguish what their research is aiming to do and consequently decide if a single or a multiple case study is most suitable. It should be noted though, that there are some circumstances that a multiple case study just simply can't be used e.g. when a researcher is studying a unique case. The basis of this research was multiple case studies. They were considered necessary to build up a rich and informative theory. The case studies were largely replicable but certain aspects of particular cases explored pertinent issues and followed particular leads.

Time Period of Cases: The time periods of case studies can vary as well. Orlikowski and Baroudi (1991) categorise the time period of case studies into four different categories: one-shot cross-sectional, cross-sectional over multiple time periods, longitudinal, and process traces. Cross-sectional are a static, one shot research of a phenomena and are the predominant form of research in information systems.

Multiple time periods employ some measure(s) administered at several time intervals. Longitudinal are where the researcher engages with the phenomena over an uninterrupted period of time e.g. a few months. The final category is process traces which are those case studies e.g. protocol analysis, that don't fit neatly into one of the previous categories. They employ continuous data collection but are not truly longitudinal as the trace is typically conducted over a single discrete event e.g. a problem solving exercise. It was anticipated that the time period of the case studies in this study would be one-shot cross-sectional. This was largely due to practical reasons. However, the researcher was able to return to the case studies to explore issues in more detail where it was deemed necessary. It took about a year and a half to conduct all of the case studies.

Data Collection Methods: The case study strategy is an all encompassing method that normally relies on multiple sources of evidence. Sources of data can include primary data and secondary data (Saunders, Lewis & Thornhill, 2000). Primary data can be collected through methods such as observation, interviews or questionnaires. Secondary data can arise from organisational communication such as e-mails or letters, formal reports, archival records, surveys, newspaper or journal articles and many other sources. The triangulation made possible by using multiple data collection methods provides stronger substantiation of constructs and hypothesis (Eisenhardt, 1989). It should also be noted that case study research can combine qualitative and quantitative evidence. Although the terms are used interchangeable (Yin, 1981), case study research can involve qualitative data only, quantitative only, or both (Yin, 1994). Moreover the combination of qualitative and quantitative data can be highly informative. The main data sources used for this research included semi-structured interviews, informal conversations, and e-mail correspondence. Other sources of data included the www, corporate websites, corporate reports, strategy documents, newsletters, organisational charts, internal surveys, system training manuals, internal correspondence, demonstrations, presentation materials, newspaper articles or publications on the organisation and the sector. A wide variety of data was sourced to build up a stronger pool of evidence.

Ensuring Validity: There are also a number of traditional concerns regarding case study strategies that have been raised (Gummesson, 2000; Hartley, 1994; Walsham,

1993; Yin, 1994). The case study strategy can be viewed sceptically by researchers who consider it lacking in rigor and objectivity (McCutcheon & Meredith, 1993; Yin, 1994). Measures have to be taken to ensure the robustness and quality of the research strategy. Yin (1994) suggests tactics for dealing with four different aspects of validity: construct validity, internal validity, external validity, reliability.

Construct validity can be ensured by using multiple sources of evidence to establish a full proof chain of evidence and cross-validation. Internal validity can be maintained by making sure that all rival explanations and possibilities are considered before making any inferences. Previous beliefs must be carefully articulated and every observation constantly questioned so as to help avoid being blinded or misdirected by what the researcher brings to the study (Kaplan & Maxwell, 1994). In order to guarantee external validity, an individual set of results should not be generalised to some broader theory without the theory being tested through replications of findings. To help ensure external validity a number of case studies were undertaken. Finally reliability must be maximised by making sure biases are eliminated from the study. Once conclusions have been drawn they can be verified through feedback from participants.

Providing Analytical Generalisations: A further concern is the lack of any basis for scientific generalisation e.g. Can you generalise from a single case study? This issue partly derives from a different interpretation of generalisation in qualitative and quantitative research. Yin (1994) states that:

> **"Case studies, like experiments, are generalizable to theoretical propositions and not to populations or universes." "The researchers goal is to expand and generalise theories (analytic generalisation) and not to enumerate frequencies (statistical generalisation)." (p. 10)**

Quantitative research are based on large numbers of observations, use techniques such as sample size, sampling frame, correlation and cause and effect relationships, and determine how much, how often and how many. They are making statistical generalisations. Qualitative research, on the other hand, make analytical

generalisation by generating, expanding and generalising theories i.e. case study generalisation is about theoretical propositions not about populations.

4.4.2 THEORETICAL UNDERPINNING

Assumptions inherent in a number of theories informed the case study research. The different theories were used as a valuable guide for the conduction and analysis of the case studies and where relevant were used to derive abstractions and generalisations.

Supply Chain Network Theories: A range of different theories and models emerged under the SCN literature in chapter 3. The key ones that were discussed included the Supply Chain Model. This was studied from different perspectives including the Global Supply Chain Forums model, the Value Chain model, the Value Shop, the Value Network and the Revised Value Chain model. These models indicated the key supply chain processes and activities for different types of organisations and supported the notion of supply chain linkages. Moreover, it has increasingly been recognised that the organisation's supply chain is part of a wider chain of events, a SCN. All of these models supported the analysis and understanding of the SCN, supply chains, processes, activities, linkages and for determining key players in the SCN in each of the case studies undertaken.

Media Choice Theories: Another set of theories that informed the research are those surrounding the selection of communication channels for organisational communication which were discussed in chapter 2. Firstly, MRT was introduced as a traditional theory that has been used to examine the conditions that influence the media chosen for different types of tasks. It uses a range of dimensions including the capacity for permitting instant feedback, the number of cues, the level of personalisation and language variety to assess the appropriateness of different channels for different situations. In contrast to this, a more recent body of research has emerged that contradicts MRT. They are in the form of social definition theories and highlight a broader range of organisational, social and situational dimensions. Collectively the different theories highlight a range of dimensions that will be taken into account for the selection of organisational communications channels. The different media choice theories went some way in understanding the pros and cons of

using particular communication channels and technologies and comprehending the reasons why certain channels were used in different situations.

Structuration Theory: Finally, Gidden's theory of structuration (1984) also informed the case study research. This is a higher level theory that has not been introduced in previous chapters. Firstly, the rational behind the theory will be explained, a few examples of its application will be given and the uses in this particular research will be explained.

In studying information technology, researchers commonly take an objective perspective. An objective perspective emphasises information technology's material characteristics and regards information technology as an object capable of impacting social systems. The social interactions and actions that may modify the impact of information systems are ignored. Other researchers have taken a solely subjective perspective that assumes that institutional properties have no influence and that the consequences of automation are mediated by the social interpretations of users. More recently, though, there has been a line of thought that considers it "improper to conceive of a social system merely as the product of either deliberate human action or of institutional forces" (Orlikowski & Robey, 1991; Walsham, 1993). In support of this view, it has been decided to draw on Gidden's structuration theory as a theoretical basis for researching the interaction of IRT and organisations. Gidden's (1984) proposes a "duality of structure" to explain social phenomena. The theory proposes that through being drawn on by people, structures and institutional properties of social systems shape interaction but it is only through interaction that the structures and institutional properties are reproduced. From Gidden's perspective, institutional properties and structure only exist as they are instantiated in action.

Orlikowski & Robey (1991) have developed a more general structuration model applied to information technology. On the one hand, institutional properties or information technology are an objective set of rules and resources involved in mediating (facilitating and constraining) human action. They will influence human action and values, norms and culture. On the other hand, institutional properties and information technology are the social product of subjective human action within specific structural and cultural contexts. They have to be used by humans to have any

effect. Although they can be a medium of human action and can enable or constrain activities from happening, they do not actually determine social practices. Furthermore, humans affect the institutional properties and information technology by sustaining them or changing them. The two influences operate continuously and simultaneously. In turn, they will determine the uptake of institutional properties and technology.

As well as offering a clearer explanation to the uptake of communication systems, structuration theory also eliminates "the artificial partitioning of research attention between macro and micro levels of analysis, because the process of structuration operates at multiple levels of analysis: individual, group and social system (organisation and society)" (Orliwoski & Robey, 1991, pp148). Overall, it is unsuitable to confine the analysis to one level. Structuration theory provides a theoretical basis for bridging levels of analysis. This constructs a more complete social theory and explores the dynamic interplay among individuals, technology and larger social structures (Markus & Robey, 1988).

Structuration theory has been adopted by organisational researchers in the analysis of organisational processes but has only more recently been applied by IS researchers. For example, Yates and Orlikowski (1992) draw on structuration theory to explain how the genres of organisational communication are embedded in social processes rather than the result of isolated rational actions. Orlikowski (1991) also uses the theory to examine the extent to which IT facilitates and changes forms of control and forms of organising when it is deployed in work processes.

The aim of this research was to investigate the role of IRT in organisations and in particular in their SCNs, processes, activities and linkages and consider the actual uptake of the technology in organisations as a means of supporting, developing and transforming relationships and information sharing across SCNs. The introduction of new communication systems and information technology was interpreted as an occasion for structuring organisations which both facilitates and constrains action. However, the nature and role of communication in organisations evolves as individuals interact with social institutions over time. By using structuration theory to explain the phenomena, the findings take account of institutional forces and social

interactions. This offers a clearer vision of the actual role of IRT in SCNs and it also makes the audience more aware of issues, complexities and problems surrounding the technology.

These various theories assisted the empirical research at the stages of preparing for the case studies, conducting the case studies and analysing the case studies. Furthermore, they guided the development of key generalisations and abstractions and the conclusions and recommendation stages. Overall, they contributed to the achievement of the key research aims and objectives.

4.5. CASE STUDIES

The case study strategy was argued in section 4.4.1. The primary unit of analysis was identified as the SCNs with supply chains, supply chain processes, supply chain linkages, relationships and information sharing being subunits of analysis. Multiple case studies were chosen, generally one-shot cross-sectional, using a plethora of data collection methods. Semi-structured interviews were one of the key data collection methods. Tactics for ensuring validity were taken into account and the purpose of the case studies was to make analytical generalisations. This remainder of the chapter is now going to look at the case studies conducted in more detail. This will include the selection process, the questions that were asked, the conduction of the case studies, an overview of each case study, the actual case studies and the techniques for analysing the case studies.

4.5.1 SELECTING THE CASE STUDIES

The strategy for the research entailed multiple case studies. A lot of thought was put into the selection of the sites for conducting the case studies. The starting point for the selection process was to consider the nature of the research topic and consequently the suitability of organisations for the research. It was decided that large organisations would be pursued as they were more likely to be more advanced in their application of IRT to supply chains and supply chain processes. The purpose of the research was to advance the theory and knowledge in an under developed field. Moreover, they

were likely to have a greater diversity of business to business linkages with other organisation's supply chains and inter-organisational relationships.

Characteristics that were considered about the organisations were their size, structure, industry, geographical coverage, diversity of their SCN and the level of inroads they had made in developing Internet technology for communicating along their supply chain. Taking these selection criteria into account, a number of organisations were approached and contacts pursued. The total number of case studies conducted depended on how much information could be gathered from each case study and how much time organisations would be prepared to give up. Obviously, further research into each organisation depended on the organisation's co-operation. Confidentiality was emphasised and assured to organisations. Some of the organisations gave permission for research to be undertaken. The research ended up involving 7 case studies.

CASE STUDY	TYPE OF ORGANISATION/ INDUSTRY	PROCESS FOCUSED ON:
Case Study A	Manufacturer, Telecommunications industry	Non-production related procurement
Case Study B	Utility Service Provider	Invoicing, Management Reporting, Asset Inspection
Case Study C	Manufacturer, IT industry	Customer Service & Support
Case Study D	Manufacturer, Engineering Industry	Logistics/ Business Despatch
Case Study E	Manufacturer, Automobile industry	Dealer Business Planning, Order Fulfilment
Case Study F	Utility Service Provider	Provision of material goods and services
Case Study G	Manufacturer, IT industry	Materials Process (Business Forecasting, Material Requirement Planning, Customer Ordering, Material Replenishment, Order Fulfilment) Testing

Table 4.1: Supply Chain Processes Studied in each Case Study

Organisational supply chains are so vast that it was impossible to analyse every part of an organisation's supply chain in detail. In fact in an ideal world the whole SCN would have been studied i.e. the supply chains of each organisation in the SCN. The most practical approach was to study particular parts of a supply chain, but study

them in relation to the overall SCN. This normally involved studying an organisation's supply chain processes or a few processes if access would allow. Most of the processes studied involved other organisations in the SCN. The supply chain processes that were studied in more detail, in each case study, are summarised in table 4.1.

4.5.2 CASE STUDY QUESTIONS

The case studies commenced with an initial outline of the main questions that were to be pursued. The overarching aim of the research was to find out about the role of IRT in SCNs. The research objectives were described in the summary section of chapter 3 and a conceptual framework was illustrated on Figure 1.1. Given these aims and objectives and the knowledge gained through the literature review, the questions were divided into four main categories: organisational, technological infrastructure, supply chain processes, evaluation. Furthermore, the researcher was also aiming to gather a notional understanding of the contextual and cultural setting for each case study. This section will outline the different categories of questions.

Organisational: The first category of questions related to general organisational issues. These involved finding out facts like what business the organisation was in, the products and services they offered, the location of the organisation, how many people were employed and the structure of the organisation. It was useful to find out how many subsidiaries the organisation had and where they were located. Moreover, it was important to try and gain an insight into the workings of their supply chain and the processes they were involved in and consequently any linkages the organisation had with other organisations e.g. suppliers, customers, logistic providers, collaborators.

Technological Infrastructure: The second category of questions was regarding the organisation's technological infrastructure. It was useful where a before and after picture of their infrastructure could be formed i.e. what was the infrastructure like before IRT was introduced and what was it like after. A number of details were sought about the existing infrastructure. This included information about the organisation's use of the Internet, the development of their organisational intranet, the

types of information that were available on the intranet and any tools, facilities, or applications that had been developed to operate on the organisational intranet. Further details were collected on the methods the organisation used to connect to the Internet which gave some indication on communication speeds and quality. Specific information was sought on technological linkages with other organisations and if they used any specific technology other than the Internet e.g. EDI. It also needed to be established, what aspects of the intranet had been made available to other organisations or people out with the organisation, the types of information that were available to them and the levels of access.

Supply Chain Processes: The third category involved gaining an overall understanding of the activities that were involved in the industry's supply chain and the organisation's supply chain. Questions tried to decipher which parts of the SCN and the supply chain operated over the Internet, the corporate intranet and were accessible to external organisations.

Information was also sought on particular supply chain processes with the focus being on the main activities involved in the supply chain process, the types of information that were required for each activity and the people, departments and organisations that were involved in the process. Most importantly, the research tried to decipher how the activities within the process had been developed by IRT, the types of IRT that were being used and the types of information and facilities that were available. Information needed to be gathered on how well web-based process systems were linked internally to other supply chain processes and externally to other organisations' supply chain processes. Interviews also pooled information on any interviewees as well like their position within the organisation, the activities they were involved in, the types of information they needed for their job and who they needed to interact with. This helped to understand the perspective they were coming from when they participated in the interview.

Evaluation: The fourth category of questions involved evaluating the role of IRT in SCNs. Information was sought on people's opinions of IRT as a communication channel, its suitability for supply chain processes, the benefits that had been gained

through IRT and the difficulties or downsides that it brought about. Wherever possible, information on the benefits and downsides were collected using a variety of data collection methods such as existing employee surveys, cost-benefit analysis etc. The questions tried to identify any particular supply chain processes or activities that did not appear to work well with IRT and possible reasons for this. Furthermore, any aspects of the supply chains or supply chain processes that could be improved in the future were identified.

Questions probed any changes in the mix of communication channels used for supply chain processes and the content of the communication. For example, had IRT led to less face to face communication? What tools and facilities were used for communicating over the Internet? They were also questioned on whether or not they regarded the content of the communication to have changed in terms of accuracy, timeliness, depth, volume, formality, level of interactivity etc.

Based on the changes in communication channels, they were questioned on the impact that this has had on relationships with people internally and externally. For example, was the supply chain activities conducted more individually or collectively? Was there any change in the level of collaboration, trust, sharing of information, patterns of communication etc? Did it enable them to build up linkages and relationships with people or organisations that they were unable to before?

Context: Finally, it was also important that the questions and data collection methods provided a notional understanding of the contextual and cultural setting of each case study. This contributed to the development and advancement of theories. A few specific questions tried to pick up on some of these contextual and cultural issues. However, a better understanding of many of these issues was gathered through general observation, informal conversations and using secondary data sources.

Contextual issues included information on the type of industry the organisation was involved in, any developments in the organisation's industry, the history of the organisation and how advanced it was with technology. Cultural issues also involved the researcher trying to gain an insight into the structure, management style, ethos etc. and trying to understand the softer aspects of culture such as motivation, openness and

social systems that were going on in the organisation. As indicated in chapter 2, the cultural environment influences who talks to who, the language and cues that are used and the meanings that they attach to certain messages. It also influences the way that people perceive technology and their uptake in using the technology. Therefore, it was useful to try and understand what changes in organisational communication, if any, were down to culture. Some measure of the impact of the culture on the communication system aimed to be achieved. In line with structuration theory, questions needed to explore how much influence the employees had on the uptake of new communication systems.

A summary of the types of questions that were pursued are outlined in Appendix I. The case studies attempted to meet the research objectives by posing increasingly specific questions within each case.

4.5.3 CONDUCTING THE CASE STUDIES

A case study strategy was argued as the most effective strategy for this particular research with semi-structured interviews being the main data collection method but supplemented with informal correspondence and a range of secondary data sources. Semi-structured interviews were conducted with top management (strategic), middle management (tactical), operational management (operational), IS specialists and end users wherever possible. Furthermore, some cases had the added advantage of the researcher being able to interview suppliers, customers or service providers that were linked to the organisation.

The empirical research began with case study A which was based on an organisation in the telecommunications industry and focused on their procurement supply chain process. The researcher started by accessing secondary data using data collection techniques such as the corporate web site, company brochures, corporate reports and newspaper articles to gain some general background knowledge about the organisation and the telecommunication industry. Further background reading was undertaken using the www, books and articles to achieve a greater understanding of the procurement process in general.

The researcher then undertook various semi-structured interviews with the Implementation Manager, IT Business Analyst for the procurement system, procurement specialists and finally the end users of the system. Top management were able to provide more information on organisational issues and in this particular case, the Implementation Manager and the Business Analyst were able to answer more specific questions regarding the technological infrastructure than other interviewees. All the respondents were able to provide details regarding the role of IRT in the procurement process and an evaluation of the benefits and limitations. A number of semi-structured interviews were conducted to ensure that all rival explanations and possibilities were being explored and a better understanding of the process was sought by interviewing different levels of employees. The researcher took handwritten notes during each interview and then typed them up in a more coherent manner immediately afterwards.

As the interviews were undertaken, further information was gathered from data sources such as corporate documents, newsletters, organisations charts, internal surveys, training materials, demonstrations, presentation material etc. Each interview was followed up with e-mail correspondence to either clarify areas or pursue further lines of inquest. An insight into the context and culture of the organisation was also achieved through talking to people, visiting the organisation and observing what people were doing. Direct observation was a useful source of data for observing behaviour, social systems, environmental conditions etc.

A major strength of the case study strategy was the opportunity to use multiple sources of evidence. Multiple sources of evidence provided multiple measures of the same phenomenon. The different sources of evidence could be used to develop convergent lines of inquiry (Yin, 2003) and stronger substantiation of constructs and hypothesis (Eisenhardt, 1989). This also ensured that construct and internal validity were attained throughout the empirical research.

For example, the semi-structured interviews tended to provide insights and explanations into various matters. They were also often useful for initiating access to other data sources such as documentation like organisational charts or survey results.

This helped to corroborate or contradict evidence from the semi-structured interviews and verify if certain inferences that the researcher had made were actually correct. It was even useful for verifying data such as the names of people, technical terms, specific figures, correct spellings etc. Documentation also provided clues for further lines of investigation which perhaps involved the researcher returning to the informants that were interviewed. Observation additionally helped to corroborate evidence. For example, the demonstration of the procurement system in case study A helped to demonstrate the benefits and limitations or problems with the IRT and aided in furthering the researchers appreciation.

Case Study B was then conducted in a similar manner to case study A. Questions were modified a little after the first couple of case studies as it became clearer what the key areas of interest were. As the researcher started to see patterns, or discovered behaviour that seemed difficult to understand, new questions invariably arose. All the questions could not be fully anticipated in advance. This meant going back to respondents and probing some issues further so that the areas that information was collected across the case studies were consistent. Case Study C and D were then conducted. Again, a little modification was made to the questions following these case studies. This meant revisiting the case studies already conducted. Finally, case study E, F and G were undertaken. Seven case studies were conducted in total.

Construct and internal validity were also improved by getting the informants to read the draft and final copies of case study material and provide feedback. This was conducted in three stages. The first stage involved providing each interviewee with a typed copy of their interview and attaining feedback. The second stage involved providing an organisational representative with a copy of the overall case study. Representatives provided comments on the accuracy and validity of the researchers understanding and interpretation of the data collected. In some cases, they requested that certain information was omitted, added or edited in some way. The third stage was less formal and was conducted at the latter stages of the research. This involved providing a summarised overview of the salient findings of the thesis.

The research questions varied slightly between case studies depending on the organisational context, the supply chain processes being studied and the people being

interviewed. A case study based on the procurement process and a case study based on the customer service and support process, for example, involved slightly different questions. Moreover, all of the questions could not be adequately answered by everyone interviewed in each case study. For example, managers could answer questions more capably regarding the strategic direction of the organisation, IS specialists were obviously more capable to answer questions regarding technological infrastructure etc.

A case study folder was set up for each case study. The folder provided an organised chain of evidence collated in each study including printed web sites, all the handwritten and typed interview notes, relevant documentation etc. This was then available for later access especially through the analysis stages of the research. The following section provides a summary of each of the case studies.

4.5.4 OVERVIEW OF CASE STUDIES

This section provides an overview of each of the seven case studies conducted. Although information was gathered on organisational aspects in each case, most of the organisations studied requested that they remained anonymous throughout the thesis. Therefore the decision was taken to keep all the organisations anonymous. Consequently, most of the organisational information collected was only used for background information, preparation for the interviews and to enable the researcher to pursue particular lines of questioning for each case. There were also some detailed materials that were made available to the author but were to remain confidential e.g. specific cost saving figures. Consequently, these types of information were also omitted from the appendices. However, the information still contributed to the author's overall understanding of the supply chain processes and the impact that IRT were having.

There are many different forms of presenting case studies. Van der Blonk(2003) introduces two dimensions that could be considered when reporting the cases. The first dimension refers to the level of complexity that the researcher wants to portray in the account of the case study. It is split between attempting to understand the case through reduction and attempting to understand the complexity of the case. The first

position (reduction) reduces the richness and variety of the case into a predefined format so that a pattern, insight or clear storyline is generated. With the cases conducted in this research, the processes were so diverse that the researcher found that they had to constantly negotiate and strive to find elements of standardization in each of the case studies so that the cases could be compared and contrasted. The second position (complexity) tries to understand the complexity and variety of the case study by including, for example, contradictory material or extreme opinions.

The second dimension to be considered in presenting the case studies is the extent to which the researcher describes the case from a distant view (the viewpoint of the researcher) or includes different characters and viewpoints in the account. In the first position the author tells the story in their way. In the second position, the case would be presented as an interaction of multiple voices Although the researcher interviewed different people to gain a fuller understanding of each case, the researcher essentially integrated the views of the different interviewees and wrote it up uniformly. The written cases don't explicitly outline the different interviewee's interpretations. In conclusion, a description is provided of each case study in the remainder of section 4.5.4 and the empirical data collated in each of the case studies are described in the indicated appendices.

Case Study A (Appendix II):

Case Study A involved a large international manufacturing organisation from the telecommunications industry with over 120,000 employees. A series of interviews were undertaken to gather information about the organisation's use of IRT in their Internet-based procurement system for non-production related goods. Interviews involved the Implementation Manager and IT Business Analyst for the Procurement System, Procurement Specialists and users of the system. The author had the opportunity to personally view the procurement system and gain an insight through corporate presentations. The findings are illustrated in Appendix II. Many of the activities involved in the procurement process were very routine but nevertheless time consuming. These activities were easily and effectively mirrored in the system. Overall, the system provided endless benefits to the organisation and employees including flexibility, improved cycle time, accountability and significant cost and time

savings. Furthermore, the system opened up the amount and depth of information available to the suppliers of non-production related goods.

Case study B (Appendix III):

An organisation in the utility sector was the focus of case study B. The organisation was a major international energy group, operating in electricity, gas and telephony markets, in residential and business sectors. Semi-structured interviews were arranged with management, IT specialists and employees of the organisation to discuss the development of the IRT within the UK division. The questions revolved around the technological infrastructure, the supply chain activities that had been developed using the Internet and its impact on daily operations. There were three main supply chain processes that had been advanced. These included invoicing, management reporting and asset inspection. The organisation had also used the technology for sales and billing of residential and small to medium businesses. Some data was gathered on this area for information but it was not the focus of the research. The focus of the research was business to business advancements. Corporate reports and other resources were also accessed. The findings are outlined in Appendix III.

Case study C (Appendix IV):

Case Study C was concerned with a large, international, IT-orientated organisation. This case study involved gathering information on the organisation's intranet and the application of the IRT to the Customer Service and Support process. A number of semi-structured interviews were conducted with key informants including top management, the eSupport & Systems Manager and members of the Customer Services and Support team. These aimed to get the perspectives of managers, IT staff, employees and customers. Materials such as corporate presentations and articles were accessed and questionnaire survey results were also discussed.

A vast amount of service and support traditionally provided over the phone or face to face was now being provided electronically using IRT. The benefits of the technologies were its 24 hour availability, easy accessibility and its ability to build a trail of information that can be used to enhance the levels of support and service. Many different links, tools and applications were provided to customers and service and support could be personalised for customers over the web, using portal facilities.

The organisation employs virtual team working across many of the business functions. This particular function or process was by far the biggest user of virtual teams in the organisation. The nature of the process is such that it benefits from the collective input of different specialists. Furthermore, mobile technology is expected to play a large role in Customer Services and Support in the future. This case is outlined in Appendix IV.

Case study D (Appendix V):

Case Study D was based on a worldwide manufacturer of specialised equipment and a provider of engineering services in the engineering industry. As well as gathering information on the organisation's technological infrastructure, the case study involved a detailed analysis of the role of IRT in their Business Despatch process. Semi-structured interviews were conducted with the Information Systems manager, Systems Developer, Business Despatch Specialists and representatives from one of their logistics providers. By interviewing representatives from different organisations in the SCN, the researcher was able to gain a better understanding of the Business Despatch process and the developments that were being made in the process as a result of IRT from a variety of perspectives. The findings of this case study are presented in Appendix V.

The case study illustrated that IRT had streamlined the Business Despatch process in that it had created some opportunities for simplifying the movement of goods, transportation information was more readily available, information was more accurate and only needed to be entered once and it could be manipulated accordingly for different needs at different stages of the supply chain process. However, the IRT still had plenty of scope for being advanced within the process further. Even given this, the Business Despatch process appeared to have progressed more successfully with organisations that had a strong, long-standing relationship with the logistics provider. Organisations that used the logistics provider periodically had problems with customer orders being late or going astray. The case study indicated that technology is not enough on its own for developing coordinated and coherent logistics services.

Case study E (Appendix VI):

Case Study E was concerned with a manufacturer in the automobile industry. The organisation was made up of National Sales Companies (NSCs). Car dealerships ordered cars from the NSCs and subsequently soldl them on to individual customers. In particular the case study examined the manufacturer's order fulfilment process. A web-based ordering system had recently been introduced into the organisation which was accessible by car dealers and was used to order cars from the NSCs.

Again, semi-structured interviews were carried out with one of the organisation's Commercial Vehicle Zone Manager, an Area Manager, a Commercial Vehicle Sales Manager based at a dealer and an employee involved in the Dealer Business Planning. The data collated is described in Appendix VI.

The key development in the order fulfilment process had been the improved visibility offered by the web-based ordering system for internal employees and also external dealers. Opening up the availability of information to key players had benefited the organisation and dealers. It was now possible to view all the orders that were in the manufacturing pipeline, the status of these orders, and provided the ability to snatch unsold orders and amend orders when they were already progressing down the pipeline. This had led to reduced levels of stock, reduced the level of products out of date, improved customer choice and provided quicker delivery.

Case study F (Appendix VII):

The sixth case study was based on a large organisation in the utility sector. Communication was considered a high priority in the organisation and the intranet was now regarded as a key communication tool. This is reflected in the plans they have for investing in the intranet in the future. Several semi-structured interviews were conducted.

The focus of this case study was the supply chain process that involved acquiring material goods and services. This process was composed of a number of activities. The interviews indicated that many standardised activities e.g. finance, requisitions, supplier lists etc. were particularly suited to the Intranet. Other activities such as technical interaction was still conducted face to face and top management face to face

interaction was used for large, high spend projects. Overall, although the intranet was considered a huge benefit to the company and a key communication tool, face to face communication was still considered the most vital mode of communication. Teams were considered the necessary underlying structure of the supply chain activities and again the intranet facilitated virtual communication between team members and team transparency. This case study is outlined in Appendix VII.

Case study G (Appendix VIII):

Case study G involved a large, global organisation in the IT industry. The organisation had numerous manufacturing sites and distribution centres. It collaborated with multiple external manufacturing partners, has long standing relationships with many leading, worldwide suppliers and delivered solutions for numerous customers.

Numerous semi-structured interviews were conducted, involving the Director of Engineering, the Sites Materials Manager and the Testing Engineering Manager. For ease the case was split into three main sections. The researcher was provided with various demonstrations and had access to several presentations. Details of the case are enclosed in Appendix VIII.

The first section provides an insight into the infrastructure including the information, tools and facilities that were available on the organisation's intranet. The second section focuses on the impact of IRT on SCM and in particular, the Materials process. The main areas of discussion were the fully integrated web-based SCM system and links with suppliers, customers and logistic providers. The final section focuses on the Testing process. Again, a range of tools and applications used are described and the impact of IRT on the process is highlighted.

From the case study undertaken, it is apparent that the IRT was being used substantially throughout the organisation. A variety of information, tools and applications were widely available. Internally, the technology had been applied to numerous processes, substantially developing them and most importantly, the organisation had developed a fully integrated end to end SCM system handling demand replenishment etc. This was available externally to major suppliers,

customers and logistic providers. This helped to develop closer relationships between major players, provide direct communication links and improve the efficiency of the overall supply chain.

4.5.5 ANALYSING THE CASE STUDIES

The next key element of the case study strategy was the analysis. The basic goal of qualitative data analysis is to develop an understanding or interpretation of "What is going on here?" It involves searching for some kind of coherence or order (Kaplan & Maxwell, 1994). A striking feature of research that builds theory from case studies is the frequent overlap of data analysis with data collection (Glaser & Strauss, 1967). Data analysis is an iterative process between field data and theory that takes place and evolves over time (Walsham, 1995b). It is only by undertaking cycles of data analysis that a satisfactory rational interpretation can be reached.

As the case studies were undertaken for this research, ongoing data analysis was conducted to try and achieve a satisfactory level of understanding. The data analysis undertaken at the beginning developed an initial conception of the setting and perspectives of the people being studied. That understanding was then tested, modified and developed through additional cycles of data collection and analysis until an adequately coherent interpretation was reached. Overlapping data analysis with data collection not only gives researchers a head start in analysis but, more importantly, allows researchers to take advantage of flexible data collection. Indeed a key feature of theory-building case research is the freedom to make adjustments during the data collection process to probe emerging themes (Eisenhardt, 1989).

Qualitative methods of analysis are concerned primarily with textual analysis (whether written or verbal) (Myers, 1997). A couple of methods of qualitative data analysis will be outlined that were employed in this study.

Hermeneutics: A mode of analysis that will be given particular attention is hermeneutics. This is a major branch of interpretive philosophy, with Gadamer and Ricoeur arguably being its most well known exponents (Boland, 1991; Myers, 1997). Hermeneutics is concerned with understanding the meaning of a text or text-analogue

(an example of text analogue being an organisation, which the researcher comes to understand through oral or written text). Taylor says

> **"Interpretation, in the sense relevant to hermeneutics, is an attempt to make clear, to make sense of an object of study. This object must, therefore, be a text, or a text-analogue, which in some way is confused, incomplete, cloudy, seemingly contradictory – in one way or another, unclear. The interpretation aims to bring to light an underlying coherence or sense" (Myers, 1997, p9)**

Klien & Myers(1999) propose seven principles that can be applied to the conduct, evaluation and reporting of interpretive research of a hermeneutic nature. The principles have been derived from philosophical writings that are considered classical contributions to interpretivism.

The most fundamental principle is that of the hermeneutic circle. This principle stems from ancient rhetoric, and modern hermeneutics has taken it and applied it to the art of understanding. In terms of language, Gadamer suggests,

> **"that we must, construe a sentence before we attempt to understand the individual parts of the sentence in their linguistic meaning. But this process of construing is itself already governed by an expectation of meaning that follows from the context of what has gone before. It is also necessary for this expected meaning to be adjusted if the text calls for it. This means that the text acquires the unity of a meaning from another expected meaning. Thus the movement of understanding is constantly from the whole to the part and back to the whole" (Gadamer, 1976, pp117).**

In terms of research, the principle advocates that the researcher should consider the whole phenomena and reach an understanding by investigating the individual parts of the phenomena under investigation. By gaining an appreciation of the individual parts and their interrelationships, the researcher is then able to improve their knowledge of

the whole context and in turn further improve their understanding of the parts. This movement of understanding is constantly from the whole to the part and back to the whole. It is referred to as the hermeneutic circle.

The second principle is that of contextualisation. It is proposed that the researcher needs to critically reflect on the social, political, economical and historical background so that the intended audience can gain a better understanding of how the current situation under investigation emerged. Additionally, the next principle requires the researcher to reflect on how the research materials were socially constructed through the interaction between the researcher and the participants. The facts that are produced are part and parcel of the social interaction of the researcher and the participants.

The fourth principle proposes that outcomes of the research may be abstractions and generalisations. It has already been argued that one outcome of case study research can be analytical generalisation as opposed to statistical generalisation. This principle requires relating the interpretations to theoretical concepts.

A further principle suggested by Klein and Myers is the principle of dialogical reasoning. The researcher should make any preconceptions that have guided the original research design as transparent as possible to the reader. The sixth principle suggests that the researcher should seek out and document multiple viewpoints along with the reasons for them. The researcher should study the phenomena from different perspectives so that they gain an understanding of the whole picture. Finally, the principle of suspicion is proposed. Researchers should be sensitive to possible 'biases' and 'distortions' in the narratives collected from the participants.

Klein and Myers are not suggesting that all these principles should be sequentially applied to all research. They are suggesting that researchers should exercise their judgement and discretion in applying the principles that are relevant to their research as and when they are required.

Various IS researchers have used hermeneutics as a mean of analysing their data in qualitative research (Lee, 1994a; Myers, 1995; Orlikoswki, 1991). For example, Lee

(1994a) studied the information richness in e-mail communications. His empirical findings highlighted that electronic mail, despite what MRT would lead us to expect, can readily support rich communication. Knowing that e-mail can readily support rich communication, however, is not the same as knowing how the richness occurs. In order to understand this, Lee identifies a number of concepts central to interpretive research and hermeneutics in particular and draws on these concepts to provide an account of how the richness occurs in e-mail communications. The medium of e-mail is, in itself, neither rich nor lean. Rather, when richness occurs, it is an emergent property of the interaction of the e-mail medium with its organizational context. Lee's study iterates between the separate message fragments of individual e-mail participants as parts and the global context that determines the full meanings of the separate messages to interpret the message exchange as a whole. He discovers that the richness or leanness of communication is not an invariant property of the electronic mail medium but an emergent property of the interaction of the electronic mail medium within its organisational context. The study effectively demonstrates the deployment of hermeneutic concepts to interpretive IS research.

Some of the principles suggested by Klein and Myers loosely guided the collection and analysis of the data in this research. In IS research, hermeneutic analysis tries to make sense of relationships between organisations, people, processes and information technology. Some of the principles were used in explaining and building a coherent framework of how IRT may impact organisations and the influence that the organisational context can have. These principles were selectively applied during the analysis stage.

Key Themes & Patterns:

The initial drive in data collection and analysis is for the researcher to make sense of what is encountered in the field. At some point though there must be a subtle shift to sharing this knowledge with others by means of a coherent argument (Holliday, 2002). The search for meaning is often a search for patterns or correspondence (Stake, 1995). Holliday promotes the formation of themes as a means of organising writing and building up a reasoned argument. This is represented in Figure 4.1.

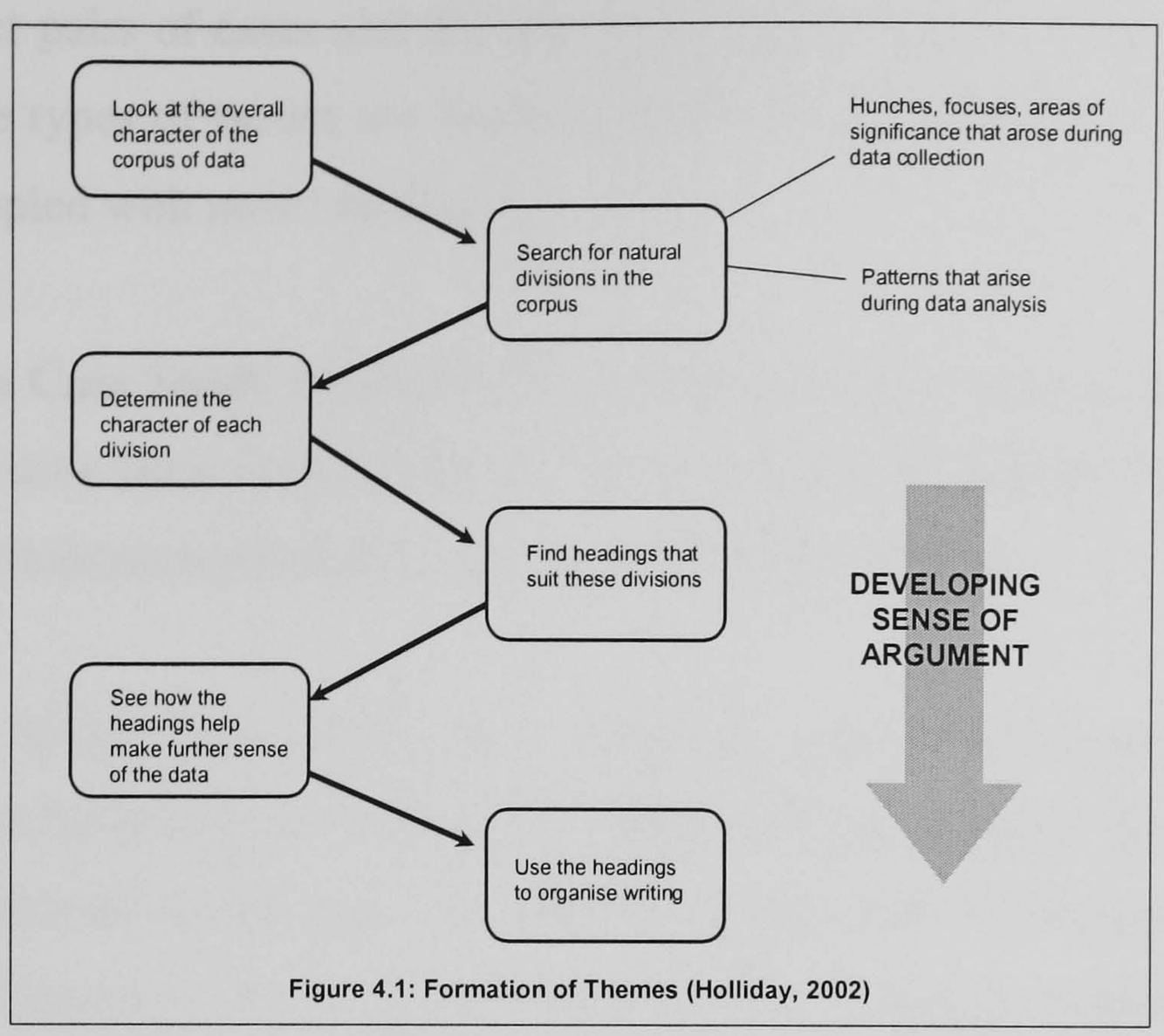


Figure 4.1: Formation of Themes (Holliday, 2002)

As the case studies are completed the researcher has to make sense of the corpus of raw data collected. The data has to be analysed for significant patterns and themes. Often areas of focus have been growing in the researchers mind from what has been learnt from data collection. The patterns and areas of focus are manipulated and divided under different thematic headings. The headings can then become sections or chapters. Under each section or chapter, data is extracted from the corpus, integrated and used as evidence in the ongoing argument. A sense of argument develops throughout the process. The development of the argument and the development of themes are interconnected.

Eisenhardt (1989) provides more specific guidance for analysing case studies and developing themes. In particular she suggests within-case analysis and searching for cross-case patterns. During within-case analysis, the researcher will closely study individual cases and become totally familiar with them as stand-alone entities. It is likely to take place in parallel with the detailed write-up of each case study and allows the unique patterns of each case to emerge before researchers push to generalise patterns across cases. A rich familiarity with each case, will in turn, accelerate cross-case comparison. The cross-case search for patterns involves comparing and contrasting multiple case studies. One tactic may be to select categories or dimensions

and then look through all the case studies for similarities and differences. A second tactic is to select pairs of cases and then list the similarities and differences between each pair. These types of tactics are likely to improve the likelihood of accurate and valid theory coupled with novel findings.

Conducting the Case Study Analysis: The methods of data analysis that were used in this research have been outlined above. These included techniques for developing key themes and techniques emerging from the hermeneutics field.

The seven case studies were conducted in sequential order. As each case study was conducted, the researcher tried to attain a greater understanding of the information that had been gathered in each case. The researcher undertook in-case analysis to gain a fuller comprehension of the multiple sources of data collected in each case study. This was achieved by reading the data over and over again and again, corroborating different sources of data, looked for similar and contradictory evidence and checking all rival explanations had been explored. It also involved going back to informants and other data sources, re-writing the cases and so on. There were lots of revisions. The case study was eventually written up uniformly and individual views and sources were integrated.

After thorough in-case analysis had been undertaken for case study A, B and C, the researcher felt that they were in a position to search for patterns and relationships between the various case studies (cross-case analysis). An initial set of themes or patterns were drawn out using cross-case analysis. These themes and patterns were influenced by the literature review to a certain extent as the literature review had provided the basis for the formulation of the objectives, directed the initial lines of enquiry and suggested dimensions and issues that were pertinent to organisations. For example, the literature provided guidance on the way in which organisations were developing their infrastructure and some of the supply chain processes that the infrastructure was gradually supporting. However, other more complex themes emerged purely through the case study analysis.

The initial themes that emerged included the use of Internet technology as a general organisational communication tool, linking different types of tools and technologies,

its use in streamlining supply chain processes, linking supply chain processes and the suitability of using IRT for some supply chain activities more than others. A range of benefits were also emerging such as visibility, efficiency, accessibility and an increase in information content as were a range of limitations such as culture, legal and technological issues. The need for integrated systems was also highlighted as were different linkages with suppliers and customers and the need for good relationships. Future developments that organisations were considering were highlighted as well. At this stage the themes were still very 'woolly' and an initial draft of one large analysis chapter was created.

Tactics suggested by Eisenhardt were then employed. Using the initial list of themes that had emerged, the researcher was then able to check for evidence of selected dimensions in each of the case studies e.g. Did all the organisations have the same level of linkages between supply chain systems? What types of future developments had each organisation planned? The researcher was also able to check across the different case studies for similarities and differences e.g. Were there similarities in the types of supply chain processes and activities that were being automised? Were organisations achieving similar benefits? Were the factors that are hampering the success of IRT in the different organisations different?

The principle of the hermeneutic circle was also taken on board at this stage to improve the researcher's movement of understanding. Once the case studies had been studied collectively, the researcher went back and studied each case study again and then undertook further cross-case analysis between the case studies to identify any further emerging themes. This process continued until the researcher was satisfied that they had explored all possibilities. The researcher felt that their overall understanding of IRT and SCNs grew and grew as they undertook more and more case study analysis.

The list of themes expanded and expanded. Although, through analysing them in more detail, it became apparent that there was a lot of overlap between them and that they could be manipulated and divided into a broader, more manageable set of thematic headings e.g. role of IRT in organisational communication, intra and inter-organisational supply chain processes, intra and inter-organisational SCN linkages,

intra and inter-organisational SCN information sharing, intra and inter-organisational partnerships, intra and inter-organisational teams, benefits of IRT, limitations of IRT, factors hampering the success of IRT, future developments etc. This was in line with recommendations promoted by Holliday (2002).

The researcher then undertook case study D, some further analysis, case study E, some further analysis, case study F and some further analysis again. Additional analysis provided more and more details of emerging themes. The headings of the main themes and sub-themes had to be continually revised to maintain some kind of coherence and manageability over the ever increasing corpus of data. By the time the researcher reached case study G, there weren't really any new themes or patterns emerging. It was only really verifying what the researcher had established already. Therefore, the researcher comfortably stopped conducting case studies after the seventh case study.

The final themes were grouped under four main thematic headings and lots of sub-headings. The first main heading was IRT and Organisational Communication which included a collection of more general sub-themes. The second main heading was Intranets and Supply Chain Processes which involved process-oriented themes with more of an intra-organisational focus. Through continually analysing, comparing and contrasting data sets, more novel findings emerged that comprised the third and fourth main headings. The third heading was Virtual Supply Chain Linkages and Information Sharing and it involved sub-themes with a technological or information-oriented theme. The fourth heading was Supply Chain Networks and Virtual Relationships and involved people-oriented themes. The latter two headings had more of an inter-organisational focus which was a more novel emerging trend across SCNs that came out of the empirical research. The first two headings formed chapter five, the third heading formed chapter six and the fourth heading formed chapter seven. Sub-themes such as the benefits of IRT, limitations of IRT and the factors hampering the success of IRT were distributed across the three chapters as they either tended to be process, technologically, information or people oriented.

The researcher actually discovered that rather than the writing up of the outcomes of the data analysis being a sterile phase at the end of the research, it was more like an

ongoing struggle with the research material and was a key development tool in shaping ideas, theories and concepts. The findings had to keep being structured and restructured as they became more complex and detailed. Moreover, it was only after many cycles that a coherent set of ideas and themes could be presented.

Overall, the various methods of data collection and data analysis ensured a high standard of research was achieved. They embraced multiple sources of evidence, investigated the viewpoints of multiple stakeholders and their multiple interpretations and questioned the surface of data collected. The analysis provided a clearer comprehension, understanding and sense of explanation regarding the phenomena. The in-case analysis allowed unique patterns to emerge from each case study and provided a rich familiarity with each case before generalising the patterns across the cases. The cross-case analysis enabled the researcher to explore beyond their initial impressions, generate more accurate and reliable data and capture the novel findings of the research (Eisenhardt, 1989). Finally, the methods of analysis allowed novel yet accurate findings to be generated that were empirically valid and constructs were generated through the theory building process that closely mirrored reality.

4.6 RESEARCH OUTPUT

At the start of this 'research journey', existing research on the role of IRT in SCNs and supply chain processes was limited. Little empirical research had been undertaken. The research aimed to contribute to the future development of the body of literature concerned with IRT and SCN and it sought to add to the knowledge and understanding of the role of IRT in SCNs and supply chains.

This research developed abstractions and analytical generalisations from a unique set of case studies. These will be outlined in the remainder of the thesis. Walsham (1995b) identified four types of generalisations from interpretive case studies including developing concepts, generating theories, drawing on specific implications and contributing to rich insight. These case studies provided the opportunity to explore issues in more depth in their context and enable the systematic piecing together of detailed evidence to generate theories of more general interest (Cassell &

Symon, 1994). A model of opportunities, benefits, limitations and factors hampering the role of IRT have been developed. Techniques and tactics that organisations can employ to improve the quality and the impact of these technologies on SCNs have also been generated. The uniqueness of the case studies pursued have developed a theoretical framework that inform and enrich the data in the field and contribute to an undeveloped field.

The research output will be of relevance to researchers in the field of IS and particularly to those interested in the organisational aspects of IS. It provides guidance to managers and consultants involved in managing organisation's supply chains and interfaces with SCNs. In particular, it provides a deeper insight to hybrid managers who try to understand and appreciate the innovative ways of applying information systems and technology to their supply chain processes. It also enriches IS specialists understanding of how the technology can be applied.

4.7 SUMMARY

This chapter has provided a detailed outline of the philosophical assumptions that underpinned the empirical research. The main aim of the research was to explore the role of IRT in SCNs and in particular supply chains, processes, linkages, relationships and information sharing. In order to explore the organisational role of IRT, it was essential to explore the dynamics of the phenomena from an inductive perspective. In line with other recent IS research concerned with exploring organisational issues of IS, the research strategy was interpretive in nature and a case study strategy was adopted.

Multiple case studies were conducted in order to build a cohort of more compelling evidence, provide greater substantiation for building theory and to enable cross-case analysis. Four main areas were investigated including: organisational, technological infrastructure, supply chain process, evaluation. A range of data collection methods were used with semi-structured interviews as the primary source. Other data collection methods were used to build up further evidence and support triangulation.

Analysis of the case studies involved techniques for identifying themes and patterns across the case studies and some of the principles of hermeneutics.

The following three chapters (chapters 5 through to 7) concern themselves with the analysis and findings of the case studies. Chapter 5 presents some general findings from the case studies regarding IRT and organisational communication and then focuses on supply chain processes. Chapter 6 and 7 develops and justifies some key themes that emerged from each of the case studies. Chapter 6 concentrates on virtual supply chain linkages and information sharing and chapter 7 looks at SCNs and virtual relationships.

Chapter 5:

Intranets & Supply Chain Processes

5.1 INTRODUCTION TO RESEARCH ANALYSIS

This chapter will describe the analysis and findings emerging from the seven case studies. As the case studies were conducted, data analysis was undertaken. The data analysis at the beginning developed an initial conception of the setting and the perceptions of the people being studied. From early on it was possible to build up a general picture about how advanced organisations were in developing IRT. Clearly, the organisations from the IT industry were more advanced in their development but that was expected considering the business that they are in. This understanding was then tested, modified and developed through additional cycles of data collection and analysis until an adequate coherent interpretation was reached.

Using some of the principles of the hermeneutic circle (Klien & Myers, 1999, Gadamer, 1976), coherence and understanding was built up by studying the individual parts of the empirical research, then examining the parts collectively and then going back and studying the individual parts again and so on. This involved analysing individual questions within each case study, analysing related questions together and then holistically studying each case study and then going back to analyse the individual questions etc. As each case study was completed, they were compared and contrasted with each other. It was often only through analysing the data that areas were identified that had to be researched in more detail. This sometimes involved going back and asking further questions or doing some further secondary research.

Finally once all the cases studies were completed, the main similarities and key issues were drawn out. The issues emerging were manipulated and organised under thematic headings (Holliday, 2002). The findings had to keep being structured and restructured as they became more complex and detailed. Moreover, it was only after many cycles that a coherent set of ideas and themes could be presented.

The outcomes of the research are organised as follows. Firstly, this chapter focuses on the deployment of intranets for organisational communication. Large organisations are developing sophisticated intranet communication channels with a variety of applications, tools and technologies. These are offering an array of benefits.

Moreover, this chapter will explore how organisations are extending their intranets to embrace supply chains and in particular supply chain processes.

Chapter 6 studies the role of IRT in SCN linkages. Supply chain linkages can exist within supply chain processes and activities and between supply chain activities and processes and they can be solely within one organisation (intra-organisational) or between different organisations (inter-organisational). These supply chain linkages are examined in terms of the level of information sharing.

Chapter 7 analyses the role of IRT in developing SCN relationships. Relationships will exist internally between different employees and externally with suppliers, customers and logistic providers. Good relationships are an essential ingredient for delivering a competitive integrated SCN.

In each chapter, there are extracts of data, experiences and viewpoints that have unfolded in the different case studies. The data has been bound together to demonstrate connections between the cases, and to build and manifest some key arguments. Abstractions and generalisations have been drawn (Walsham, 1993; Walsham, 1995b).

5.2 ORGANISATIONAL COMMUNICATION CHANNELS

This first main section of this chapter will analyse the role of IRT as organisational communication channels. It will begin with a brief overview of the importance of organisational communication to large organisations, their use of the internet, intranets and other supported tools and technologies.

5.2.1 ORGANISATIONAL COMMUNICATION

Communication is clearly a main concern for all organisations. Communication is even more important in the information age (Rayport & Sviokla, 1995). Organisations realise the benefits of good communication in terms of improving performance, organisational outputs and customer service (Meyer, 2002; Te'eni, 2001; Daniel & Wilson, 2003). Effective communication can add value. When asked about the

importance of communication in Case Study F, the Engineering Director replied that "Communication is a high priority within the organisation - with the focus on making the best use of all means available". The organisation recognises that clear and simple communications form a vital part of an effective working environment. Recent focus has shifted to using IRT as a key organisational communication channel. This is demonstrated by the level of investment in corporate sites, intranets, extranets, other internet-based tools and technologies and employee surveys. IRT is getting used as a communication channel internally and externally by all large organisations. This is largely down to the ease at which organisations can connect to the Internet, its wide availability, cheapness, its ability to support different types of networks and operating systems and different media types.

5.2.2 INTERNET

The Internet has been getting used for a while in large organisations for general external communication. All the organisations studied have a corporate web-site available externally on the Internet that can be accessed by anyone using a web browser. The types of information and facilities available on these corporate sites tended to be geared up towards promoting or providing general information about the organisation, providing financial information to investors and sponsors or providing information to customers on products and services. Depending on the type of organisation, they are also used for e-commerce purposes i.e. buying and selling products and services. However, many of the organisations studied were mainly involved in business to business transactions and did not sell products and services directly to individual consumers.

The corporate sites included information on the organisation such as the history and background of the organisation, the business they are in, their vision and mission, the structure of the organisation, locations of the organisation, the executive team, company performance, share prices, annual reports, latest new releases, ethics of the organisation, environmental concerns, government affairs, community investment, health and safety concerns, awards, sponsorship, presentations, events, investors, contact information and career opportunities.

There were also general details about each organisation's products and services. In addition to this, some organisations had provided product catalogues, manuals, demonstration of products, downloads, case studies, facilities for registering products, returns policy, warranty information, product recalls, special offers, maintenance and service and on-line training and forums. Furthermore, as indicated, some organisations products and services could be purchased on-line. In some cases, there was support for on-line shopping, in the way of setting up an account, supporting order and delivery, providing an up-to-date picture on inventory levels, invoicing and payments and customer service and support.

Overall, corporate sites are useful informational, promotional and sales tools. In today's day and age, it is really expected that all larger organisations will have established corporate web-sites and organisations will continually seek to improve and enhance these sites. However, as indicated in earlier chapters, a greater strategic focus for larger organisations is their intranets and the adoption of e-business (Ash & Burn, 2003; Farhoomand & Wigand, 2003).

5.2.3 INTRANET

Intranets have been developed for a range of organisational needs (Bernard, 1998; Kraemer & Dedrick, 2000; Lancioni, Smith & Oliva, 2000). Firstly, information was sought through the case studies on the general information and facilities available on organisational intranets. The organisational intranets generally linked together corporate home pages, business function or site home pages, departmental home pages and hundreds of other web pages. The case studies showed evidence of providing information, on the intranets, on areas such as the corporate strategy, corporate structure, corporate policies, PR and communications (e.g. news stories, media briefs), announcements (e.g. industry announcement, people on the move) corporate documents (e.g. annual reports, strategic plans), staff lists, telephone books, human resource issues (e.g. pension plans, job vacancies, code of conduct), employee benefits and services, careers services, sales and marketing information, quality tools, health and safety, training materials and so on. Obviously some of these types of information overlap with information available on the internet whilst other information is much more specific to organisational employees.

Each function, site or department within large organisations normally have their own web site. These provided information about the department, members of staff, information on departmental activities and projects and various departmental tools and facilities. As an example, the types of information on the 'Manufacturing Engineering' website in Case study G are given in Figure 5.1. They are responsible for taking the design of products and making them manufacturable.

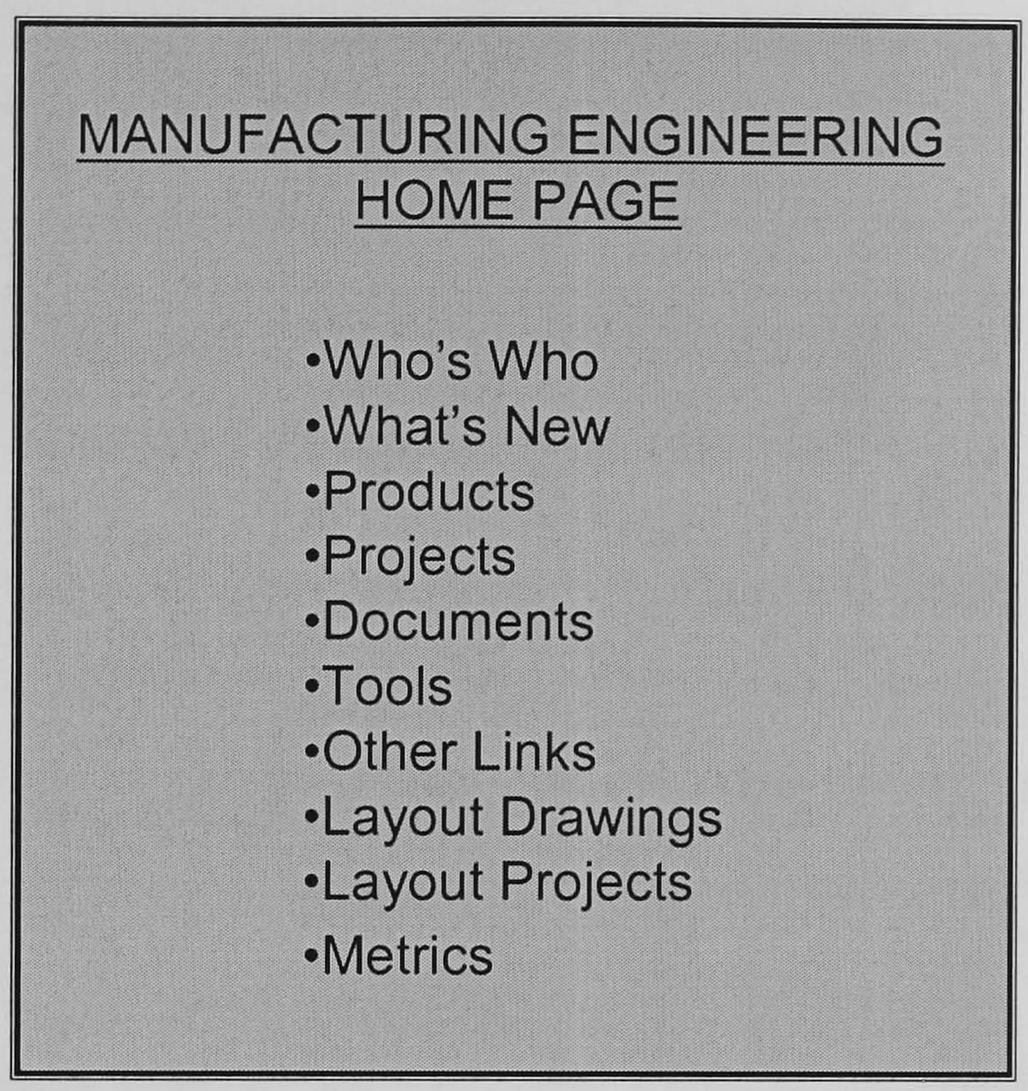


Figure 5.1: Manufacturing Engineering Home Page (Case G)

As well as providing an overview of who is who in the department and what's new, this departmental web site provides a list of all the products produced by the department, and a list of all the projects they are currently running and all associated costs and return on investment. There are also a number of documents, tools and drawings which can be viewed using Drawing Office, that are relevant to the department and accessible through the departmental site. Performance metrics are also available providing a list of corrective actions that need to be taken with regards to their products.

Another example of a departmental web site is depicted in Figure 5.2. This illustrates the home page of the Information Management department in Case G. This department supports the information management requirements of employees.

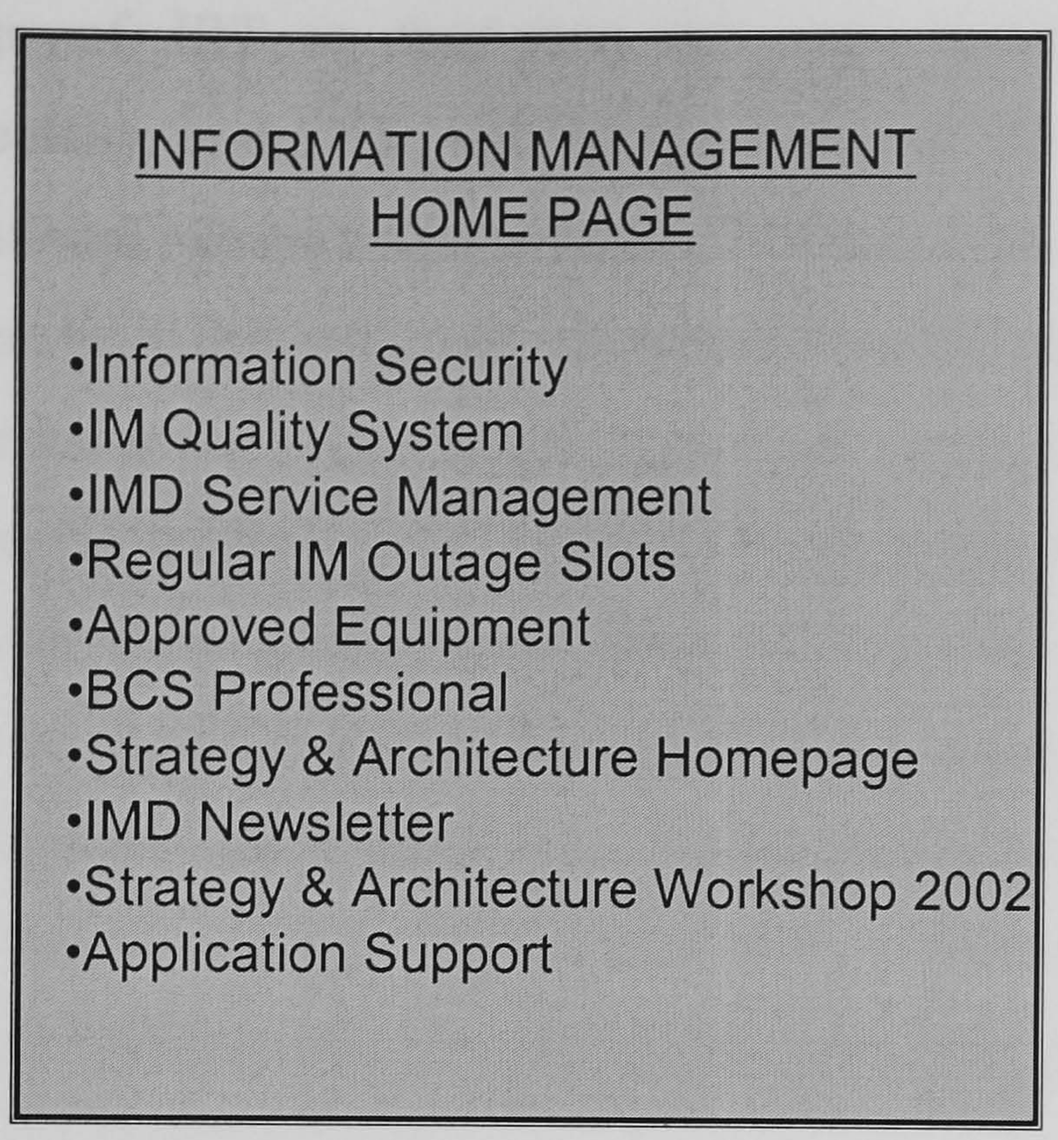


Figure 5.2: Information Management Home Page (Case F)

Therefore, the web site provides information on maintaining information security, the IM quality system, the IM service management, IM outage slots, the IM list of approved IS equipment, BCS professional and the IM applications support. It also provides information about the IM departmental strategy, their architecture, recent IM workshops and newsletters that the department produces. Each functional or departmental web site is geared towards the particular activities of the department.

One of the key advantages of using intranets for organisational communication is the way in which linkages can be set up between different web pages. There are many linkages established between different organisational web sites and pages and also with external web sites. This potentially gives organisations the opportunity to systematically organise and order all the information on their intranet in a way that will support mutual understanding amongst all employees (Te'eni, 2001). Moreover, many of the organisations use common intranet templates across their web sites. As indicated by Mulgan (1991), a standard layout or format makes information easier to comprehend and requires less effort on the employee's part. Unfortunately though some employees did still sometimes find it difficult to find certain information but this may be more to do with the way that the organisation has laid the intranet out rather than to do with the technology.

A further advantage of IRT is that they are very accessible channels of communication. Especially, in the UK, US and most parts of Europe. In most of the case studies, organisational intranets were available 24 hours a day, 7 days a week. As a result, employees can be in different parts of the world but can still be able to access their organisation's intranet and communicate with other employees. The employees in case G can access the organisational intranet simply using a web browser and digital card. This gives them access to all their personal data and any facilities required. Employees of organisations are finding that they communicate more and more because the method of communication is so easy to access. Obviously if the people that they are communicating with are located in a different time zone there may still be problems with being able to communicate with other people as and when required.

Intranets have also enabled vast improvements in terms of the speed that things can be done. Firstly, the speed of actually accessing the Internet or the organisation's intranet does not appear to be a problem at all in large organisations. Secondly, it allows information to be communicated and retrieved much more quickly than before. The interface is very easy to use and it saves a lot of time searching for relevant information. As most information is now generally being distributed using this common technology, employees are also becoming more and more familiar with using the channel as well. As a result communication is getting easier and easier as employees learn quicker and smarter ways of doing things.

An issue that was raised in Chapter 2 as a potential problem was scalability. However, it appears that large organisations are not concerned about the scalability of their web-based systems or the level of service that will be possible as more and more people access the web. This is partly due to the fact that they are closer to the Internet backbone than other organisations but mainly because large organizations have internet connections that have considerable bandwidth designed to support many users (e.g. T1 lines). The connections will not be 100% utilised all of the time thus when a user goes on to the internet they basically have a large amount of bandwidth available to them. Also when users access the organisation's intranet, the technology is available to provide quick download speeds to employees. Organisation systems that are web-based can also be much more easily expanded than other networked systems.

They can be easily extended by the addition of extra servers when required. Overall, the ease at which users can actually be added to the web-based system is regarded as an advantage within large organisations.

Finally, all employees tend to be authorised to access all general information and applications available on the intranet although more specialised aspects of the organisational intranets tend to be restricted to certain employees. Essentially this is for security reasons but also it is because certain information is only relevant to certain employees and therefore, there is no advantage in giving them access to all aspects of the Intranet. In case E, it was evident that marketing information was restricted to relevant personnel. In case F, aspects of engineering were restricted from non-engineering specialists. Even in case C, where the organisation operated an open policy with regards most information, they still had to restrict some information for confidentiality reasons.

5.2.4 OTHER TOOLS AND TECHNOLOGIES

Many intranets also have plug-ins to external sources like the www or information providers that enable information to be gathered on aspects such as share prices, financial information or travel. Over and above this the empirical data also highlights a vast amount of other tools and facilities that are available over organisational intranets.

Firstly, these include general tools such as e-mail, message boards, instant messaging, filing and printing facilities, diaries, calculators etc. A range of on-line booking tools are commonly available as well now. In particular, in case study B there were a variety of booking tools available for holiday booking, travel booking, visitor centre booking, room booking and catering services booking. These tools make it easier for employees to see exactly what is available when and for them to easily make bookings.

Many of the organisations studied have on-line IT Ticketing Systems for IT support. The on-line ticketing system in Case study A allows employees to log on, create a ticket and provide information on the type of IT hardware or software that is causing problems e.g. desktop and a description of the problem. This registers on the system

and can be picked up by someone in IT. Information will be stored online, regarding the date the problem was logged and any progress or work done on the problem. The employee that has registered the problem and IT staff can view the progress of the problem at any time.

The organisation in Case study C also has an Employee lookup directory which is a tool that can be used for finding the right people for the right jobs. It provides multiple search criteria including employee skills, projects, business interests and team data. This was voted their most commonly used intranet application. Again it provides very useful information that was not readily available before.

Organisations are developing searching facilities and profiling tools to make information easier to find on the intranet. Furthermore, one technology that was described in chapter 2 that appears to have taken off particularly well in larger organisations is portals. Portals are being used to personalise and integrate specific information, linkages, applications and facilities for individual employees (Chaffey, 2002; Lawrence et al, 2000).

This was certainly what was happening in the majority of the case studies conducted. When an employee logs in, it would say for example, "Welcome Joe Smith". Personalised information would be tailored about their particular salary scale, pension scheme, expenses etc. Facilities and information would be customised depending on what they need to access. For example, an employee in case study C can choose from 300 channels for internal and external news feeds. The user filters out news pertinent to their position and interests. An employee in case study G can choose which applications they want to have available on their intranet welcoming page depending on which applications they regularly use and need to be able to readily access. Applications may include Netscape Messenger, Decision Support tools or Productivity tools. As outlined in chapter 2, the level of adaptiveness or personalisation is a further dimension that can be used to assess communication channels (Daft & Lengel, 1986). Portals are particularly geared up towards being able to adapt intranet communication channels to people with different communication requirements.

Intranets are also linked to other technologies like DBMS, ERP systems, SCM systems, financial systems, document management systems, decision support tools, project management tools, workflow systems and EDI systems. Some of these systems are off the shelf solutions while others are custom made. The fact that all of these tools and technologies can operate on the intranet reduces costs for organisations. In the past they had to have several systems on their desk at the same time and they had to acquire licences for the different systems. Many of these tools and technologies are well suited to supporting and developing supply chain processes and activities. Therefore, these will be expanded on and assessed later on in the chapter in the Supply Chain Process section.

Corporate intranets are clearly distributing a vast amount of organisational information and the information flows are not only one way either. Intranets have interactive tools and facilities that allow information to be gathered from employees. For example, employees can input information like expense details and have this directed electronically to the relevant organisational department. Employees in case study E can choose to have sales and marketing information available on the intranet broken down by month or product. Likewise employees can input details into the on-line ticketing system in case study A or specify details to lookup relevant travel information in case study G or enter details into the employee lookup directory in case study C. More and more interactive elements are being added to organisational intranets which make it more value-added. Again as outlined in chapter 2, interactivity is an important dimension of organisational communication channels as it is advantageous in checking the receivers understanding, reducing the number of words required to communicate and improving the accuracy of communication (Daft & Lengel, 1986; Dennis & Kinney, 1998)

In conclusion, IRT appear to open up a vast amount of opportunities for organisational communication and employees generally favoured them. In the Global Employee Survey in case study C the intranet was voted the most credible, preferred and useful source of information about the organisation's strategy, results, products and policies. Co-workers were voted the second best communication channel with many believing that the grapevine is a much more useful channel for passing on tacit

pieces of information (Nonaka & Takeuchi, 1995) and they were more willing to trust information provided face to face.

A staff survey in case study F also indicated that intranets have facilitated better internal and external communication and that is considered a positive development universally within the company. It is apparent that there has been a huge uptake in the technology and most employees are being encouraged to, and indeed use it as a primary means of communication. However, this organisation (as did others) still stressed the importance of face to face communication channels. This organisation, for example, had a policy to hold weekly cascade face to face briefs to distribute key information.

Probably the most advanced organisation at the time studied was the organisation in case study G. The intranet was certainly regarded as the organisation's main communication channel tool. However, interestingly enough, one manager commented that " he received that many e-mails each day that probably the best way of ensuring that he responded to your communication was by phoning him or at least making your e-mail summarised and to the point. Even one of the lesser technologically-developed organisations studied in case study B still use the intranet as an integral communication channel. The majority of employees use the intranet for searching for general organisational information, sending e-mails or booking rooms etc.

In case C, the intranet was seen as being more suitable on many occasions than the telephone and in some situations face to face. For example, rather than trying to explain something over the phone, it may be easier to attach a document to an e-mail. Employees find that unstructured information can easily be communicated via e-mails, semi-structured information can be attached to e-mails in Word or Acrobat documents while highly structured information can be communicated through databases. Also some regard it as a good communication channel because it takes away the feeling of fear or embarrassment of asking 'silly' questions, that they would have had communicating face to face or on the telephone. In fact, most large

organisations are finding that telephone usage is down while the fax machine is almost obsolete.

Overall, it is clear that intranets are becoming more and more the favoured organisational communication channel. Internet-related communication channels are proving to be vital and a key component of the working environment. However, depending on the situation and the information being communicated, many employees still consider a mix of appropriate communication channels. Face to face communication obviously still being a key channel. More recently and probably more revolutionary, however, organisations are looking beyond using the intranet as an organisation-wide communication tool. They are focusing efforts on using intranets to support and transform organisational supply chains. The next section studies the role of intranets in supply chain processes.

5.3 SUPPLY CHAIN PROCESSES

The remainder of the chapter will explore the role of IRT in supply chain processes. In line with the literature reviewed in chapter 3, the organisations studied have increasingly extended their intranets to support and enhance supply chain processes and activities (Cagliano, Caniato & Spina, 2003; Lancioni, Smith & Oliva, 2000). The organisations are realising that in order to compete more effectively they need to streamline their supply chains and supply chain processes (Cagliano, Caniato & Spina, 2003). Each case study showed general evidence of IRT being applied to enabling processes such as Human Resource Management (HRM) and Training. In addition to this, case study involved examining the role of IRT in other enabling, operational or strategic supply chain processes in greater detail. The supply chain processes studied were outlined in table 4.1. The case studies provided evidence that once larger organisations are satisfied that enabling, and subsequently operational supply chain processes, have been adequately automised, they are shifting their focus to the role of IRT to more strategic supply chain processes and activities and the strategic advantage that can be attained. (Ash & Burn, 2003; Farhoomand & Wigand, 2003; Lancioni, Schau & Smith, 2003)

The examination of different supply chain processes across different organisations was not always straightforward. This was for a range of reasons. Firstly, in studying the supply chain processes, it was not always clear to the researcher at what stage a supply chain process began and at what stage it ended. The researcher had to probe with further questions to get a clearer picture. Secondly, the supply chain processes studied did not always have the same level of importance within an organisation. Some supply chain processes studied were at a higher level of importance than other supply chain processes. For example, the Materials process that was studied in case study G emerged as being a very high level supply chain process that was actually made up of many sub-processes such as Material Replenishment and Customer Fulfilment etc. The Invoicing process studied in case study B was a much lower level supply chain process. Thirdly, to further complicate matters, supply chain processes may have a strategic component and an operational component to them (Croxton, Garcia-Dastugue & Lambert, 2001) and it is sometimes difficult to distinguish between them. However, the supply chain processes that have been studied have been categorised as well as possible as strategic, operational or enabling (Peppard & Rowland, 1995) and the role of IRT in the different supply chain processes will be outlined. Some of the supply chain processes may appear under the operational and strategic categories because there is an element of each in the supply chain process.

5.3.1 ENABLING PROCESSES

These types of processes enable strategic and operational processes to be carried out e.g. HRM, management accounting and information systems management (Peppard & Rowland, 1995). The main ones studied in the case studies were HRM, training and non-production related procurement. These enabling processes support the general day to day running of the organisation's operational and strategic supply chain processes.

Enabling processes seemed to be the earliest supply chain processes (Ash & Burn, 2003) to be implemented with IRT. This is probably because they are the easiest processes to be implemented and the lowest risk processes. Furthermore, these types of processes are fairly standardised and lend themselves to self service applications. All of the organisations studied had used the intranet to some extent for HRM and it

was apparent that the very nature of this process was well suited to web technology. The types of areas of HRM that IRT was being used for included providing HR policies and manuals, staff handbooks, HR forms, employee lists, employee personal information (e.g. pay and performance, pension, retirement plan, job description and pay stubs), career information and employee self service (e.g. personal detail changes, timecards).

There are many benefits in applying IRT to HRM. In many cases human resources want to just be able to distribute information to employees and the intranet offers the ideal distribution channel. In the past many of these documents were available in organisations but many people did not know where to access them. Intranets and the www provide a mechanism for organising information and forms into folders and reducing employee search time. In many situations, employees can now enter their own personal details online rather than a third party from HRM doing this. This gives employees more power over the accuracy of their own personal details. This also provides huge efficiency benefits and substantially reduces the administration for HRM thus increasing their availability to perform value-adding tasks.

Although IRT has made substantial improvements in many elements of HRM, there are limitations in using IRT as well. The main problem is that IRT can distance and alienate HRM personnel from other departments. Consequently, the HRM personnel are portrayed as unapproachable and in many cases employees don't actually know the member of HRM that they should be approaching. This can be a problem when employees perhaps have softer, more personal issues that they would like to discuss with a member of staff from HRM face to face. Rather than improving some elements of HRM it has actually only resulted in dehumanising them.

Another enabling process that has been exploited using IRT is training or e-learning as web-based training solutions have recently become known. IRT is being used in this area for a range of different activities. The www is being used to provide electronic courses and learning events. It supports the use of multiple media in many formats to enhance the learning experience. Features such as recorded playback, guest speakers, subject matter experts, and breakout sessions are regularly added in to on-

line courses. Organisations such as the one in case Study C saw savings of around $400 million in 2001 through delivering employee web-based training.

On-line training can be distributed globally which is particularly beneficial for a mobile workforce. For example, an employee may be based at a customer site for a long period of time and it may not be convenient for them to come back to their organisational site for training. Also in some cases, the training can now be more easily extended to customers or suppliers. This can prove to be beneficial to the organisation and the customer or suppliers e.g. if more training is extended to customers and suppliers, the organisation may not need to provide as much customer support or the service provided by suppliers may be enhanced. However, despite these benefits, it is still unclear if the actual quality of on-line training is more or less effective than face to face training. Moreover, some employees find that it can be difficult maintaining enthusiasm and drive in on-line learning and they are not so sure that they are actually absorbing the material to the same level.

The final enabling process that was studied was non-production related procurement. Many of the organisations referred to the fact that this type of procurement had been automised using IRT and case study A studied an organisation's non-production related procurement process in substantial detail. This organisation has used IRT to integrate various procurement activities from submitting requisitions to generating orders to payment and was available to all employees through the intranet. The system incorporated a number of systems including the intranet, a web-based CD catalogue, e-mail, EDI, EFT and a web-based Signature Authorisation Tool. The system is essentially driven by an approval engine which channels procurement requisitions to the relevant approvers. It is also linked to an Oracle Accounting system which enables procurement to be aligned with accounts.

Again, many benefits in using IRT for the supply chain process were evident. Firstly, the organisation has made substantial cost savings through controlled expenditure, reduced labour costs etc. The supply chain process has also been streamlined with the workflow engine driving requisitions through the stages of the procurement process. The electronic system is much more flexible as employees can submit requisitions from different parts of the world. Moreover, the system is a lot quicker as authorised

employees must process electronic requisitions within a limited time period. As highlighted by one of the IT Business Analysis for the system, "employees no longer need to waste time walking around looking for the relevant manager to approve a requisition". Overall, the case study findings support and substantiate literature that is rich with estimates of the benefits of e-procurement (Presutti, 2003; Subramaniam & Shaw, 2002).

There are a few issues that should be highlighted though. Amongst these are the difficulties inherent in making direct links between e-procurement strategies and the organisation's financial performance. There are also many factors that will affect the actual value of an e-procurement system e.g. the quality of the procurement process design, types of product being procured, level of integration with other organisational systems, participation of business partners etc (Presutti, 2003; Subramaniam & Shaw, 2002). B2B managers will need to understand these conditions as they will determine the value of resultant procurement systems. Overall, a more coherent framework is needed that can better determine the value of the web for an organisation's procurement process (Subramaniam & Shaw, 2002).

Enabling processes appear to have been the first category of supply chain process that organisations have attempted to implement over their organisational intranets (Ash & Burn, 2003). Most elements of enabling processes appear to work well using IRT. This is largely due to the fact that many activities in enabling supply chain processes are fairly standardised. Although there are some aspects of enabling processes that require human interaction or some flexibility and they don't appear to work as well.

5.3.2 OPERATIONAL PROCESSES

Operational processes are carried out in the day to day functioning of the organisation. There were many operational supply chain processes studied such as Invoicing, Customer Service and Support, Business Despatch, Order Fulfilment, the Acquisition of Material Goods and Services, Materials Replenishment and Testing. The role of IRT in each of these operational processes will now be described.

Firstly, one of the main supply chain processes studied in the utility organisation in case study B in detail, was business to business invoicing. The organisation has moved various activities involved in business to business invoicing online and provided larger customers with secure access through an extranet. The internet invoicing service is especially designed for organisations with more than 25 sites. Customers can now view, analyse and download invoices and statements, and the system supports automated validation, payment processing and management and financial analysis. Consequently, the organisation has seen a reduction in the end to end processing of monthly statements from several days to under two hours. Bill validation has advanced and can now be conducted at all levels. The organisation claims the system saves customers a lot of time and money and certainly appears to promote early settlement of debts and improves cash flow.

Case study C involved gathering information on the role of IRT in the Customer Service and Support supply chain process. A vast amount of service and support traditionally provided over the phone or face to face is now provided electronically using IRT. The department is responsible for providing a warranty service for desk PCs, portable PCs and servers, up and running support and extended help for certain customers. There is a technical support web site, which will be described in more detail in chapter 6, which provides customers with a self-help facility and there is also the technical capability for employees to remotely access customer's PCs and take control of them. Future developments are going to enable customer PCs to automatically connect themselves to the technical web site when they are not working and allow engineers to use mobile communications to view the components of a customer's machine, while checking the availability of parts etc. Overall, most aspects of the Customer Service and Support will eventually be supported by IRT with the benefits of 24 hour availability.

Technological advancements mean that remote customer service is now possible 24 hours a day in many areas that it was not before. The benefits of using IRT for service and support to the organisation are primarily reduction in costs. This is partly because many customers can solve their own problems now using the self help facilities and partly because there are much less on-site visits. The potential benefits to the customer are a more sophisticated and enhanced customer service and customers

feeling more in control of their own situation. However, there are some customers that find on-line customer service and support unfriendly, unapproachable and not very reassuring. Therefore, IRT are more likely to damage the relationships with these types of customers than enhance them.

Barnes, Mieczkowska & Hinton (2003) suggest that IRT provides many opportunities for enhancing the functional dimensions of customer service such as reliability, responsiveness, competence and access. However, maximising the value of on-line customer service and support also requires addressing the emotional dimensions of customer service and support e.g. credibility, communication. Often these dimensions are not adequately addressed through IRT, and if they are not, then barriers to enhanced supply chain processes will still remain. The importance of the different dimensions will vary from customer to customer.

The main operational process analysed in case study D was Business Despatch. Business Despatch involved the transportation of finished goods to customers. Generally, organisations are increasingly outsourcing aspects of their supply chain (Manchester, 2003). A specific aspect that is increasingly being outsourced is logistics and transportation. This organisation outsourced these activities to logistics providers. Logistic providers are expected to conduct a range of activities including warehousing, haulage, handling HM Custom's documentation, booking and arranging feeder vessels, transportation of cargo, arranging claim liability insurance etc. The organisation's Business Despatch department are responsible for managing and liaising with the logistic providers to ensure the different activities are completed.

The case study sought to understand the developments in Business Despatch following the proliferation of IRT. The case study unravelled a number of enhancements to the logistic services following the introduction of IRT. IRT provided various benefits to the logistics providers such as centralised systems, reduced costs, easier manipulation of logistic-related information etc. However, not all of these benefits were being fully realised in their customer's Business Despatch processes. Although organisations that had strong, long-standing relationships with the logistics provider had less problems than others. Those organisations that only used logistic providers periodically found that problems emerged such as lost orders, orders

delivered wrongly etc. and they found there was a lack of coordination with the logistics providers to quickly resolve the problems. Unfortunately, when there are 3rd parties involved in the supply chain process, efficient coordination between parties is even more important (Auguste et al, 2002).There must be management involvement in building good partnerships (Manchester, 2003).

Case Study E was concerned with a manufacturer in the automobile industry. The organisation is made up of National Sales Companies (NSCs). Car dealerships order cars from the NSCs and subsequently sell them on to individual customers. In particular the case study examined the manufacturer's order fulfilment process between the NSCs and the car dealerships. A web-based ordering system has been recently introduced into the organisation that is accessible by car dealers. The system streamlines the order fulfilment process in that it provides on-line reports and detailed analysis to support dealer business planning, it allows on-line ordering, on-line order dressing, it enables orders to be called off and for dealers to snatch other dealer's orders.

The web-based ordering process operates much more efficiently than the system before. Many general benefits to the organisation and the dealers were apparent from conducting the interviews in this case study. Amongst these was the depth of information available regarding the availability of cars throughout the UK. This will be discussed in more detail in the following chapter. The system has also reduced costs for the organisation in terms of cutting inventory, the number of plants required, the security required, the resultant damage of vehicles and the obsolescence of stock. For customers, the organisation claims it increases customer choice and that their vehicle requirements can be better met.

The main area of interest in Case F was the acquiring material goods and services supply chain process. The activities involved in this process involved specifying requirements, budget approval and authorisation, tendering, raising requisitions, and placing contracts, managing contracts and many sub processes such as purchasing, receipt, installation, commissioning and finally closing contracts when they are complete. The front end of the acquiring goods and services process has been fully automated using IRT. Many benefits are similar to those experienced in the

procurement process in case study A, including reduced timescales in each of the stages of the process, reduced paperwork, availability of an on-line audit trail and substantial cost savings. The more technical and management aspects of the process are still handled face to face.

The Materials department in Case Study G are responsibility for a key operational supply chain process, Materials Replenishment. Materials Replenishment links purchasing, manufacturing and ordering supply chain processes and activities together. It involves establishing the types and quantities of materials to be purchased while taking inventory levels into account and predicting when to place orders by taking lead times into consideration. The intranet and ERP system has been developed to enable the exchange of a broader scope of real time information (Heizer & Render, 2001; Waller, 2003; Wisner, Keong Leong & Tan, 2004). As sales are entered as orders into the ERP system, necessary materials are automatically replenished in time for products to be made to order. This has the benefits of firstly improving inventory management as products are not building up in stock and secondly, providing a smoother, more efficient customer service.

A further operational process studied in case study G was testing. Testing involves checking and monitoring all the products manufactured on the product lines and it is conducted at every stage of the manufacturing process e.g. when a motherboard is slotted into a computer it is connected up to a computer for testing. The organisation's intranet is now used to drive the testing of all products manufactured on the product lines and managers and employees can use a variety of tools and applications to monitor and coordinate testing. This has resulted in a greater level of coordination, it has substantially reduced the amount of human error and it has improved the speed at which problems with products can be resolved. However, the organisation has become particularly reliant on the intranet for testing organisational products and if the system goes down, there is no longer the same level of specialised knowledge and understanding of product testing within the organisation.

Operational processes are more critical than enabling processes and have taken longer to be developed using IRT. On the whole, though, many elements of operational processes also appear to operate well using IRT. The technology has become so

advanced now that many aspects of these processes can now be conducted just as effectively, and in some cases more effectively, using IRT, than being physically present. This is largely due to all the information being at hand through one communication channel. Again there are a few elements of operational supply chain processes that did not work as effectively with IRT and these were activities that were not as standardised or alternatively required personal interaction.

5.3.3 STRATEGIC PROCESSES

Strategic processes can be defined as processes that plan for an organisation's future direction e.g. strategy planning, product development (Peppard & Rowland, 1995). Various strategic processes and sub-processes were also studied throughout the case studies.

For example, Case study G embraced Business Forecasting and Material Requirements Planning which are both essentially strategic supply chain processes. Business forecasting is a critical strategic process involving predicting future customer demand. This provides the basis for the Material Requirements Planning process which is concerned with the long-term strategic planning of stock requirements. The intranet and in particular the ERP system contributes to both of these strategic processes by providing information that can support decision making. For example, the ERP system provides information on orders, customer demand etc., contributing to the materials planning cycle, thus enabling the cycle to be reduced from 3 weeks to 1 week. IRT contribute to the process by delivering more accurate plans and plans that are more responsive to economic changes, resulting in reduced inventory costs and obsolescence of materials. The forecasts and plans from these strategic supply chain processes will filter into the operational processes in case study G that were described in the previous section.

Moreover, many key supply chain processes embrace a combination of strategic and operational sub-processes (Croxton, Garcia-Dastugue & Lambert, 2001). The strategic sub-processes consist of the establishment and strategic management of the process and provide a blueprint for implementation while the operational sub-

processes are the actual realisation of the process (Croxton, Garcia-Dastugue & Lambert, 2001).

The Order Fulfilment process in case study E comprised of a strategic portion and an operational portion. The strategic portion involved the Dealer Business Planning sub-process while the operational portion included the sub-processes and activities described under 'Operational Processes' such as ordering, order dressing, calling off orders, snatching orders etc. Dealer Business Planning is strategic in nature. It involves forecasting a suitable mix and volume of cars for each dealer. It takes place about 3 months prior to production and involves the management team, the brand (marketing teams) and dealer management. They will analyse historic sales mixes, customer buying trends, product life cycles, objectives, future marketing programmes etc. They will then forecast a suitable mix and volume of vehicles to be allocated to each dealer. IRT provides information, reports and analysis tools to support these decisions. This information could be about what the sales mix has been for each dealer in the last 3 weeks or the last six months and how many they have sold etc.

Management supply chain processes such as Business Forecasting and Business Planning were also explored in Case Study B. These kinds of processes are now supported by an intranet-based management information system (MIS). The Intranet-based MIS system has far superior information delivery than the existing trouble management system and it provides the management team and large customers with general information about electricity markets, faults in the networks and assets and warnings about variations in electricity supply. These different types of information support the formulation of forecasts, plans, and decision making.

IRT have been introduced into strategic supply chain processes most recently. Again they have significantly advanced strategic supply chain processes, though in general they are probably playing more of a supporting role in strategic than in operational or enabling supply chain processes. The technologies are improving the strategic processes to the extent that they are being conducted more quickly, monitored more regularly and are producing more informed decisions, though the actual plans and decisions are still being conducted by the key people involved in the strategic supply chain process.

5.4 FACTORS AFFECTING SUITABILITY OF IRT

Large organisations are leading the way in extending their Internet system to enhance supply chain processes. When building internet-based systems for supply chain processes, it is essential to carefully consider the process involved and the nature of the activities and tasks that need to be undertaken to complete the process.

5.4.1 NATURE OF ACTIVITIES IN SUPPLY CHAIN PROCESS

The supply chain processes studied through the case studies were made up of a number of sub-processes or supply chain activities. When the individual supply chain processes were dissected, it was evident from the case studies that within each supply chain process there are certain activities that are more suited to IRT than others. Factors influencing an activity's suitability are the level of standardisation in the activity and the level of human or personal interaction required.

This section will firstly focus on the level of standardisation in supply chain activities. Some activities are very routine i.e. there is a standard way that they are carried out the majority of the time and there are very few variables that will make the activity or task deviate from a standard set of procedures. These types of activities are particularly suited to leaner IRT. Large organisations are realising the suitability of the technology and are employing it as a primary method of communication. Activities that are not standardised i.e. they are carried out differently each time, are more complex and tend to be more suited to richer IRT or face to face interaction.

A few standardised and non standardised activities are highlighted from the case studies. The first example will examine the Customer Service and Support supply chain process in Case study C. There are many customer problems that are routinely dealt with. A pool of common technical customer problems is stored on a DBMS. Technical support for common or routine problems are taken from the DBMS and distributed to customers using the www. Technical support includes tips, information on known product faults, warranty information, software and installation information. Other customer problems are less straightforward. Discussion forums are available

and more recently remote access software technology (that accesses customer PCs remotely and takes control) is available to handle less straightforward problems. For very complex problems, a representative would have to attend the customer site face to face.

The second example will analyse the supply chain process studied in case study A which was non-production related procurement. As indicated earlier in the chapter, this process is made up of a variety of supply chain activities including sourcing suppliers, negotiating with suppliers, submitting requisitions, approving requisitions, placing orders, receiving orders, invoicing and payment. The procurement supply chain process generally worked extremely well using IRT and the various aspects of the supply chain process are automised. Employees browse product catalogues using web-based catalogues. Standard information is submitted into a requisition like name, user id, product etc. Requisitions are channelled automatically for approval by a workflow approval system, employees confirm they have received their product via e-mail and invoice and payments are sent using EDI. A clear benefit of using these leaner types of IRT for the process was the level of standardisation that can be enforced. However, these types of technologies can also be regarded as limiting because of the restrictions they place on the range of allowable expressions (Morris, Tasliyan & Wood, 2003). In fact, the only time when this supply chain process did not appear to work so well was when an employee wanted to submit a requisition for a non-standard product and they were looking for the system to be more flexible. Instead, they would have to speak directly with the procurement specialists and try and come up with a compromise solution. However, most products for non-product related procurement were fairly standard.

The second factor influencing a supply chain's activity to IRT is regarding the level of human or personal interaction required for the activity. This was highlighted through a number of case studies. For example, the role of IRT in the personal-oriented activities in HRM fell short when using IRT. When employees need to discuss personal issues with members of HRM very few employees wish to discuss these issues electronically. IRT was also regarded as unfriendly and unapproachable by customers in case study C who were seeking emotional service and support. Supply chain activities that appear to be requiring a higher level of personal interaction or

emotional support are not considered to be well suited to leaner IRT. They are more suited to richer IRT or face to face communication. This issue will be discussed further in chapter 7 which explores the relationships and personal interactions required for supply chain processes in more detail.

5.4.2 TYPE OF SUPPLY CHAIN PROCESS

The empirical research illustrates that IRT can play an important role in supply chain processes and in many instances they can totally transform them. Enabling supply chain processes have obviously been the first type of supply chain process to be developed using IRT. This is because it is easier to take an enabling process as a single entity and develop it on its own. Enabling processes do not have as critical an impact on the operation of the rest of an organisation's supply chain as the other types of supply chain processes.

More recently, operational supply chain processes have been developed using IRT. Operational processes are increasingly more critical to the organisation and complex as they directly impact other supply chain processes. Therefore linkages with other supply chain processes need to be integrated into technological solutions to reap the full benefits and this will probably complicate advancements. The next chapter will explore these supply chain linkages. Despite this many aspects of operational supply chain processes evidently work well with IRT. As outlined the main areas of enabling and operational supply chain processes that tend to not work well are those activities that are not standardised or those that require personal interaction. In general though enabling and operational supply chain processes are more standardised than strategic supply chain processes.

Strategic supply chain processes have been the most recent type of supply chain process to be developed. These types of processes are the most critical to the overall organisation as they determine its future direction. IRT can greatly benefit strategic processes but there will be more elements of them that may not be suited to IRT as strategic activities are less standardised and require more personal negotiation and interaction.

5.5 LIMITATIONS OF USING IRT FOR SUPPLY CHAIN PROCESSES

The previous section outlined several factors that need to be taken into account when deciding how to best apply IRT to supply chain processes. Some limitations in using IRT for specific supply chain processes have also been outlined throughout the chapter. This last section in the chapter will finish by describing some general limitations that may hamper the role of IRT across supply chain processes.

5.5.1 SECURITY

The first limitation that will be highlighted is security. Large organisations have security measures in place like firewalls to protect information available on their intranets. However, security still remains a huge concern. Organisations need to continually look for ways to advance the security measures already in place to prevent against hacking, viruses etc. as there is definitely greater risks to organisations if they make valuable information available on the web.

5.5.2 TECHNOLOGY

A further limitation that was indicated on several occasions was to do with the reliability of the technology. More and more organisational information and supply chain activities are now available on the intranet. Employees have become largely dependent on intranets to undertake their work. If there are technical problems with server(s) or networks and the system goes down then this can be a major and costly problem for organisations. Employees work will become hampered if not impossible.

5.5.3 EMPLOYEE SKILLS

The advancements in Internet-based systems also have all kinds of implications for the organisational skill base. Firstly, this will in terms of the IT specialists that will be required to support the system and the employees using the systems. Clearly the IT infrastructure of organisations is becoming more and more sophisticated. Modifications to organisational systems are more subtle and the IT support needs to be increasingly specialised. Organisations such as the one in Case study G are finding that when there are problems with organisational systems fewer personnel can

actually solve the problem. Evidently, it is not satisfactory for an organisation to be dependent on such a limited base of specialists. If these employees leave the organisation, a potential skill base gap is created.

Secondly, the employees using the systems need to have the necessary skills to use the systems effectively. Employees may vary in the levels of technical skills that they have and the layout of the systems should be customised to users with different technical capabilities. In large organisations, the issue is not so much employees having the skills to use computers, intranet or e-mails etc but the issues focus tends to be on employees being able to interpret the data correctly. Information appears in so many different formats that there are lots of ways a decision can be made or an argument can be built. All too late, people often realise that they are actually talking about the same thing but they have maybe gone about it differently. It is more about knowing what questions to ask or what reports to run.

5.5.4 LACK OF FLEXIBILITY

Finally, some organisations and employees are finding that automising supply chain processes and activities with IRT can also be restrictive. Some employees find web-based systems inflexible for dealing with non-standard scenarios in supply chain activities. There was evidence of this particularly in Case A and F. For example, in Case A employees find that they are more limited in procuring goods as they have to use the pool of suppliers on the system. Sometime, employees find this restrictive as they no longer have the flexibility that they had in the past, to use their own 'personal favourites'. Similarly, in case F, an approved supplier list had been defined on the Acquired Goods and Services system. This list potentially restricts the pool of external suppliers that are approached by the organisation to tender for new work as the immediate focus is on suppliers on the approved supplier list. The system relies upon a proactive approach from potential new suppliers and the SQEP (Suitably Qualified and Experienced Person) to ensure a fully competitive tendering process. Sometimes departments or employees feel locked in to certain suppliers. One of the interviewees in Case G said that employees sometimes experienced a feeling of 'loss of control' as everything is so automised.

These limitations are relevant to the application of IRT to any organisational supply chain processes and should be taken into account. The chapter will close with a summary of the salient findings.

5.6 SUMMARY

This chapter began by analysing the advancements in intranets in large organisations. It started by studying the proliferation of intranets for organisational communication. Organisational communication is clearly a high priority in large organisations and intranets offer accessible, timely, cost-effective and scalable communication channels. Consequently organisations are investing more and more in corporate web sites, intranets, functional web sites, departmental web sites, various tools and technologies and developing specialised applications.

The second half of the chapter explored the adoption of intranets and other tools and technologies by large organisations for supply chain processes. More and more aspects of the supply chain have been developed using a variety of IRT. The first types of supply chain processes to be developed were enabling processes such as human resources, training and non-production-related procurement. These were followed by operational supply chain processes such as order fulfilment and materials replenishment. Most recently, organisations have sought ways in which the technology can support and develop strategic processes. Overall, supply chain processes have been substantially improved in terms of being streamlined, reduced timescales, cost savings (less expenditure, reduced stock, less human error, less paperwork, less duplication of work), improved efficiency and enhancing customer service.

There were two main factors that were highlighted as affecting the suitability of IRT in supply chain activities. These factors included the level of standardisation in a supply chain activity and the level of human or personal interaction required. Standardised activities are suited to leaner IRT like the www, EDI, databases and document management systems. Non standardised activities are more suited to richer technology such as discussions forums or video conferencing or in some cases face to

face communication. Enabling and operational supply chain processes tend to be more standardised than strategic supply chain processes and this is probably one of the reasons that has lead to more aspects of these processes being suited to IRT. Furthermore, supply chain activities with a greater level of human or personal interaction are more suited to richer IRT or face to face communication. Finally some general limitations in using IRT in supply chain processes and activities have been outlined.

Supply chain processes are the basic building block of supply chains and the increasing role of IRT in supply chain processes is dramatically impacting business operations. However, supply chains are not just a collection of independent processes and activities but rather a system of interdependent processes and activities (Porter, 1985). Therefore, the following chapter will study the role of IRT in intra-organisational and inter-organisational supply chain linkages within and between supply chain processes. One important aspect of supply chain linkages is the information that is exchanged and this will be examined in parallel.

Chapter 6:

Virtual Supply Chain Linkages & Information Sharing

6.1 INTRODUCTION

The previous chapter began by describing the analysis and findings of the case study research. It focused on the role of intranets in organisational communication and the development of intranets for enhancing supply chain processes and activities. IRT are obviously playing a commanding role in the operation of supply chain processes although a number of limiting factors were outlined.

Moreover, supply chain processes and activities do not operate in isolation. Different supply chain processes and activities are interrelated by supply chain linkages. The outputs from one activity can affect the cost or performance of another activity (Ensign, 2001; Porter, 1985). Intra-organisational supply chain linkages exist between activities in a supply chain process and between activities in different supply chain processes and inter-organisational supply chain linkages exist between activities in different organisational supply chains. Inter-organisational linkages are increasingly more complex and diverse as organisations pursue a greater range of mergers, partnerships, alliances and outsourcing etc. (Auguste et al, 2002; Manchester, 2003).

With increased importance being placed on supply chain linkages, organisations are concentrating on linking supply chain processes and activities internally and externally across the SCN using IRT. The accelerated use of technology and information-based products and services has also exemplified the importance of information sharing in supply chain linkages. Therefore, chapter 6 focuses on advancements in applying IRT to SCN linkages and the level of information sharing that is supported by these technological linkages.

The first half of this chapter will analyse the general advancements that have been made in information sharing through using IRT for SCM. It will then concentrate on the advancements in intra-organisational linkages in terms of linking supply chain processes internally, linking internal employees, linking organisational sites and supporting the management of internal processes. Inter-organisational linkages will then be explored in terms of linking organisational processes externally, linking with

different SCN members and in terms of the management and manipulation of information in inter-organisational processes.

The second half of the chapter will explore the diverse range of inter-organisational linkages that are possible between different SCN members in greater detail and highlight the flexibility and different methods of contact that are now possible. This will be demonstrated in terms of the different ways in which contact points can be accessed in organisation's supply chain, the different linkages between different supply chains, linkages with different tiers of SCN members and in the direct linkages between different SCN members.

Finally the chapter will outline a number of limitations in using IRT for intra-organisational and inter-organisational linkages and information sharing. The chapter will close with a summary of the main contributions to theory.

6.2 INFORMATION SHARING

Firstly, the case studies uncovered a number of general advancements in the information available to employees using internet-based technological linkages for supply chain process-related work. These were evidently key issues for organisations and were grouped under the following headings; amount, timeliness, consistency, relevance and levels of detail.

6.2.1 AMOUNT

There is over-whelming evidence demonstrating that the amount of information available has increased within organisations. Intranets make it easier to distribute information through channels such as e-mail, the www and ERP systems etc. and as a result, employees are being given access to a far greater amount than was ever the case before. Employees are being provided with greater information on corporate, functional and departmental issues and are being supported with information corresponding to HR, training, IT, etc.

They also have access to so much more supply chain process-related information. For example, in terms of procurement, in case A, employees now have access to

information on products that can be ordered, product types, descriptions and prices, and information on the progress of requisitions, orders and delivery etc. In Testing, in case study G, the employees now have access to information ranging from project information to service desk information to testing information to monitoring information. It enables them to make more-informed decisions. Managers also have access to much more information. In case F, the managers can now have access to a complete electronic trail of material goods and services required, budget approvals, acquisitions, contract management and many other sub-processes. Thus giving them the necessary information to monitor budgets, live projects etc.

Key benefits of greater amounts of information include more well-versed employees that will enable them to make more-informed decisions. However, in line with the literature, there are still some concerns that more information is not necessarily always a positive advancement in organisations (Curry & Stancich, 2000; Diffley, 2003). One manger in case study G explained that because e-mail was so heavily used in their organisation there was no guarantee that he would actually read an e-mail. Likewise sometimes there is so much information available on the intranet that organisations should not assume that employees actually read the information.

6.2.2 TIMELINESS

The timeliness of information has also improved. Information is so much more up-to-date and current. For example if a new promotion is launched in the automobile organisation in Case study E, details of the promotion are sent simultaneously to everyone concerned via e-mail. In the past, it often took several days for details of new promotions to filter through.

The value of the timely exchange of information in Materials Replenishment in case G was discussed in chapter 5. The purchasing, manufacturing and sales departments all have simultaneous access to orders on the ERP system. As the information is real time, materials can be replenished as soon as fresh orders appear on the system. Real time information is improving the efficiency of organisations.

Up-to-date information in case study E is readily available to employees and dealers. Dealers will always have a timely picture of vehicles in stock or at other stages in the pipeline. This means that dealers are always in a more knowledgeable position to source vehicles and meet customer requests for vehicles. Furthermore, it is also less time-consuming for employees if they can access all the relevant information required for a supply chain process or activity through one communication channel. In the past dealers could be phoning an endless amount of other dealers to establish vehicle availability.

6.2.3 CONSISTENCY

A common communication channel for supply chain processes and activities ensures that all users are all accessing the same information. There are minimal inaccuracies in the content and if there are, they are likely to be detected sooner. In case study A, now, for example, there is a single unified view of an aggregated catalogue of all the products that can be purchased for non-production related activities that is accessible to all employees. Employees know exactly what products that they are restricted to purchasing and from which supplier.

In case C there is also a pool of information available to all Customer Service and Support specialists regarding the details of previous customer interaction and service. This allows the specialists to pick up from where someone else has left a customer problem and continue to provide a coherent efficient service. Overall, common communication channels are also helping organisations to have better control over the consistency of the information and documents that are being distributed to employees.

6.2.4 RELEVANCE

Organisations have also made inroads in developing tools to streamline the abundance of information, improve the personalisation of information and guide users to information that is relevant to them. There are a number of general advancements. Firstly, the common intranet templates that are being used by organisations in their intranets make it easier for employees to navigate the intranet and find exactly what they are looking for. Moreover, direct linkages between associated internal and external web pages will help employees find relevant information. Portals are also

being heavily used to improve the relevance of the information that employees are being presented with. Many organisations have also developed lots of on-line forms for self service applications such as claiming expenses, booking rooms and ordering products. They ensure that employees are entering substantial but only pertinent information. In case G, they have facilities to monitor the usage of different parts of the intranet to see what information and facilities are used most regularly. The organisation also operates a 'publish and subscribe' system. Once information is published, employees have to subscribe to access or receive information from a particular web-site. This helps the organisation monitor information usage and also means employees are not receiving information that they don't require.

Supply chain-related systems are also being developed to provide employees with more relevant information. For example in case study A, the organisation is experimenting with integrating profiling tools into the procurement system for purchasing non-production-related products. They are experimenting with setting up more advanced forms that gather information from the buyer when they are searching for a product. Generally when people are buying products they normally start with a vague idea of what they want to buy. However, they may want to be able to ask for something general, be given more information then be a little more specific about what they want and so on. As they learn more they gain a better idea of what they are looking for. It is through this process of filtering that they find more relevant and specific information. Once employees find a suitable product then they are in a position to create a requisition.

In case study G, the manufacturing engineering department regularly use a product failure analysis tool that monitors and reports product failures. Different people within the department will have specific information that is relevant to them on product failures. The tool has been developed with search engines that guide different users to information on product failures that are relevant to them very quickly.

6.2.5 LEVELS OF DETAIL

A great deal of value in using intranet communication channels for supply chain processes is attributed to the way in which information can be manipulated to provide

information at different levels of detail depending on what supply chain activities or tasks the information is being used for and the needs of the user. There is also the ability to communicate information in a greater depth than was ever possible before. This manipulation is possible because the information is all available over one channel and the facilities and applications can be operated over the intranet to use the information and manipulate it.

The procurement system in case study A provides manipulation and a level of detail about the procurement process that was not feasible before. For example, the current system now keeps track of the times at which people submitted requisitions and the times at which requisitions have been authorised or rejected. Employees will regularly view information presented in this format. Moreover, the information can be manipulated and presented in different formats for managers and approvers and further levels of detail can be viewed by looking at comments added by employees or approvers at the different stages of the procurement process.

Section 6.2 has demonstrated general advancements in information sharing through IRT in terms of the amount, timeliness, consistency, relevance and level of detail. Substantial evidence emerged across the seven case studies. The next couple of sections will explore the development in intra-organisational and inter-organisational linkages in SCNs.

6.3 INTRA-ORGANISATIONAL LINKAGES

This section will begin by exploring the role of IRT in intra-organisational supply chain linkages. Intra-organisational supply chain linkages are necessary between internal processes or activities that affect or are affected by others (Ensign, 2001) e.g. between product design and manufacturing or between quality management and customer services and support. Technologically supported intra-organisational linkages are being used to integrate organisational supply chain processes internally, link organisational employees together, link different organisational sites and support the management of internal supply chain processes.

6.3.1 LINKING SUPPLY CHAIN PROCESSES INTERNALLY

In addition to individual supply chain processes being automised, organisations are finding that in order to be fully effective, the internet-based systems of certain supply chain processes and activities need to be integrated. The outputs from one supply chain process or activity can affect the cost of performance of another (Ensign, 2001; Porter, 1985). IRT is being used to link internal organisational supply chain processes together.

The eSupport & Systems Manager in case C commented that a key factor necessary for successful supply chains is that all applications are fully integrated and that various parts of the enterprise system can communicate with each other. SCM, procurement, customer support and service, customer ordering, knowledge management etc. all need to be fully integrated to ensure that information is consistent and that appropriate information is shared between activities.

Intranets enable many different system, tools and technologies to be fully integrated on a common network. Many large organisations are addressing the problem by having an ERP system at the core of their intranet and having all supply chain-related information filtering in and out of the ERP system (Waller, 2002; Wisner, Keong Leong & Tan, 2004). SCM systems, EDI systems, financial systems, procurement systems, customer service and support systems and many other systems can all be integrated and linked to document management systems, decision support tools and project management tools, databases and many other tools and applications.

A number of examples are provided in the case study results. The organisation in case A, for example, has developed their procurement system by linking it the ARIBA procurement system, supplier's catalogues, an Oracle Financial System, a Signature Authorisation List Tool and e-mail together. Intra-organisational linkages are necessary for example, between procurement and finance, to enable purchasing information to be used within invoicing and budgeting. By electronically integrating one part of the supply chain to another, the organisation is gaining the benefits of being easily and speedily able to check purchases off against the budgets.

Intra-organisational linkages between different supply chain processes were also evident in case study C. A customer service and support specialist has to deal with customer problems and queries. To handle them effectively, the customer service function can operate more efficiently if they have access to information that is derived from other supply chain activities. Supply chain systems are all linked to an ERP system. Therefore, customer service specialists can view customer's order history from the ordering process, delivery details from the logistics process and payment details from accounts processes. As this is now possible with the IRT, it means that an improved and accurate service can be delivered to customers

In case study F, the intranet links the acquired goods and services system, a document management system and a budget management system. Budget-related documents arising from the Acquired Goods and Services process are channelled through to Accountancy supply chain processes by the document management system and the budget documents are then matched to invoices using the budget management system.

Again, one of the key features of case study G was not only the individual advantages that were achieved through the automation of single business processes, but also and more importantly the advantages that were achieved through linking and integrating different processes together. For example, costing, customer ordering, material replenishment, product tracking and customer fulfilment are all technologically linked. By linking the supply chain processes together the benefits of the technology can be further maximised.

It was highlighted through the semi-structured interview that linkages between the ordering system and other organisational systems in case study E could notably be improved. For example, employees recognised that the organisations would benefit from technological linkages between the ordering system and the delivery system internally and externally. At the moment dealers often have to use their judgement as to when they reckon an order may be delivered and it is only if they happen to phone up enquiring about an order that they may be informed of delivery problems. The ordering process could be improved if real-time information was exchanged between the delivery system and the ordering system providing information on the average lead times of products and when there are supply constraints or potential delivery

delays, it would be helpful if alerts could be passed immediately from the delivery system to the ordering system.

One of the key business benefits of applying IRT to intra-organisational linkages is the improvement in information sharing. Information can be shared and manipulated to suit the particular needs of different aspects of the business. Often the information outputs from one process or activity are the information inputs for another process or activity. IRT is being used to enhance linkages between supply chain processes and activities in terms of information sharing, leading to better performance in individual activities and in the overall supply chain. This is an area that still needs to be further developed in organisations considering its importance in enabling the whole supply chain to operate smoothly. Often the real cost savings are achieved through linking the processes together. It is only through having these linkages that organisations can actually reduce customer lead times, speed of decision making and transactions. It will not be so critical to supply chain processes such as Human Resources which do not directly impact other supply chain processes. However, it is essential for processes such as material replenishment which has a major impact on other primary supply chain processes like customer fulfilment. These processes cannot operate in isolation.

6.3.2 LINKING ORGANISATIONAL EMPLOYEES

IRT is allowing employees to collaborate with each other on supply chain activities and tasks from globally dispersed locations (Lipnack & Stamps, 2000; Palmer & Speier, 1998; Townsend, DeMarie & Hendrickson, 1998). For example, employees from Customer Service & Support in case study C often find themselves collaborating on customer problems using IRT while they are based at different locations. In case study G, employees can access the Testing web-based system from any location so they can collaborate with each other on the Testing supply chain process using IRT. The relationship aspect of supply chain linkages will be explored in detail in chapter seven.

6.3.3 LINKING ORGANISATIONAL SITES

Technological linkages can support the collaboration of people based at different sites as employees can share information regarding supply chain processes and activities.

For example the IT manufacturer in case study G has a number of organisational premises. New intra-organisational linkages have been established between the sites for the purpose of sharing information regarding the Testing supply chain process. The web-based monitoring tool is available on the intranet. This is used to monitor the products that are being tested in each cell of the manufacturing line. In the past, UK employees would only have had access to information on the UK manufacturing lines and US employees would have only had access to information on the US manufacturing lines. Now, however, all the information available on the web-based monitoring tool is available to all sites. This means that employees can compare and contrast information regarding the UK manufacturing lines to the US manufacturing lines. This is particularly useful if there are problems with a product on one of the lines as the employees can check and see if there is a similar problem on the lines of other sites.

Likewise, the Utility Service Provider in case study F now has Internet-related linkages in place that allows their different sites to collaborate. The UK sites regularly interface with North American site for the purpose of sharing information regarding engineering supply chain processes e.g. the design of plants. This type of information was not shared between the different sites in the past.

6.3.4 MANAGING INTRA-ORGANISATIONAL PROCESSES

Technological linkages have also enabled managers to manage intra-organisational processes more effectively. The management of internal supply chain processes contributes to the overall management of the supply chain. Managers need to be able to plan, implement and control the efficiency of supply chain processes. On-line information is increasingly available to enable managers to analyse supply chain processes from different angles and manipulate information to provide appropriate levels of detail. A few examples will be illustrated.

In terms of the Testing process in case study G, managers now have access to on-line applications for more advanced management tasks such as analysing product failures. In the past, product failures were analysed using spreadsheets and this could mean that managers had to search through rows and rows of data to find relevant

information. A new application has now been developed which maps the figures on a products' failure rate to different colours on a product grid. Green indicates a satisfactory product failure rate while red indicates an unsatisfactory failure rate. Failure can be analysed in terms of product codes, product names, areas, who owns it or where the issue lies. The manager simply clicks on products highlighted in red to zoom in on the underlying details regarding their reasons for failure. The Materials Manager commented that "it is possible to access information in a much more easy, flexible and digestible format".

Another application used in the management of the Testing process is the Test Supervision application. This provides an overview of the whole shop floor and enables managers to analyse bays that are failing or not getting used etc. Armed with this information, mangers are in a better position to manage the shop floor.

A major area that has been developed and improved in case study B, is the use of IRT in management reporting. The organisation's web based system provides timely reports on network and asset faults and up-to-date reports on emergency situations. The reports can be scheduled snapshots or on demand and the format of the reports can be customised to suit managers. In addition, another main area that was developed was reports on variations in electricity supply at particular times. These types of reports can arm managers with detailed information to make decisions and effectively forecast and plan.

Management also have the ability to manage the Procurement process in case study A and the Acquire Goods and Services process in case study F using on-line analysis tools. The analysis tools are designed for tracking organisational and employee spending, identifying trends in spending and forecasting for strategic planning.

Section 6.3 has explored the deployment of IRT in intra-organisational supply chain linkages. Inroads have been made in linking supply chain processes internally, linking employees, linking sites and managing internal processes in terms of information sharing. Inter-organisational linkages will be analysed next.

6.4 INTER-ORGANISATIONAL LINKAGES

This section concerns itself with the role of IRT in inter-organisational supply chain linkages. Inter-organisational linkages are essential between organisations involved in a common SCN delivering products and services to end customers (Handfield & Nichols, 1999; Ward & Peppard, 2002). The supply chain processes in one organisation's supply chain will affect the process and activities in another organisation's supply chain. Organisations have inter-organisational linkages with suppliers, collaborating partners, customers and with service providers such as logistic providers.

The empirical findings highlight a number of trends in using IRT for inter-organisational linkages. IRT is being used to establish and strengthen linkages with other organisation's supply chain processes and different SCN members and to enable more effective management of inter-organisational processes and manipulation of information across the SCN. As indicated by Li & Williams (2000), the focus has shifted to managing and manipulating information flows over the SCN. Flows can be drawn on using the web to deliver value to SCN members in new ways.

6.4.1 LINKING SUPPLY CHAIN PROCESSES EXTERNALLY

Inter-organisational linkages involving different organisations supply chain processes and activities can be strengthened by the facilities, applications and information that can be shared and manipulated between the different organisations using IRT. Many organisational systems are being linked through intranets, ERP systems and EDI etc. This can allow different organisations' supply chain processes to be linked. For example, the procurement supply chain process in the organisation in case study A is linked to the ordering and customer service supply chain processes of their suppliers. Information flows from one process to another through the technological linkages.

Furthermore, organisations are also setting up portals for SCN members. Portals incorporate all necessary connections to resources, applications & information unique

to their specific requirements. Portals assist in streamlining the diffusion of information between organisation's supply chain processes and integration and visibility have clearly enhanced SCN cohesiveness and coordination. It enables SCN members to gather information and an understanding of what is happening across a SCN and facilitates the coordination of products and services from one supply chain to another. It helps reduce inventory, save costs, improve decision making, improve timeliness and overall provide a better level of service to customers.

6.4.2 LINKING SUPPLIERS

Organisations are implementing web-based inter-organisational systems because they open up endless opportunities for sharing information between organisations involved in a common SCN environment. This is certainly the case with organisation's suppliers. Organisations are not only enhancing linkages with suppliers by providing them with greater information but also by providing more relevant information.

The organisation in Case Study G has set up a portal for key suppliers. The supplier portal is personalised with personal information, relevant reports such as forecasted customer demand for the next 30 days, applications, facilities for transactions, up and coming events, bookmarks, trade magazines and education. Suppliers also have access to information on supply chain processes such as planning, order fulfilment or material replenishment. This not only lets them manage their own supply chain processes and activities better e.g. when and how many components they need to produce but it means there is more chance of the organisation's supplies being delivered at the right time. It reduces inventory levels for the supplier and the organisation, warehousing requirements and associated costs etc. Overall it appears to have reduced common problems associated with the Bullwhip Effect (Machuca & Barajas, 2003).

In Case Study A, suppliers are provided with a portal through the Ariba Service Network which allows suppliers access to product catalogues and they can use it for exchanging business documents such as EDI-based invoices. They are not allowed to make changes to the catalogue though for security reasons. Suppliers also have access to the organisation's ERP system for viewing the status of their account, what has still

to be paid, what's been approved for payment and what's not been approved. This provides benefits to the supplier and the organisation. It saves the organisation time as it stops the supplier phoning as much. They only phone if there is a problem now. The supplier, on the other hand, can plan financial matters better.

Furthermore, IRT are being used to set up linkages with new suppliers. In particular, the organisation in case A find that they are now procuring goods from smaller suppliers that they would not have used before. This is because many smaller suppliers can now much more easily develop and participate in inter-organisational systems available on the www. The organisation is also finding that they are using some foreign suppliers that they would not have bothered to use before as language barriers were too much of a hindrance. However, they find that the automation of standardised inter-organisational processes reduces many of these barriers and the language barriers are only really a problem when the technological linkages are first established. Once these barriers are overcome and the catalogues etc. have been automised, they are normally able to transact fairly smoothly with the foreign suppliers.

6.4.3 LINKING CUSTOMERS

Organisations are also enhancing inter-organisational linkages with customers using IRT. For example, in case study C, larger customers that have set up some kind of partnership with the organisation are being provided with their own dedicated web-portals. The portal is tailored to the customer needs and highlights information specific to their requirements. It is set up with the customer's logo and filled with approved product configurations, prices, systems, accessories and spare parts. Customers also have access to the intranet for a range of customer service facilities. This includes access to on-line technical support, tips on known product faults, discussion groups, parts information, installation information, software and hot news. It provides facilities for service ordering and progression tracking. Service and warranty notification would be sent automatically to service teams via the portal and warranty upgrades that have been negotiated and agreed would be readily available. On the one hand this provides the customer with an enhanced, quicker and more accessible service. On the other hand, it cuts costs for the organisations providing the

service as they have to deal with less customer enquiries and they can concentrate their efforts on more complex problems.

As well as providing information to customers, the organisation has the capability of gathering information from customers. Hagel and Sacconaghi (1996) suggested developing information capture strategies for gathering customer information. This organisation gathers, organises and synthesises the types of questions that customers are regularly asking and based on these questions they continually develop the customer service and support web site to provide relevant information. Overall, this has led, to much less customer problems with their products. Secondly, Customer Service employees, of case study C, have clear visibility of the trail that customers have followed in order to try and solve a problem with a product. When the customers send e-mails regarding problems, the trail that they have already followed would be swept up and attached to the e-mail. Customer service and support employees can use this trail of information to help solve the problems and pursue alternative avenues. Furthermore, the customer service and support employees now even have facilities to gather information on what is going on in a customer's PC using IRT.

The internet-based ordering system established in case study E is also available to customers. This organisation permits dealers (essentially their customers) to have clear visibility of customer orders, stock of cars at other dealers or vehicle holding centres and cars currently in the manufacturing pipeline. Before the system was introduced, dealers would try and manually locate vehicles to meet customer orders. This was a timely exercise and would invariably lead to orders being placed for cars which were lying unsold at other locations. The internet-based system, however, enables them to easily view unsold cars online at different stages of the pipeline: planning stage, production stage and storage stage. It allows dealers to tap into this information and snatch cars to meet the demands of their customers. This will improve customer service in terms of how quickly they can get the cars to the customers and allow dealers to accurately match customer requirements. It also helps to cut down on cars in stock and therefore reduce costs and enables cars to be transferred to suitable customers before they become obsolete.

Furthermore, the organisation in case B, provide facilities to their customers, using IRT. Customers can access an Internet Invoicing service. Through this service, customers can view and analyse the invoices or statements online or download them into Excel or Lotus. They can also customise extracts of the invoices to interface with their own systems. This enhanced availability of information supports customer management and financial analysis.

6.4.4 LINKING LOGISTIC PROVIDERS

The organisations appear to be using IRT for enhancing inter-organisational linkages with logistic providers as well but to a much lesser extent. For example, the large IT manufacturer in case study C had some technological linkages with logistic providers in terms of the Internet, e-mail and in some cases access to the logistics provider's systems. This is used to exchange delivery requirements. Furthermore, the engineering manufacturer in case study D exchanged e-mails with the logistic providers or entered delivery instructions into the logistic providers systems via a dedicated PC and are able to use the system to track the despatch status of various goods. Overall, this simplifies the movement of goods and the provision of information to the relevant parties.

Although both of these organisations have made some advancement in developing technological linkages with logistic providers, the information exchange with logistic providers is still much more limited in comparison to suppliers and customers. Moreover, in reality, both of these organisations still have various problems with the delivery of their goods such as customer orders being late or going to the wrong place. In addition to this, there appears to be a lack of coordination between the organisations and the logistic providers and consequently, the problems are not even getting resolved quickly.

In contrast to the experiences of the two cases discussed the telecommunications organisation in case G is providing greater information to logistic providers. They have developed portals for logistic providers providing information such as order scheduling. This allows the logistics provider to plan better and they are experiencing

a number of benefits including what they believe to be an improvement in the coordination of logistics services and customer delivery.

Overall, it is important that organisations do not just think that because they have outsourced their logistic services that they can neglect inter-organisational linkages with the logistic provider. Outsourcing arrangements must be well managed and companies should not see outsourcing as an excuse to take their eye off the ball (Manchester, 2003). In many cases, technological linkages could be developed further to enable more controlled management and coordination between the needs of the organisation, the needs of the organisation's customers and the service delivered by the logistics provider.

6.4.5 MANAGING INTER-ORGANISATIONAL PROCESSES

SCM is increasingly about managing the supply chains of all organisations involved in delivering the end product or service to the end customer (Lambert & Cooper, 2000). IRT can be used for managing inter-organisational supply chain processes and wherever possible accessing information on supply chain processes in other SCN members supply chains.

This is epitomised in case study E. The management in the automobile organisation use the intranet and order fulfilment system for analysing supply chain information regarding different dealerships in their SCN. They can use the system to study stock information e.g. the number of vehicles in stock in each dealership, the order status of these vehicles and the age of these vehicles. They also use it to analyse customer information. Questionnaires are filled in by customers that buy cars from the dealers and the information from these questionnaires is stored on-line by the dealers. The automobile organisation can access the information to analyse the level of customer satisfaction in the handover of cars from dealers to customers. They can also manipulate the information to compare and contrast the level of satisfaction in different areas of the United Kingdom and identify any trends that are appearing.

The management in case study C can use IRT to optimise the inter-organisational supply chain process, Customer Service and Support. They have access to analysis

facilities on the intranet that allows them to monitor the number of customers that have used the self help facility, common customer problems, common trails that customers have followed to try and solve problems, the types and number of products bought, the number of claims, the number of repairs etc. Using this information, managers can try and optimise the process and better meet the needs of the customers in their SCN.

6.4.6 MANIPULATING INFORMATION

The level of detail of the information communicated can be manipulated and presented in different ways to meet the needs of different SCN members as well. In the ordering system in case E, summarised information is extracted and presented to managers in the focal organisation while the dealers (customers) will automatically get more detailed information to suit their uses. They will only request more summarised or detailed information if required. For example managers may get a summary of the overall average age of cars in stock in dealerships while the dealers would be provided with a detailed breakdown of the ages of their stock units.

The logistics provider in case D presents logistics information in different ways, to different SCN members. A collection of vital documents are used throughout the logistics process and much information on the different documents overlap. The 'Export Job' and the 'Bill of Lading documents, for example, provided information on the organisation exporting goods, goods being exported and the customers receiving the goods. However, the information presented on the 'Export Job' document form is in a slightly different format from the 'Bill of Lading' document. This is the case as employees in the logistics company need information in a format of which is conducive to the activities and roles they are involved in. While, the 'Bill of Lading' is a legally required document that needs to be presented in a set way to shipping lines and is then sent overseas. Fortunately, information no longer needs to be retyped for different documents and systems. The intranet system can automatically manipulate the information into different formats and make them available on-line or have them e-mailed to relevant personnel.

In summary, various applications and information can be shared across inter-organisational systems using such tools as the www, extranets, portals, EDI, ERP

systems etc. As indicated by Croxton, Garcia-Dastugue and Lambert (2001), supply chain process integration and reengineering activities should be aimed at boosting total process efficiency and effectiveness across the whole SCN. The level of integration provided through IRT pulling SCN members closer together and consequently improving the performance of the SCN.

6.5 DIVERSITY OF LINKAGES & INFORMATION SHARING

Porter (1985) referred to the points that a SCN member comes into contact with an organisation's supply chain as contact points. Traditionally SCN members had limited points of contact with an organisation and limited methods of making contact. However, using IRT, the choice of paths and options for contact are increasing. There is much more flexibility in the different paths that are possible to communicate across a supply chain and a SCN. This is largely due to the web links between systems, the levels of integration between systems and the visibility now possible. These different linkages will be explored under four headings; same point of contact; different points of a supply chain; different tiers of SCNs; direct links between other supply chain members.

6.5.1 SAME POINT OF CONTACT

Using IRT there are now often a number of alternative ways of linking a SCN member to the same point of contact in an organisation's supply chain. For example, in case study C, there is two web links that customers can use to access the relevant level of customer service and support in the organisation. They can either go in as an experienced user or as an unexperienced user. The experienced user can access it using a quick path while the less experienced user can be walked through the system step by step using an on-line assistant. These may be two different pathways but each pathway has consistent information. The end result is the same but the level of support and time taken in each pathway is different.

6.5.2 DIFFERENT POINTS OF A SUPPLY CHAIN

There is also an increase in the number of different contact points that a SCN member can make with an organisation's supply chain. In case study G, IRT supports different

areas of a supplier's supply chain in interacting with different areas of an organisation's supply chain. These links can be easily accessed via the supplier portal and are illustrated in Figure 6.1.

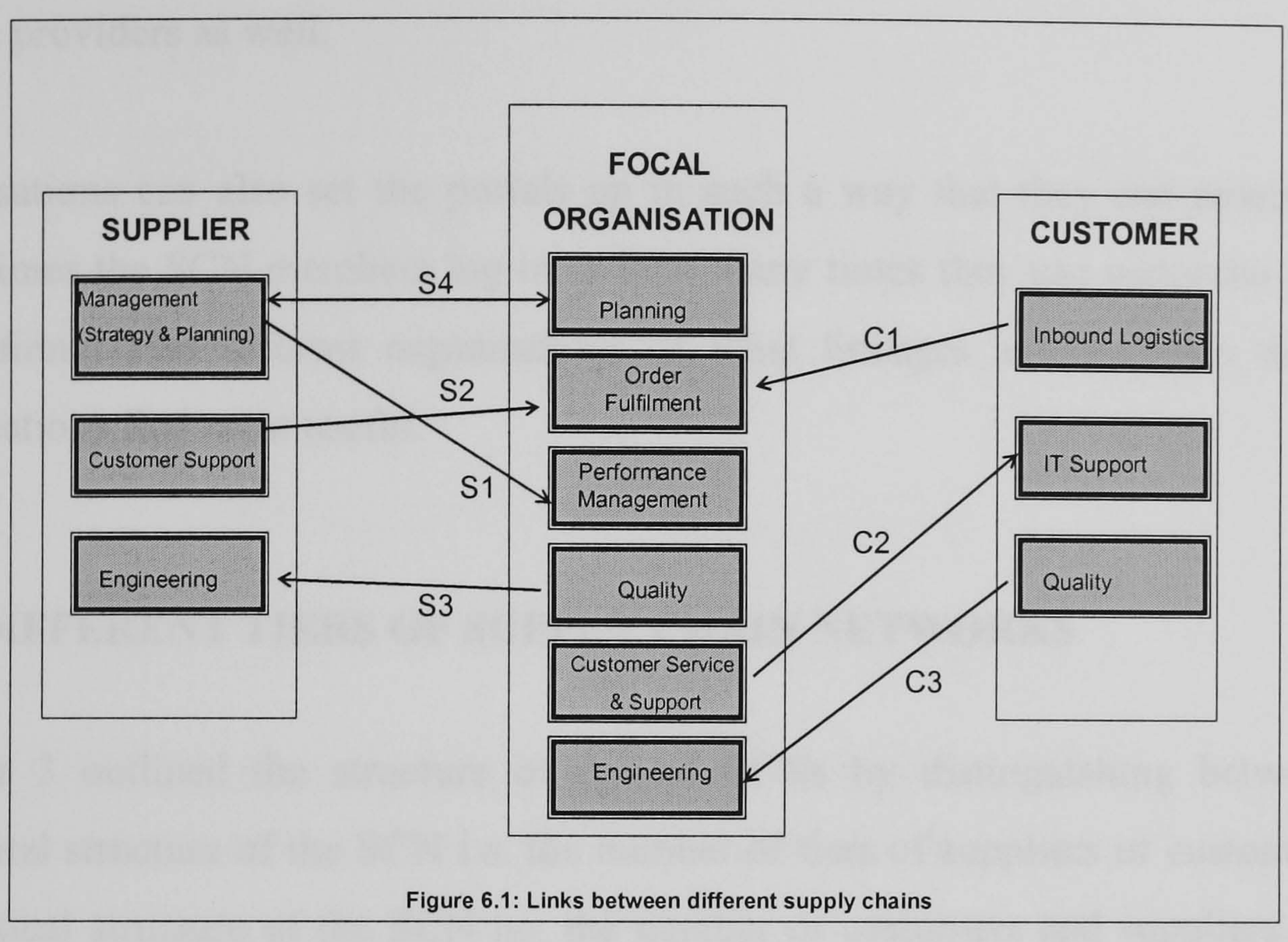


Figure 6.1: Links between different supply chains

For example, the supplier's managers may access an online scorecard application that is updated by the organisation's Performance Management section (Link S1). The supplier's Customer Support function accesses demand replenishment information from the organisation's Order Fulfilment (Link S2). The suppliers Engineering function provides updates on processes or products to the organisation's Quality function (Link S3). Supplier's Planners can collaborate with the organisation's planners on materials replenishment plans (Link S4) and so on. The diagram only shows the relevant functional areas.

Case Study C also highlighted many different points of contact between a customer's supply chain and the organisation's supply chain with the customer portal providing a starting point. This is also shown on Figure 6.1. Customer's Inbound Logistics are able to view shipments of orders online (Link C1). The organisation's Customer Service & Support can inform the customer's IT department of warranty information (Link C2) and the Customer's Quality department can highlight product faults to the organisation's Engineering function (Link C3).

Even though the diagram only illustrates a collection of linkages between organisations and selected suppliers and customers, it demonstrates the potential complexity and diversity in different linkages that have emerged, supported by IRT. Many different links have developed between an organisation and their partners and logistic providers as well.

Organisations can also set the portals up in such a way that they can monitor how many times the SCN members log in or how many times they use particular links or applications. This informs organisations of what linkages and facilities the other organisations find most useful.

6.5.3 DIFFERENT TIERS OF SUPPLY CHAIN NETWORKS

Chapter 3 outlined the structure of typical SCNs by distinguishing between the horizontal structure of the SCN i.e. the number of tiers of suppliers or customers and the vertical structure of the SCN i.e. the number of customers and suppliers at each tier (Lambert & Cooper, 2000). Traditionally, inter-organisational linkages were restricted to key suppliers and key customers probably in the first or second tier. However, a common technological infrastructure across the different tiers of a SCN enables more flexibility and opportunity for inter-organisational linkages between further tiers and non-key suppliers and customers.

This can be demonstrated by referring to case study G. In the past the IT manufacturing organisation only had limited interactions with 1st tier suppliers. Now that the organisation has implemented IRT and many of their SCN members have followed suite, the organisation is able to have on-line interactions with 2nd and other tiers of suppliers and customers. They use the technological linkages to interact with Tier 1 suppliers on an ongoing basis on a fuller range of SCM issues (e.g. execution planning, demand replenishment, performance management) while technological linkages are used to interact with Tier 2 suppliers on more specialised SCM issues (e.g. demand replenishment for a specific product) or sometimes on emerging issues (e.g. design of a specific product). This is displayed in Figure 6.2. The diagram only

illustrates two tiers of suppliers and customers for simplicity. The organisations also have inter-organisational linkages with further tiers of suppliers and customers.

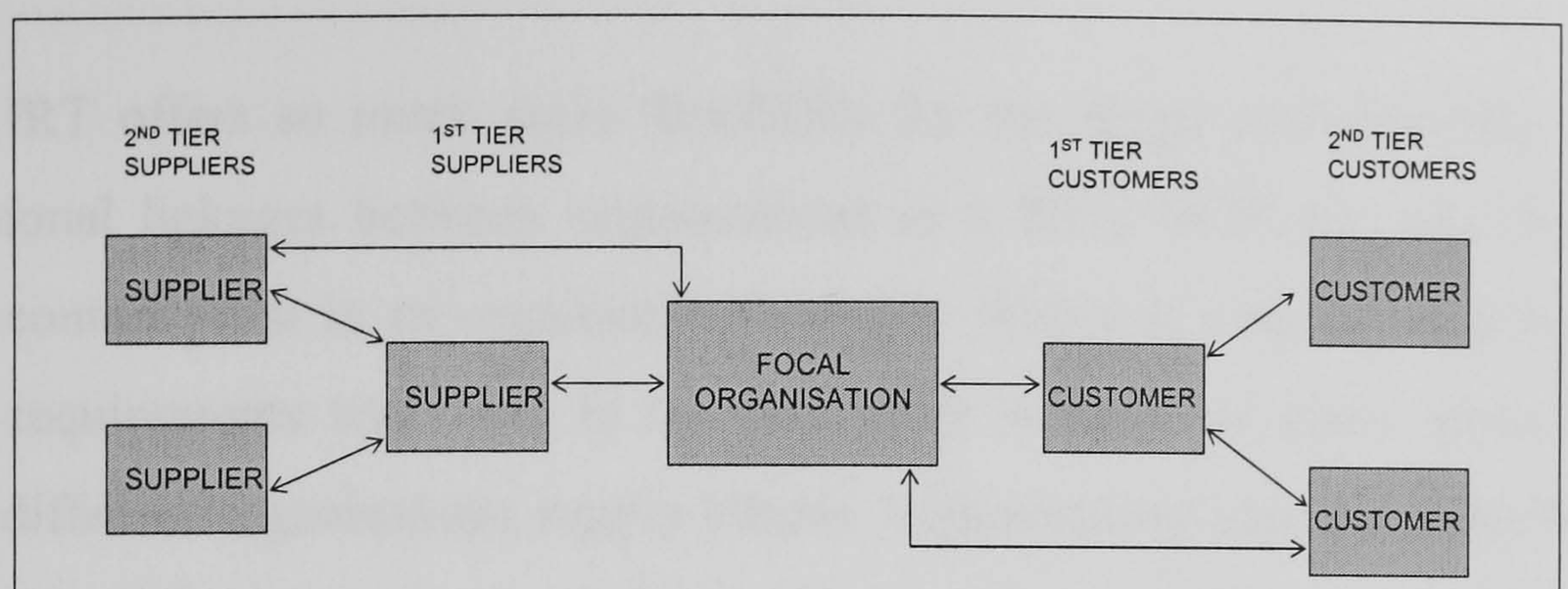


Figure 6.2: Links with Different Tiers of Suppliers & Customers

6.5.4 DIRECT LINKS BETWEEN OTHER SCN MEMBERS

Even more revolutionary, though, is the Internet's capability to establish new, direct links between the other members of the SCN i.e. between suppliers and customers, between suppliers and logistic providers and between logistic providers and customers. These linkages are highlighted in Figure 6.3. Indeed in case study G, SCN members can now directly interact through the organisation's portal.

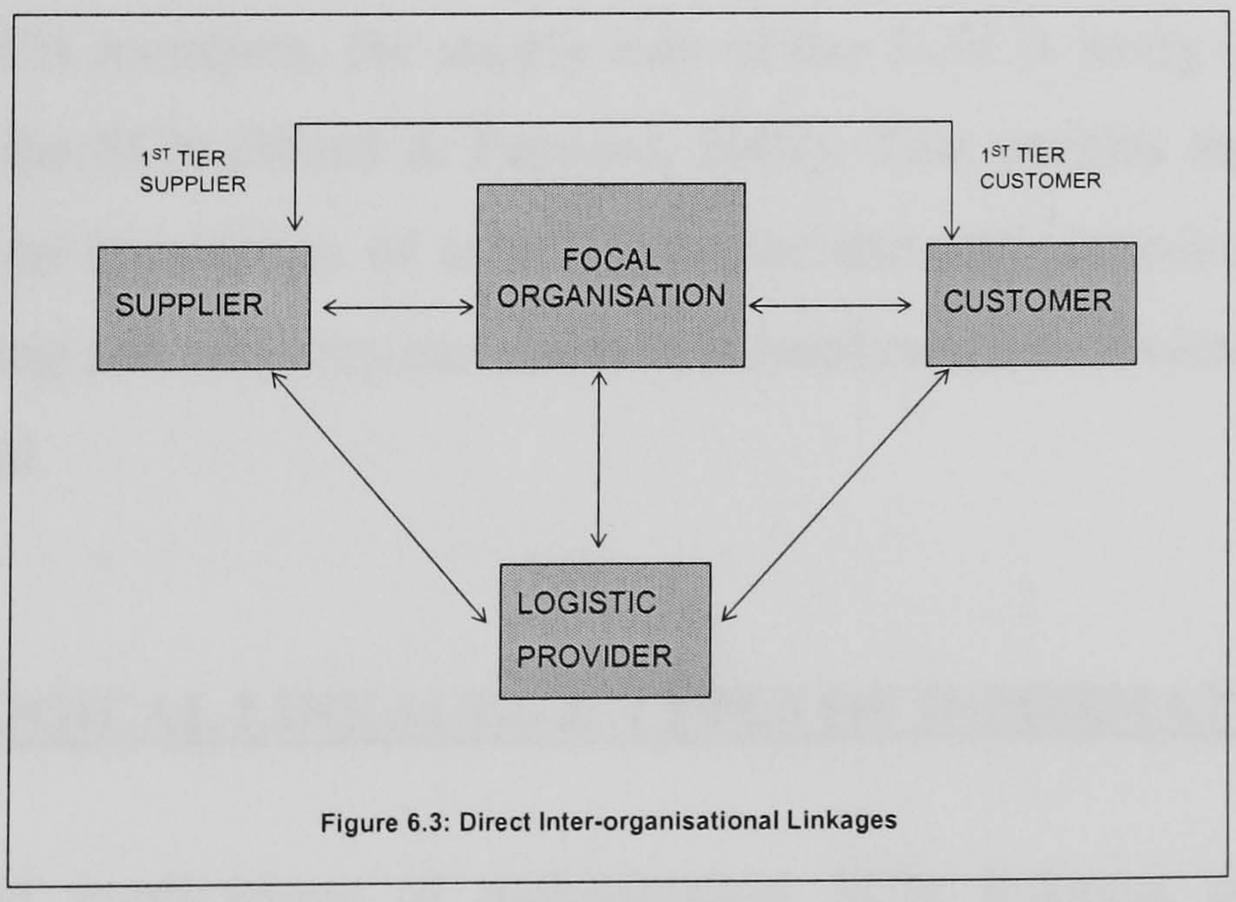


Figure 6.3: Direct Inter-organisational Linkages

Suppliers can interact with customers and gain access to real-time customer ordering information. Logistic providers can interact with suppliers to get a better estimation of when products will be ready and with customers to find out more about their delivery requirements. This enables them to aggregate different products that make up an order

and deliver the order in one batch rather than in bits and pieces. Information no longer needs to be 2nd hand through an intermediary. It can be directly exchanged between SCN members.

Overall, IRT offers so much more flexibility for the scope and diversity of inter-organisational linkages between organisations in a SCN. SCN can use the web to access a contact point in an organisation's supply chains in various ways depending on their requirements and there is the flexibility to have so many more linkages between different organisations supply chains. Organisations also have the flexibility to link with different tiers of suppliers and the other members in their SCN e.g. suppliers and customers can directly interact.

There are many reasons why organisations will be tempted to pursue these technological developments. Enhanced linkages with suppliers will allow suppliers to improve their performance by providing more timely inputs. More coherent linkages with customer supply chains will allow organisations to 'sense and respond' to customers desires rather than simply make and sell products (Rayport & Sviokla, 1995). Better supply chain linkages with logistic providers will allow them to access information necessary to anticipate, aggregate and deliver orders and to provide customers with a more proficient service. Moreover, by allowing direct linkages between other SCN members, the supply side of the SCN is being connected to the demand side of the SCN (Ward & Peppard, 2002). This enables suppliers to make decisions based on knowledge of actual customer demand. Potentially the level of information sharing and visibility can result in mutual process efficiencies for all SCN members involved.

6.6 TECHNOLOGICAL LINKAGES & TYPES OF INFORMATION

The benefits and implications of technological SCN linkages are clearly vast. However, the types of information that are required to be shared for supply chain processes and activities may limit the diversity and flexibility in SCN linkages. Section 3.5 of chapter 3 explored the definition of information. Distinctions were made between data, information, explicit knowledge and tacit knowledge (Davenport

& Prusack, 1998; Nonaka & Takeuchi, 1995; Von Krogh, Nonaka & Aben, 2001). For simplicity the majority of the dissertation has generally used the term information. However, at this point, it is worth noting that depending on the type of information that is being shared across the SCN i.e. data, information, explicit knowledge or tacit knowledge, different types of IRT or other communication channels may be more suitable.

Technologies such as EDI are leaner media as they have minimal interactivity, limited cues and little adaptability (Daft & Lengel, 1984; Daft & Lengel, 1986). In many cases, leaner technologies such as EDI are more suitable for sharing data. In case study A's procurement process, orders are placed by transmitting purchase orders to suppliers using EDI. These order forms contain structured data about the product to be ordered and the quantity. EDI is particularly well suited as few cues and little if any adaptability are required. Furthermore, the invoicing process was studied in detail in Case B. The actual task of invoicing is also adequately handled using technologies such as EDI as it only involves sending organisations details of the amount of electricity they have consumed, the cost per unit and the total amount due. One of the interviewees in case A actually commented that using IRT to streamline manual repetitive work that added no real value and was essentially data, enabled employees to concentrate their efforts on information and knowledge.

There are also technologies that can be used for sharing information through technological linkages. These tend to be slightly richer technologies i.e. more interactive, more cues etc. Examples of data being manipulated and presented to users as information are vast throughout the case studies. For example, the orders in case A are analysed using DBMS and in particular reports to produce a breakdown of total spend by employee and by department.

More explicit knowledge and in some cases tacit knowledge can be shared between different people using technological linkages as well. These technological linkages need to be formed by technologies that are richer again. For example, employees using video conferencing and shared whiteboard can observe how someone else would approach a task e.g. the order of the steps they go through, the thought process

they go through etc. In essence this can allow explicit knowledge and in some occasions tacit knowledge to be shared between different people.

It should however be noted that tacit knowledge is more deeply rooted in an individual's experiences, ideals and values (Nonaka & Takeuchi, 1995) and there is still a tendency for face to face communication to be the vehicle for sharing tacit knowledge. For example, in case E, managers are more likely to pass on their knowledge and experience in advancing promotions in the dealerships when they are involved in informal face to face communication at the dealer's premises. All in all, tacit knowledge is not as readily shared using IRT and supply chain activities and tasks involving sharing tacit knowledge may require more varied means of communication e.g. face to face communication (Von Krogh, Nonaka & Aben, 2001). The next chapter will expand on this in more detail as it focuses on IRT and interpersonal relationships.

In conclusion, the types of information that are being shared will influence the level of richness in the communication channel (e.g. the number of cues, level of interactivity, level of adaptiveness) that is required. The different forms of information (from data to information to explicit knowledge to tacit knowledge) can be placed on a continuum ranging from leaner IRT to richer IRT. Data would be placed at the leaner end of the spectrum and tacit knowledge would appear at the richer end. Data requires the leanest type of IRT and tacit knowledge is likely to require the richest type of IRT and actually in many cases it requires face to face communication.

Therefore although advancements in technology are likely to provide a much greater diversity and flexibility in the supply chain linkages possible across SCNs, the types of information being shared for supply chain processes and activities will still place some limitations on the scope of these SCN linkages.

6.7 LIMITATIONS OF USING IRT FOR SCN SUPPLY CHAIN LINKAGES

There are a vast amount of benefits in using IRT for SCN linkages. These are largely related to the level of integration that is possible between intra-organisational and inter-organisational supply chain processes and the level of visibility it provides in terms of information sharing. Moreover, the technological supply chain linkages provide a diverse range of SCN linkages enabling a more flexible yet coherent SCN. There are however a number of further limitations in using IRT for supply chain linkages and information sharing. These limitations can be categorised as security, technological, legal and organisational issues and they should be taken into account.

6.7.1 SECURITY

Security is a major issue for inter-organisational linkages. Some SCN members are using intranets that don't have the same level of security as an organisation's own intranet. This issue needs to be taken into consideration when the organisation decides what supply chain linkages and information they will make available to them. There is also always the fear that other organisations will use information that they have access to against you. Organisations need to be extremely careful who they decide to share supply chain-related information with.

6.7.2 TECHNOLOGY

The technological infrastructures vary dramatically in different countries in terms of performance and level of advancement. This may be a problem if the supply chain linkages encompass different employees, subsidiaries or SCN members that are based in different countries. The Customer Services & Support function in case study C was very aware of this in terms of customer service and support. There are a number of different ways of accessing service and support that are provided to customers. In many cases the US subsidiaries are so advanced that they are using new technological developments for customers accessing service and support that are unsuitable for less developed countries. In addition they are looking to discontinue older methods of access that are actually required for less well-developed countries to be able to even access the service and support. Sometimes the US subsidiaries of the organisation are so far ahead that they forget that the infrastructures vary substantially and they need to be reminded of this.

6.7.3 LEGAL

Global organisations are clearly making intranets and supply chain related systems available in different countries. Organisations seeking to make organisational systems globally available need to be aware that there are variations in the law in different countries this can limit the systems of an organisation. Legal limitations were evident in case study A. When the organisation developed their procurement system, a multi-cultural core team was established that liaised with different functions in different countries. The team had to determine real legislation within each country (not perceived legislation that has formed through the rules that have been adopted through the years). For example, in France invoices need to be numbered in sequential order. In other countries, the organisation needs to keep hard copies. Therefore, for legal reasons, the organisation's procurement system had to be set up slightly different for subsidiaries in different countries. These types of issues need to obviously be taken into account for other SCN as well.

6.7.4 SKILLS

Another problem of having internet-based linkages is that employees use all the facilities and features of the technology and communicate far too much information. Problems arise such as information overload. Also in line with the literature review in section 3.5, some employees are reluctant to share information over the intranet (Apgar, 1998; Markham, 1989/99). They resist sharing information as it is perceived as giving them power and securing their position within the organisation. Often this is usually the information that adds value to the organisation and would benefit from being disseminated using communication channels. Overall, the culture needs to be one of effective information sharing. One way of encouraging this is by manager's recognising the individual's ability to share information. The organisation in case C, do this by rewarding employees for effective information sharing.

These different limitations must be given due attention in the development of technologically based SCN linkages. Overall, this chapter has explored the different angles of IRT, supply chain linkages and information sharing. The chapter will now be summarised.

6.8 SUMMARY

In summary, this chapter has explored the role of IRT in SCN linkages and information sharing. Firstly it has highlighted how IRT has developed information in terms of the amount, timeliness, consistency, relevance and level of detail that can be shared across SCNs.

Secondly, the chapter demonstrated that IRT are being increasingly used to enable and enhance intra-organisational and inter-organisational linkages within supply chain processes and between supply chain processes. Intra-organisational linkages have advanced in terms of their scope for linking internal organisational supply chain processes, employees, organisational sites and managing internal processes. Inter-organisational linkages have developed the ability to integrate inter-organisational supply chain processes, link different SCN members and manipulate information to suit different SCN members.

Thirdly, the chapter focused on the increased diversity and scope of supply chain linkages across the whole SCN and the advancements in these linkages in terms of visibility, flexibility and information sharing. The potential depth and diversity of linkages have been advanced in terms of different ways of accessing supply chain contact points, different linkages between different organisational supply chains, linkages with different tiers of SCN members and direct linkages between other SCN members. Consequently, SCN members can collaborate more closely, establishing a more coordinated and optimised SCN and enhance the level of service and product offering.

The scope of these SCN linkages will however be limited by the types of information that is being shared. Different types of information will be suited to different types of SCN linkages. The suitability of data, information, explicit knowledge and tacit knowledge can be placed on a continuum in terms of the most suitable type of SCN linkage ranging from leaner IRT to richer IRT to face to face communication. Finally a variety of other limitations were outlined that were based around issues such as security, technology, legalities and employees skills.

The proceeding chapter will study the interactions and relationships that are necessary in order for supply chain processes to operate and the impact that IRT has had on these matters.

Chapter 7:

Supply Chain Networks & Virtual Relationships

7.1 INTRODUCTION

The previous chapter studied the role of IRT in inter-organisational and intra-organisational SCN linkages and in particular information sharing. This chapter explores another component of SCN linkages which is also playing an increasingly greater role in SCNs, namely SCN relationships. SCN relationships exist externally with suppliers, customers and logistic providers and internally between different employees. Strong relationships are an essential ingredient for delivering a competitive integrated SCN.

The chapter is organised as follows. It will begin by discussing a range of issues that are driving the increasing significance of relationships at all levels of the SCN and how inter-organisational and intra-organisational relationships are even more complex in supply chain processes as they increase in scale and scope. It will explore the advancements and benefits that organisations have made in terms of using IRT for virtual relationships (inter-organisational partnerships, inter-organisational and intra-organisational teams and interpersonal relationships). Firstly it will analyse how IRT such as integrated intranets, ERP systems, portals etc have been used to strengthen the quantity and quality of virtual partnerships in terms of flexibility, depth of linkages and personalisation. Secondly it will outline how IRTs such as the www, e-mail, team portals, collaboration tools etc. have been used in developing the quality and quantity of relationships within virtual teams (inter-organisational and intra-organisational) in terms of sharing information and expertise and providing greater personalisation leading to traits such as trust and identity.

The type of relationship that an organisation has with other SCN members will affect the role of IRT. Critical or beneficial relationships with key SCN members should be nurtured and developed over a longer period of time. IRT should be manipulated to provide these types of SCN members with a greater depth and diversity of linkages, a superior level of information sharing and a more advanced level of personalisation. The application of IRT to non-key or shorter term relationships should be more limited and incorporate less time and monetary investment.

A range of factors that will potentially restrict the use of different types of IRT for SCN relationships will also be outlined. These include the stage of the supply chain process, top management involvement and inter-organisational processes, supply chain conflict and the need to establish a suitable mix and pattern of communication channels. Finally some limitations of using IRT for building and developing SCN relationships will be reflected upon. These focus on contextual, cultural and social presence aspects of organisational environments.

7.2 SUPPLY CHAIN NETWORKS & RELATIONSHIPS

Although technology is having significant strategic impact on SCNs in terms of SCN processes, supply chain linkages and information sharing, technology is not enough on its own. As indicated by the Engineering Director in Case study G, the SCN still needs people and interpersonal relationships to drive supply chains at all levels of the SCN. There are a number of factors that have emerged from the case studies that have collectively led to an increase in the importance and level of relationships at all levels of the SCN.

Firstly, the significance of inter-organisational relationships between different members of the SCN is fetching more and more prominence in SCNs. This is largely due to the fact that organisations are increasingly entering global marketplaces by forming partnerships and alliances (Cohen & Mankin, 2002; Speier, Harvey & Palmer, 1998) and outsourcing aspects of their supply chains (Manchester, 2003; Thomas, 2003). On top of this their business environments are becoming more and more competitive (Day, 2003; Van der Aalst, 2002) and strong inter-organisational relationships are critical in achieving a competitive level of corporate performance in terms of flexibility, quality and efficiency (Wisner, Keong Leong & Tan, 2004).

Relationships are also becoming increasingly important in terms of building teams to conduct supply chain activities and tasks. There is an increased need to pool the expertise and specialised knowledge of people together to compete more effectively on supply chain activities in international business environments (Lipnack & Stamps,

2000; Palmer & Speier, 1998; Townsend, DeMarie & Hendrickson, 1998; West et al, 1997).

For example, in case C there was mounting pressure for the Customer Service and Support function to create teams to provide a fuller level of customer service to customers. Teams of customer service personnel and engineers are specifically aligned to large corporate customers providing specialist support based on the product mix that the customer has installed and the language they speak. This means that if a customer has a problem with a product a team of people can pool their specialised knowledge together to solve the problem thus providing an enhanced and more competitive customer service. It is essential for customer service and support specialists at the front end of the service spectrum to integrate, collaborate and share information, knowledge and experience with engineers at the back end. Also, customer service and support specialists need to tap into the specialist knowledge of the engineers. Some teams are slightly less formalised and are formed and disbanded at different stages of the process depending on supply chain needs. In case G, employees from different functions e.g. manufacturing, testing and IT, may form temporary teams to work towards solving technical problems on the line and then once the problem is resolved the team can be disbanded.

The need for organisations to build SCN relationships is also exemplified in supply chain processes as they increase in scale and scope. The scale and scope of processes were discussed in chapter 3. To recall, the scale of the process can range from a very simple set of tasks to a very highly complex set of interrelated activities (Peppard & Rowland, 1995). At one extreme, a simple set of tasks may only involve one or a few individuals. At the other extreme, a complex set of interrelated activities may require the expert skills or contribution of a large team of people. In general, greater scale processes are likely to require more people to be involved. As organisations are becoming more globally dispersed in today's competitive environment, it is inevitable that the larger scale processes are increasingly comprised of relationships between employees that are globally dispersed.

The other aspect of a supply chain process, depicted in chapter 3 was the scope of the process. The scope of a process is concerned with the extent to which it crosses

organisational boundaries. A process with a narrow scope usually takes place within a single department or function. A process with a broader scope is likely to cross a number of functions or departments and an even broader process will cross a number of organisations. Broader scoped processes are potentially more diverse and/or complex as they cross inter-organisational boundaries. They may involve people from a greater range of backgrounds, outlooks, knowledge or skills. Moreover, a supply chain process crossing more boundaries is more likely to involve people that are globally dispersed.

Supply chain processes covering a larger scale or broader scope can potentially be more intricate and complicated, involving a greater number of people and people from a greater range of organisational backgrounds. Therefore it is of even greater importance that these types of activities and processes have a strong team of people driving them and working together. Inevitably, the larger the scale and/or scope of the process, the more likely that the teams of people be geographically dispersed and will have to operate virtually.

Lastly, it is clear from chapter 5 that the different elements of enabling, operational and strategic supply chain processes are progressively being automised. This has resulted in the dehumanisation of many aspects of supply chain processes and activities. Consequently, it is more and more important that strong interpersonal relationships are still developed for the remaining softer or more personal aspects of supply chain processes that often require sharing tacit knowledge. Otherwise, organisations may find that IRT begin weakening the success of SCNs rather than being the success that organisations bargained for. Clearly, inter-organisational and intra-organisational relationships have a key role at different levels of the SCN.

7.3 INTERNET-RELATED TECHNOLOGIES &VIRTUAL RELATIONSHIPS

The previous section has outlined the increasing importance of relationships across SCNs. Organisations need to cope with an ever increasingly level of complexity in these SCN relationships as they have to cross a greater amount of organisational,

geographical and temporal boundaries (Li & Barlow, 2000). Global dispersion and the availability of IRT have seen co-located relationships become less and less common in large global organisations and virtual relationships becoming progressively more practical. Although IRT will not replace SCN relationships the different IRT can be manipulated to enhance supply chain relationships across the SCN. Section 7.3.1 will explore how IRT have been used to enhance virtual partnerships and section 7.3.2 will highlight ways in which IRT have been used to improve virtual teams.

7.3.1 IRT & VIRTUAL PARTNERSHIPS

IRT are being developed for virtual partnerships in a variety of ways. Firstly, internet-based related supply chain linkages have increased the quantity and flexibility of relationships that can now be developed with other organisations. In case C, the organisation can now provide customer service and support to medium and smaller sized organisations that it was either too costly or impractical to service in the past face to face. The facilities of IRT can be used to provide a more flexible remote service that will contribute to enhancing future relationships with these types of customers. In case G, the quantity and flexibility of relationships has also increased. In the past there were many second tier and greater tiers of suppliers and customers that they could not have practically built relationships with. As illustrated in the previous chapter on figure 6.2, IRT has provided them with the flexibility to develop relationships with these different tiers of suppliers and customers. For example, they can build stronger relationships with a second tier supplier by providing information to them on the requirements that the organisation has in terms of supplier performance or by collaborating on the design of specific products. This will strengthen relationships as the organisation is more likely to use the second tier supplier in the future and it also strengthens the relationships the organisation has with their customers as they will be provided with a better quality product.

The depth of the technological supply chain linkages (in terms of linkages between organisation's intranets, ERP systems, DBMS, applications, resources and information etc.) are also improving the quality of virtual partnerships. Integrated supply chains are supporting a more efficient and flexible SCN that can potentially

lead to stronger SCN relationships. For example, the increase in supply chain information flows can lead to better relationships with suppliers by providing them with better supplier planning that will subsequently improve their inventory management and material flows. It can also provide the organisation with greater planning awareness, a better understanding of customer requirements and improved inventory management that will benefit their customers. Moreover, customers benefit from being better informed and being provided with a more flexible and reliable service. These types of benefits will improve relationships with customers and make them more likely to buy the organisation's products or use their service in the future over other organisations. Strong customer relationships are necessary to keep customers coming back (Wisner, Keong Leong & Tan, 2004).

The quality of inter-organisational relationships is also being enhanced through the use of IRT in personalising interactions. As indicated in chapter 6, portals are being developed to provide SCN members with tailored facilities, applications, information and resources. Technologies such as cookies, data warehousing, data mining and virtual communities are being used to gather information that will further help organisations personalise interactions. In many cases it is personalised relationships with suppliers in Case study G that leads to suppliers providing them with a better quality product or providing them with a more flexible service. Personalisation is likely to provide the SCN members with a stronger affinity with organisation and will potentially demonstrate a reciprocal level of service or commitment to the organisation.

Wisner, Keong Leong & Tan (2004) highlighted the importance of all of these factors in strong SCN relationships. Consequently, it is increasingly important that organisations are improving their SCN flexibility, integration and personalisation for building stronger relationships with SCN members that directly affect their SCN so that customers are being provided with a coordinated, coherent and efficient service. All of these factors will provide a stronger grounding for developing relationships over the longer term.

7.3.2 IRT & VIRTUAL TEAMS

The case studies also illustrate a major uptake in IRT for developing relationships within virtual teams. First of all, IRT has enabled many more teams to form virtually that were not feasible before due to logistical and other practical reasons. For example, virtual teams have now been established between Testing Engineers in the UK and Testing Engineers in the USA in case G. In the past these employees may have communicated occasionally on the phone but now they can actually benefit from the advantage of being able to establish and develop a formalised virtual team. This allows organisations to leverage a greater extent of knowledge than they were not able to before and consequently produce higher quality products or service.

The variety and advancements in IRT are also providing scope for improving the quality of relationships in virtual teams. Internet technology and the www provide facilities for developing a shared environment between team members that is conducive to communicating and sharing information for supply chain processes and activities. As virtual teams no longer have a 'physical place' where they can meet and 'belong' to, a shared space needs to be developed that all team members are comfortable with and provides them with a sense of identity or belonging (Lipnack & Stamps, 2000). An internet-based shared space provides a variety of tools and technologies including intranets, the www, e-mail, instant messaging, portals and various forms of e-meetings such as audio conferencing, web conferencing and video conferencing. Some examples of organisations using IRT for virtual teams and the benefits that are experienced will be provided.

The Acquired Goods and Services process in case F requires virtual teams to be formed between the organisation's engineers and suppliers for contracted projects. The purpose of these teams are to maintain the supplier's status on the approved supplier list, to manage the handling of the financial aspects of supplier contracts and most importantly to actually coordinate what the suppliers have been contracted to do. A mixture of Internet-related communication channels are used to enhance the teams including e-mail, bulletin boards, team portals, audio conferencing and web conferencing.

These types of teams consider tools such as portals to be extremely beneficial for making team information available to all team members and other interested parties. The portals contain information on areas such as the team's vision, mission, remit of group, profiles of individuals, roles and responsibilities, project planning information and group work programs. Other information such as the progress of the project, meetings, drawings, electronic task files and links to necessary databases applications are also available to team members. The portals enhance the relationships between team members by ensuring that all team members are clearly informed of the team's goals, purpose and expectations. Project schedules and progress reports will also provide a certain level of transparency by clearly outlining each team member's contribution and allow them to see how their area will contribute to the overall goals of the team. This is more likely to ensure that members are working towards a common purpose rather than focusing on their individual tasks (Hammer, 2002). It provides more coherence between team members.

There is also cross-functional 'Operational Experience Feedback' teams within this organisation which are made up of employees from different operational sites and business units. The purpose of these teams is to help different operational sites learn from similar experiences at other operational sites. They are ongoing and their face to face communication is supplemented by the daily use of the intranet, e-mail and bulletin boards. These types of teams consider e-mail and bulletin boards to be particularly beneficial for keeping all team members up-to-date, allowing easy and flexible sharing of experiences and for site experiences to be saved and retrieved as and when required.

Teams are also formed between the procurement specialists based worldwide in case A for the purpose of sourcing and negotiating with suppliers. These teams are responsible for producing and sending out requests for tenders, analysing responses, viewing supplier presentations and making selections. The team members communicate with each other daily. The methods of communication used vary between face to face communication, the intranet, e-mails, portals, teleconferencing, net meeting and phone calls. The team meet face to face for regional and global team meetings that take place a few times a year but the majority of their communication is through electronic channels.

Teams responsible for large projects in the organisation normally have a web page with information on the project's mission, goals, team members, project schedule, work progressed etc. Smaller teams would not tend to set up a web site. All teams also generally use a file repository system for their projects called Compass. This is available on-line and is used to store and share project documents, relevant templates and forms. Different team members have different permissions to the system depending on their involvement. Again the web pages and the file repository system are beneficial in providing members with clear expectation and norms.

One of the interviews in Case A involved an IT Business Analyst who described an Electronic Work Requirement system that some teams use depending on the type of project work they are involved in. It is not used specifically by the procurement specialists but it was by IT specialists for developing the procurement system. The Electronic Work Requirement system can be used to monitor the status of an IT project. It would store a description of the project, requirements for the project, proposed move to test date, proposed move to production date, implementation date, start date and information on the progress of the project. Documents would be attached from their repository system and relevant documents such as Test plans would have to be approved on-line and signed off by relevant people. Again this type of on-line system provides transparency about who is conducting which supply chain activities and tasks. As team member see the progress that other people are making it can potentially build up trust and commitment and reciprocal progress from others members.

One of the procurement specialists interviewed commented that they did not feel isolated or restricted by using mainly electronic methods of communication. Through meeting face to face periodically with other procurement specialists at certain times of the year and through regularly using other communication methods they have generated a secure working relationship.

Virtual teams in case G commonly adopt Instant Messaging as a key component of their 'shared space'. Instant Messaging Applications is used to support daily messaging. This application provides the benefits of team members being able to see

who is on-line, who is available to respond, being able to send instant messages and being able to converse with a group of people. This can improve trust etc. as well as sometimes with e-mail they are unsure if team members are not replying because they are avoiding them.

Furthermore, most teams in this organisation generally have a team portal page on the intranet as well. The team portal pages contain information such as the team's vision, mission, purpose, strategy, team member names and pictures, structure, contact numbers, responsibilities, goals and tasks, costs, return on investment and risk assessment. They also provide details of meetings, agendas, working session notes, earlier session notes and pointers to related information. Project schedules are available, process flows, work progressed, estimated timelines and assumptions and there would be links to any relevant drawings, files, databases and other necessary organisational resources. The portals would be most detailed for the most important projects and employees would have specific rights to the portal depending on their involvement in the project.

Key advantages of the team portals highlighted in this case were the level of personalisation that the portal could provide. Teams develop their portals into their own working space providing a high level of identity and uniqueness to their team. Furthermore, the work progressed by different people in the team is much more transparent. This means that each person in much more aware of what other person(s) is up to and vice versa and information is available to all the people involved. That in itself generates a greater level of trust, security and common understanding. Even just simple elements being provided on the portal such as team pictures help to build up identity especially in teams that are completely virtual. There are also facilities for employees to synchronize the server copy of their mail, calendar and address book onto mobile devices such as PDAs. This provides employees with more flexibility to contribute to teams, interact with team member and share expertise (Chescher & Kaurqa, 1998; Varshney & Vetter, 2000).

Team meetings are conducted by the virtual teams in the different organisations using various forums. The organisations in most of the case studies used audio conferencing along with shared whiteboard. As indicated by the Engineering Director in Case G, it

is far easier for him be part of a meeting on-site with all documents available on-line. This saves on a lot of paper but also means that if the meeting digresses and requires team members to pull up a document from the past, it is readily at hand. Video conferencing is also used in some occasions. Video conferencing appears to be a particularly good application for starting up virtual teams as it allows team members to put faces to names and e-mail addresses giving them a sense of identity. As indicated by Gray (2003) it humanises a distributed workplace. Although a number of employees commented on the fact that video conferencing did not convey the same level of expressions, angles etc. as face to face communication and that the quality was not always great. The organisation in case G actually had an initiative under way to get all employees using web meeting instead of combining teleconferencing and video conferencing in order to cut down costs. Web meeting has the same capabilities as these applications but it is cheaper as it does not use the phone line. In the organisations in case study C and G web casts are used for distributing live events to large audiences or large teams of people. The web casts are viewed using media players at work stations or via the TV network.

There are clearly many benefits from using IRT for enhancing virtual relationships (inter-organisational partnerships, inter-organisational teams, intra-organisational teams and interpersonal relationships). Given these benefits many organisations are focusing on greater advancewment of IRT for the purpose of developing relationships even further. For example, the organisation in case study C were one of the more sophisticated organisations studied and they had several initiatives underway. They were currently piloting an application for hosting on-line brainstorming events. The pilot was going to include 60,000 employees from the Business Consulting Services Division and they would explore crucial business topics. Anticipated benefits included flexibility and an environment conducive to innovation. The organisation is also piloting Lotus Notes email access to and from a handheld computer by providing a web browser on the device. This is aimed at giving employees more flexibility for communicating and maintaining relationships when working on supply chain activities and tasks. Furthermore, another new tool is currently being piloted within Europe that has the power of a Thinkpad and uses mobile communication technology to connect to the internet. It is expected that this will significantly impact the

Customer Services and Support supply chain process by providing even more flexibility in the way that service and support is provided to customers.

In summary, relationships are increasingly being conducted electronically and IRT are clearly being used to strengthen SCN relationships. A number of features and facilities provided though IRT are particularly beneficial to improving the quantity and quality of virtual partnerships and virtual teams (Warkentin, Bapna & Sugumaran, 2000). Strong relationships are important as it is more likely that people will go the 'extra mile' for each other.

7.4 TYPE OF RELATIONSHIP WITH SCN MEMBER

The other factor that needs to be taken into account in inter-organisational linkages is the level of relationship that an organisation has or wishes to have with other members of the SCN. It is not strategically beneficial for organisations to invest and develop the same quantity and quality of supply chain relationships for all SCN members. Organisations should be applying IRT to supply chain linkages selectively depending on the nature of the relationship they have with SCN members. This should be in terms of the depth and diversity of linkages that are provided, the level of information that is shared and the level of personalisation.

7.4.1 LONG TERM/KEY RELATIONSHIP

Chapter 3 highlighted the key characteristics of long-term relationships. These included elements such as trust, norms, expectations, interdependence and reciprocity and the need to focus on strategic goals, cultivating cooperative ties and developing dependency (Schultze, 2002). Organisations should concentrate on developing long term cooperative relationships with key SCN members that are critical to the operation of their SCN and/or beneficial to their strategic effort.

For example in case G the Materials Replenishment supply chain process is a critical process in the day to day operation of the organisation. It is an inter-organisational process that cuts across the SCN with key component suppliers playing a vital role. Thus it is important that long-term, secure and reliable relationships are developed with key component suppliers to ensure a good level of supplier service.

Likewise in case A, the non-production related procurement supply chain process is not critical to the end product or service of the organisation. However, it provides support to the day to day running of other processes in the organisation. There are a selected number of key suppliers of non-production related goods that the organisation needs to build up long term relationships with. This can help reduce costs and provide other benefits to the organisation.

Organisations should invest a lot of time, effort and money in developing long-term relationships with key SCN members. These types of SCN members can be provided with access to more aspects of the organisation's intranet, specialised applications and other resources. The relationships should be developed more fully by providing a greater level of linkages, more in-depth information by providing superior personalisation.

The ever increasing diversity in SCN linkages were discussed in chapter 6. Firstly, section 6.5.1 demonstrated how organisations can be provided with many on-line paths for accessing a particular contact point in an organisation's supply chain. Organisations should ensure they provide key SCN members with a greater variety of potential pathways. For example, a key SCN member accessing customer service and support in Case C would be provided with many different ways of accessing the support. This would provide the range of users in the key customer organisation with much greater flexibility.

Moreover, by referring back to figure 6.1, SCN members can be provided with differing amounts of linkages between their supply chain and the organisation's supply chain. The organisations in case G should consider providing key suppliers access to linkages S1 to S4 while restricting non-key suppliers to fewer linkages. Key suppliers will also be granted greater authority to key business information. For example, in case G, key suppliers can additionally access information on the prices that the organisation has negotiated with other suppliers for components. This allows key suppliers to negotiate similar prices for components as the focal organisation. Suppliers may be placed on a continuum depending on their importance.

Figure 6.2 also illustrated that direct linkages are now feasible between organisations and other tiers of suppliers and customers. The focal organisations should focus time and investment on developing linkages with only suppliers and customers in these other tiers that are critical or beneficial to the organisation. Finally it would certainly only be key suppliers, customers or logistic providers that would be provided with the direct linkages with other SCN members that were illustrated in Figure 6.3

Key SCN members should also be provided with more personalised SCN linkages. The linkages can be personalised to suit the culture of the organisations and provide a securer, more rewarding interaction. This was demonstrated in case study C. The technical support was customised for long-term key customers. One of the main criticisms in the past was that too much information was available and it took too much time and effort to find the information they were looking for. Through customer profiling and using cookies in customer's machines, the web-site has been customised to provide an appropriate level of information. This saves customers a lot of time when using the service and support (saves clicks and frustration). Also, occasionally, the organisation can send them pro-active e-mails about developments to a product or faults etc.

Furthermore, the suppliers in case study G are also being provided different levels of access to the organisation's applications. There are potentially sixteen applications available on the supplier portal. Application A is for Execution Planning, Application B is for Merge in Transit, Application C is for Demand Replenishment, Application D is for Performance Management etc. The supplier's portal can be customised with these applications depending on their level of authority. For example, a key supplier may be able to customise applications A to J while a non-key supplier 2 may be able customise applications A to D.

Long term key relationships will probably require more than just technological linkages. Many organisations still favour an element of face to face for developing trust, common understanding, compatibility and other attributes associated with long term relationships. As a result, critical or collaborative types of relationships will often be lead and negotiated by top management teams that periodically meet face to face. This discussion will be pursued further in section 7.7.

Overall, long term key relationships do not just develop overnight. As indicated by the Materials Manager in Case study G their suppliers are generally measured on aspects such as cost, quality, availability, strategic capability and technical capability and performance. However, suppliers often perform similarly on these aspects. In these situations, it is actually the experience of working with a supplier or the way they do business that will make the final decision. Long term relationships can take two to three years to fully develop.

7.4.2 SHORT TERM/ NON-KEY RELATIONSHIP

Organisations also interact with a range of SCN members in short term relationships. Chapter 3 outlined the key characteristics of short term relationships as lean, sporadic, arm's length and requiring little human or social contact. For example, organisations may purchase materials from suppliers, use the services of a logistic provider or customers may purchase a product from the organisation on a one off basis. These types of SCN members are non-key SCN members and will sporadically change with little damaging effects to the organisation. Non-key short term SCN members would be provided with more limited levels of SCN linkages, information and less personalisation. Channels of communication would generally be leaner and would involve little if any face to face communication.

Short term or non-key SCN members will have access to a more limited pathway choice. This can be controlled by the security and the level of accessibility via web linkages. For example, the organisation in case study C has many short term customers. Linkages are handled differently with them than with long term customers. While long-term customers have access to portals, vast amounts if information, applications and facilities, shorter term customers only have a standard level of access to on-line customer service and support. Despite this, more and more of the short-term customer are using the self-help facility available on-line. It adequately meets the needs of their one off queries and it saves a lot of time for employees in customer service and support.

There is also much less personalisation in the interactions with non-key suppliers and customers. For example this can be demonstrated by revisiting the Material

Replenishment process in case study G again. A key aspect of many large organisations' procurement strategy, at the moment, and including this one, is dynamic bidding or on-line auctions. Organisations trade through electronic intermediaries with short-term suppliers for sub-tier components or one-off components. For example the organisation may hold an auction if they have needed some extra disk drive space. Suppliers would be informed that a bid was taking place, the auction would open electronically for 10 minutes and all suppliers would make their bids online. The interaction would be short, sporadic and impersonal and would not develop any kind of long-standing, trusting relationship between the organisations. However, the interaction meets the needs of the circumstances. The organisation has also used these auctions for off-loading excessive stock to customers. Again, customers would be informed that they were holding an auction to sell stock and customers would make the appropriate bids to buy the stock.

The closeness of relationships and length of relationship will clearly vary at different points of the SCN and the appropriate quantity and level of IRT linkages will need to be provided to different SCN members. The type of relationships will determine the diversity of the inter-organisational linkages that should be established, the level of information sharing and facilities, the intensity of personalisation and the different communication channels that will need to be used. Overall, organisations need to place great emphasis on developing collaborative linkages with key organisations in the SCN.

7.5 FACTORS AFFECTING SUITABILITY OF IRT

There are also a number of issues that must be taken into account when considering the suitability of IRT as a communication channel for building SCN relationships and working collectively on supply chain activities and tasks. The following issues are highlighted in this section including: the stage of the supply chain process; top management involvement in inter-organisational processes; level of conflict; communication mix and pattern.

7.5.1 START OF PROCESS/ ESTABLISHING RELATIONSHIPS

Through analysing different supply chain processes, it is apparent that the stage that the supply chain process is at has a big impact on the suitability of IRT for advancing SCN relationships. These initial stages of supply chain processes are more suited to an element of face to face communication or certainly richer IRT such as video conferencing. The initial stages tend to involve defining goals, procedures and parameters for the process and involve some element of planning or negotiation. They are also crucial for developing interpersonal relationships with people involved in the supply chain process, developing a common understanding and building enough trust and identity that is conducive to sharing expertise.

Whenever possible, the organisations participated in some form of face to face interaction at the early stages of a supply chain process and considered it essential for the smooth operation of the rest of the process. The procurement specialists in case study A initially met face to face to establish a team that would be responsible for the smooth operation of the procurement process. By meeting face to face they were able to build up a social rapport between team members at an early stage of the supply chain process and a sense of identity (Dalton, 2003). Furthermore, the early stages involved sourcing, reviewing and negotiating with potential suppliers. This involved producing and sending out Requests for Tender, analysing responses, viewing supplier's presentations, selecting suppliers and negotiating arrangements with suppliers. Although IRT are used to access information a substantial amount of these tasks involved face to face communication or richer IRT. The organisation feels that by the procurement specialists getting together at the early stages of the supply chain process and periodically throughout the year that they are able to generate a securer working relationship.

7.5.2 TOP MANAGEMENT & INTER-ORGANISATIONAL PROCESSES

Top management often have a critical role to play in leading and negotiating the early stages of strategic processes and activities involving more than one organisation e.g. procurement, customer ordering. Top managers will potentially come from different organisations, different cultures, different backgrounds, different expertise and different agendas. The nature of the tasks that top management tend to be involved in

are unstructured, more diverse, more uncertain, more complex and often involve a degree of manoeuvring or negotiation. They generally have to make higher-stake decisions, in the face of considerable uncertainty and are under pressure to move quickly (Eisenhardt, Kahwajy & Bourgeois, 1997). It is important that appropriate procedures are negotiated and clearly established at the start of these processes by top management as this will help minimise future problems or conflict in inter-organisational interactions. Inevitably the different types of conflict are more likely to be heightened in relationships between top management, as they are making important decisions and very often they have their own personal and organisational agendas. Organisations will need to take careful consideration in deciding how the top managers will communicate.

All the organisations had formed relationships or teams between top management of some form for the purpose of establishing and negotiating the early stages of inter-organisational supply chain processes. A few examples will be highlighted from the empirical research. Firstly, Dealer Business Planning is a strategic sub-process that takes place at the beginning of the order fulfilment process. This was described in chapter 5 and emerged from the findings in case E. This process involves forecasting a suitable mix and volume of cars for each dealer and concerns the automobile manufacturer and the dealerships. It relies heavily on input from internal top management, brand managers and top management from dealers. The planning process will involve a substantial amount of discussion, negotiation and debate. Much of this intensive inter-organisational interaction is conducted face to face. The management consider this face to face interaction necessary for putting forward their opinions and ideas and for reaching some kind of consensus on such critical issues. Although face to face meetings involve management having to give up time for travelling to the meetings, they feel that this kind of interaction would be much less fruitful and unsatisfactory if it was conducted using IRT.

Once the sourcing stage of the procurement process is complete, the organisation in Case A and its selected suppliers will need to set up a strategic team, negotiate prices and terms, set up catalogues and determine methods of ordering and payment in order for the rest of the process to operate smoothly. This is a critical stage which is vital to the success of the remainder of the process and normally involves the procurement

management and the supplier's top management getting together face to face to collectively make key decisions and take part in heavy negotiation. It enables the organisations involved to establish ground rules on how activities will proceed and helps reduce any future process conflict. It is also very much an ongoing process as the organisation needs to continually negotiate prices; arrangements and contracts based on the previous years spend. Therefore, management get together face to face periodically to review and maintain the supply chain process. Again, although face to face communication can be more expensive and impractical, the organisation considers the benefits of face to face communication for this type of activity to far outweigh the downsides.

In case B top management teams are involved in setting up services or contract agreements with large organisations and normally conduct business at the initial stages using face to face communication. Likewise in case C, top management from their organisation and their larger customers, meet face to face to negotiate a suitable level of customer service and support. In case G the Business Forecasting and Materials Requirement Planning processes take place prior to the initial stages of the material replenishment process. The global senior management team meet face to face with suppliers and customers to generate business forecasts and material plans for the coming year. This will involve a substantial level of face to face negotiation, debate and potential conflict.

Top management face to face communication is vital for conducting critical tasks, negotiating and making complex decisions at early stages of inter-organisational supply chain processes and periodically throughout the processes. It was highlighted by a top manager in one of the case studies that "face to face communication at the early stages of a process involving top management can be more vital now as so much of the processes are being automised". Moreover, good top management relationships can make a huge impact on big issues such as future bids, flexible level of service arrangements and levels of information flow etc. Overall it is worthwhile investing time and money in top management relationships especially with key SCN members.

7.5.3 SUPPLY CHAIN CONFLICT

It is inevitable that relationships and team working will harness certain levels of conflict at different stages in their life span. Chapter 3 revealed three common types of conflict in the field of organisational conflict: relationship conflict, cognitive conflict and process conflict (Jehn & Mannix, 2001; Amason et al, 1995). The various forms of conflict are likely to be heightened as the scale and scope of the supply chain process increases. Conflict can be either beneficial or detrimental depending on the type of conflict, how it is handled and the situation. There is already evidence that effective relationships are those that successfully harness these different types of conflict. Therefore, it is crucial that channels of communication are selected that will suitably control the different types.

As outlined, organisations are tending to use face to face communication channels or richer IRT at the early stages of supply chain processes. Process conflict is likely to occur at the early stages and it is through this process conflict that a clear and engaging direction should be negotiated and work norms, responsibilities, deadlines and milestones agreed on. To reduce any further process conflict, every individual, team member, function or organisation involved in the supply chain process or activity should be clear about how task accomplishment is going to proceed. This builds on the recommendations that Marucca (1998) makes for clearly defining goals, leadership, accountancy, formal reviews etc. at the early stages of activities.

If organisations use face to face communication channels or richer IRT to establish and periodically sustain relationships this should help to minimise but not necessarily avoid relationship conflict. The team of procurement specialists in case A find that by meeting face to face at the start of the procurement process and by periodically meeting face to face throughout the process they are able to get to know each other better on a social basis, they can identify better with the other team members, get to know how they like to operate, the language they use and develop shared patterns of behaviour including how criticism and disagreement are interpreted etc. Social relationships can help to build a feeling of solidarity, identity and can reduce feelings of distrust etc. If team members are more familiar with each other, team cohesiveness is more likely to be improved and subsequently team members are more likely to engage in activities or tasks that are critical to team effectiveness. Well-established

relationships are necessary for positive patterns of future interaction and can help to avoid or reduce future misunderstanding that may lead to relationship conflict.

Face to face communication and richer IRT also enables those involved in the relationship to engage in cognitive-related conflict. It facilitates discussions of task goals and debate around the various opinions of team members to determine the specific content of the final product or decision. For example, the Testing Engineering Manager discussed how sometimes there is conflict over how a particular problem or task should be approached within engineering. Employees from testing, manufacturing and IT may have to pull their skills, expertise and opinions together on how a task should be accomplished before they decide on which way to proceed. This would be done using face to face communication or richer IRT at different stages of the supply chain process, as and when required.

Organisations recognise that process conflict and relationship conflict can arise in supply chain activities and may result in problems if they are not adequately handled at the early stages of a supply chain process or activity and maintained throughout. Cognitive conflict is likely to arise periodically during the duration of supply chain processes as well. At the various stages of conflict, appropriate communication channels must be used to ensure conflict resolution such as face to face communication or richer IRT. This supports the proposal by Daft & Lengel (1986) that equivocal tasks such as resolving conflicts should be dealt with by richer communication channels. Overall, improved conflict resolution will benefit the organisation in terms of a clearly directed, cohesive and effective team that is more likely to perform better.

Furthermore, a considerable body of research has demonstrated that conflict over issues is not only more likely within top management relationships, but is also valuable. Successful strategic decisions are most likely to be made by top management that promote active and broad conflict over issues (Eisenhardt, Kahwajy & Bourgeois, 1997). It is likely to lead to a more inclusive range of issues, a deeper understanding of issues and a richer set of possible solutions (Eidenhardt Kahwajy & Bourgeois, 1997). The types of conflict discussed are heightened in top management relationships. This was certainly indicated in the Dealer Business Planning team

described in the previous section. The team involves a high level of conflict as members of the team are all striving for different outcomes. Members of the team include top management from the focal organisation and also from the dealers. Not only do different organisations have different aims and objectives but so do the managers. Clearly, common aims and objectives and a clear sense of direction needs to be negotiated and defined by the overall top management team. It is vital that this negotiation takes place at the start of the process, preferably face to face.

7.5.4 COMMUNICATION MIX & PATTERN

Another factor that will affect the use of IRT is the need for organisations to establish regular patterns and mixes of communication. Firstly, organisations recognise that regular patterns of communication are critical for achieving successful relationships. In Case F the organisation have pre-arranged weekly cascade brief meetings providing information on a range of important issues such as the state of the plant, safety incidents, company media or board executive issues. Likewise the Customer Service and Support teams in case C arrange weekly web conferences. These regular meetings ensure bringing everyone together on a regular basic (face to face or electronically), reinforce challenges and purpose, improve commitment and involvement, keep everyone informed and reduce ambiguity etc (Lipnack & Stamps, 2000). Regular patterns of communication are even more important as relationships are increasingly handled virtually as problems can escalate out of control much more quickly and without managers even realising it.

Furthermore, the various factors discussed in this section so far will obviously impact the mix of communication channels that need to be used at different stages of the supply chain process. These factors have included the stage that the supply chain process is at, the level of top management involvement, the level of conflict and the types of supply chain activity. These different factors are often related to each other. For example, the early stages of inter-organisational supply chain processes are likely to involve top management from different organisations and issues such as conflict are often heightened in top management negotiation. The early stages of the supply chain process are the most suitable time for resolving and preventing future process

conflict and minimising relationships conflict. All of these factors so far require face to face communication or richer IRT.

Supply chain processes will also benefit from periodic face to face communication or communication using richer IRT, especially for top management to maintain relationships, for resolving any further relationship conflict as it arises and managing cognitive conflict. Therefore, when organisations are determining a suitable mix of communication channels for supply chain processes and in particular handling SCN relationships they need to take all of these factors into account. A suitable mix may involve a range of communication channels from face to face communication or richer IRT to using instant messaging (perhaps at a set time each day), e-mail, portals, bulletin boards etc. on a day to day basis. Supply chain managers need to take all of these issues into account and establish an appropriate pattern and mix of communication channels early on to ensure greater potential success.

7.6 LIMITATIONS OF USING IRT FOR SCN RELATIONSHIPS

A number of factors have been outlined that will need to be taken into account in using IRT in SCN relationships. Over and above this there are still a number of people-related limitations in using IRT for sustaining SCN relationships. These limitations can be categorised as being contextual, cultural or as being related to social presence issues.

7.6.1 CONTEXT

Contextual factors (e.g. social, cultural factors) will influence the adoption and adaptation of communication media. Organisations may actively introduce IRT into SCNs and enable or constrain people from communicating in different ways. However, organisations alone, do not determine the actual uptake of the technology and the ways in which employees use it e.g. who they communicate with, what they use it to communicate for, the mix and pattern of their communication etc.

Structuration theory was outlined in chapter 4 and it proposes that the patterns of communication are not only influenced by the standards and procedures of the

organisation but also by the social interpretations of employees (Lee, 1994a; Orlikowski & Robey, 1991; Walsham, 1993). The two influences operate continually and simultaneously to determine the actual uptake of technology. Therefore even if an organisation fully promotes the introduction of IRT in SCN, if the contextual environment does not embrace the technologies, the actual uptake may be less than anticipated.

This in turn questions the complete validity of MRT (Daft & Lengel, 1984; Daft & Lengel, 1986) which proposed that the capacity for media to process rich information was dependent on their capacity for permitting instant feedback, the number of cues they had, the level of personalisation and language variety. The developments in structuration theory are proposing that communication channels traditionally regarded as lean communication channels may work as effectively as rich communication channel in specific contexts (Lee, 1994a). In contrast, richer communication channels may not work as effectively in other contexts.

This can be demonstrated by examining case study C and D. The organisation in case study C promotes a technologically based information sharing environment. Moreover, employees are rewarded for their ability to use technology for the purpose of sharing information and knowledge. Over time this has generated a contextual environment that embraces change, is innovative and likes to be leading the way with technology. The two influences working in parallel have resulted in different types of IRT being used as rich communication channels. For example, employees use Instant Messaging for all kinds of activities ranging from social interactions to brainstorming ideas to worldwide team conferencing. In contrast, the organisation in case study D is more traditional and slower to embrace change. Although the organisation has introduced IRT into many aspects of their SCN the technology tends to be used for more standardised activities and leaner types of information.

7.6.2 CULTURE

One aspect of an organisation's environment is the culture and a few more limitations surrounding this area should be highlighted. Culture can impact the way that people communicate verbally and non-verbally, the way that people perceive things and the

way that they respond to communication channels (Samover & Porter, 1988). The empirical studies have highlighted that culture still remains an issue for developing and using Internet-based organisational systems and that it can potentially limit their role in SCNs. Although more people are using IRT there is still a minority who are not as comfortable using the technology and who prefer employing conventional mediums. For this very reason, the Customer Service and Support function in Case Study C recognise that it is still necessary for them to provide alternative SCN linkages that use conventional channels such as the telephone. Some people simply perceive the telephone as being more traditional, user-friendly and personal and more suitable when they wanted to talk to someone for encouragement and support.

The language used in Internet-related systems can also be an issue. Again this organisation found that customers from countries such as Germany were happy to accept an Internet-related system that was in the English language while customers from countries such as France, Spain and Italy were generally much more reluctant. Therefore, they eventually had to translate the system into different languages. The overall acceptance and the uptake of web-based systems definitely appear to be dependent on culture and therefore this needs to be taken into account when building Internet-based systems.

7.6.3 SOCIAL PRESENCE

A further limitation is regarding the level of social presence. Social presence theory promotes the notion that person-oriented or relationship-oriented tasks need to be carried out using media that promote higher social interaction (Christie, 1985; Dennis & Kinney, 1998). The prevalence of IRT have definitely led to less face to face interaction. Moreover, IRT instead of people using IRT that convey higher social presence for these types of tasks many people use IRT that convey little social presence. This is when problems and limitations will emerge with IRT. Thus leading to a lack of social involvement, social chat, trust, identity, spreading of ideas, enthusiasm etc.

These types of problems emerged in case study E. The internet-based ordering system enabled the organisations and dealers to tap into a vast amount of ordering and stock

information providing a wide array of benefits. However, the system that had been implemented also restricts the amount of personal or social information that was traditionally passed on through 'word of mouth'. In the past, a sales manager from the organisation would have visited the dealers twice a month. Information was often shared through 'off the cuff' conversations e.g. "By the way that is a good offer…..". "Did you see that note about….." etc. Now, however, they probably visit the dealers about every two to three months. That is not to say that they are not available via e-mail and they can actually communicate with them much more frequently but sometimes the lack of more regular face to face communication or use of media that promote higher social presence, prevents these traditional and important socials interactions from taking place.

Although there are many benefits in using ITR for nurturing SCN relationships, this section has clearly demonstrated that there are still a number of prevailing limitations that need to be carefully considered. The next section will summarise the key contributions of this chapter.

7.7 SUMMARY

Relationships are becoming significantly more important in SCNs as organisations are increasingly globalising, forming partnerships and outsourcing. Organisations are also competing in more competitive marketplaces and there is a greater requirement to pool specialist expertise and knowledge. Relationships are additionally becoming more complex as a greater number of SCN members are involved in the SCN and the SCN is increasingly dispersed. Stronger SCN relationships are more critical than ever for achieving a competitive level of corporate performance.

This chapter has demonstrated how IRT have been used to improve the quantity and more importantly the quality of virtual SCN relationships. Virtual partnerships have been enhanced through the use of linkages between intranets, ERP systems, DBMS. EDI, portals and many other applications and resources. Suppliers and logistic provider's relationships have been enhanced by providing benefits such as better information, superior material flows and inventory management. Stronger customer

relationships have been enabled by demonstrating benefits such as greater reliability, on-time delivery, higher quality products and services and the flexibility to respond to customer needs better etc. Portals have allowed greater personalisation and closer SCN relationships. Overall, integrated supply chain systems improve the cooperation and coherence between people involved in the SCN.

Virtual teams have also been advanced with the deployment of IRT. IRT are providing more flexibility in forming virtual teams and they are also enhancing virtual teams in terms of more effectively combining expertise and skills to provide a higher quality of product or service. IRT are becoming an integral component of a virtual team's shared space and a valued channel for developing relationships and interactions between team members. They provide many benefits such as greater personalisation, trust, identity, expectations, commitment and common purpose.

Relationships with SCN members can be long-term key relationships or short term non-key relationships. Organisations should be applying IRT to supply chain linkages selectively depending on the nature of the relationship they have with these members. This should be in terms of the depth and diversity of linkages that are provided, the level of information that is shared and the level of personalisation.

Furthermore, a number of factors have been outlined that may undermine the benefit in using IRT for SCN relationships. These were categorised as the start of the supply chain process or the establishment of the process, the critical stages of inter-organisational supply chain processes that involved top management and the various stages of supply chain processes that involved conflict. Face to face or richer IRT communication channels were deemed more suitable when these factors were evident. Successful relationships should take these factors into account and establish a suitable mix and regular pattern of communication channels for the duration of the SCN relationships.

Finally the chapter closed by analysing a number of limitations in using IRT for SCN relationships. These were related to the context of the organisation, the culture of the people involved in the relationships and if relationships would perceive and be hampered by a lack of social presence.

In conclusion, chapter five to seven have presented the analysis and findings from the empirical research conducted through case study research. The findings were discussed under the following categories: Intranets and Supply Chain Processes; Virtual Supply Chain Linkages and Information Sharing; Supply Chain Networks & Virtual Relationships. The final chapter (chapter 8) will synthesise these findings and present the overall key arguments emerging from the thesis.

Chapter 8 :

The Way Forward for Supply Chain Networks

8.1 INTRODUCTION

The purpose of this thesis has been to investigate the aspect of e-business that is concerned with the role of IRT in supply chains and SCM. The opening chapter of the thesis highlighted the importance of this growing field as a result of advancements in the international marketplace, the increasing complexity of supply chains, developments in inter-organisational relationships and the proliferation of IRT (Ayers, 2002; Day, 2003; Martin & Towill, 2002; Thomas, 2003; Van der Aalst, 2002. These developments are placing greater pressures than ever on organisation's supply chains to become more dynamic and responsive. Therefore the thesis has examined developments in supply chains and SCM through IRT in terms of supply chain processes, supply chain linkages and information sharing and supply chain relationships. This research has embraced the whole SCN.

Chapter 1 provided an introduction to the overall thesis and contextualised the field of work being studied. Chapter 2 analysed the developments in IRT in an organisational context and chapter 3 critically reviewed the existing literature on supply chains, SCM and SCNs and the emerging role of IRT in these areas. The research strategy was outlined in chapter 4 including a detailed outline of the design of the case studies. Chapters 5, 6 and 7 have analysed the data emerging from the seven case studies conducted. Analysis has focused on IRT as a general organisational communication channel and for conducting supply chain processes, for linking supply chain processes and activities together, for information sharing and for developing relationships conducive to working on supply chain processes and activities.

In this final chapter, the overall findings and outcomes of this research are synthesised. The chapter begins by synthesising the salient findings of the research and extracting the key themes and recommendations and outlining the implications of the research. The chapter will then reflect on the achievement of the research objectives and highlight some limitations of the research strategy. Finally, the chapter will finish with an insight into future developments in virtual SCNs, further technological advancements and potential areas for future research.

8.2 SYNTHESIS OF OVERALL FINDINGS & KEY RECOMMENDATIONS

This thesis has involved a detailed literature and empirical investigation into the role of IRT in SCNs and has focused on supply chain processes, linkages, information sharing, relationships and the benefits and limitations. A number of general findings have emerged as a result of the literature research, the empirical study and the analysis. Most importantly, though, four key recommendations have emerged from the research and these include organisations being able to use IRT across their SCNs to achieve the key benefits of integration, visibility and information sharing, flexibility and personalisation. At the same time, though, organisations should be strategic in their application of IRT. They need to take the various factors and limitations into account that have been highlighted in the thesis when determining how best to use IRT. Overall, the research has revealed that if strategically applied, IRTs will play a key role in improving the responsiveness and effectiveness of SCNs. The remainder of Section 8.2 will begin with an outline of the general findings and then concentrate on the key recommendations.

8.2.1 GENERAL FINDINGS

Intranets are continually being developed as a primary method of communication within organisations. Corporate web sites, intranets, functional and departmental websites, extranets, tools, technologies and specialised applications are persistently being advanced. Furthermore, organisations are increasingly extending their intranets to support and enhance supply chain processes (Ash & Burn, 2003; Cagliano, Caniato & Spina, 2003; Farhoomand & Wigand, 2003; Lancioni, Smith & Oliva, 2000). The empirical findings showed a wide array of evidence of organisations extending their intranets to enabling, operational and most recently strategic supply chain processes.

Large organisations can no longer be considered as individual organisations. They are part of a network of organisations that undertake a chain of activities to provide customers with an end product or service. The focus needs to shift from the 'organisation' to the 'networked organisation' (Lambert & Cooper, 2000; Ward & Peppard, 2002). Therefore, the research has demonstrated how IRT are also being used to advance intra-organisational and inter-organisational linkages within and

between supply chain processes. The technology is being used to provide a greater range of supply chain linkages across the whole SCN and linkages between SCN members that were not possible before. Furthermore, there is a greater level of information sharing as a result of the increased linkages, integration and visibility. The research has also provided evidence of organisations using IRT to extend and strengthen their intra-organisational and inter-organisational SCN relationships across the SCN. In particular, it is being used to enhance virtual partnerships and virtual teams.

A range of benefits through using IRT in supply chain processes have been identified, including more streamlined supply chain processes, cost savings, reduced timescales, improved accuracy and efficiency, reduced paperwork, greater information, reduced inventory and better decision making etc. Moreover, the development of IRT for supply chain linkages, information sharing and relationships has further extended the benefits of using IRT in SCNs. It has lead to a more coordinated and coherent SCN. There are improved information and material flows, better inventory management, greater reliability, higher quality products and services, more flexibility to respond to customer needs and overall an enhanced level of customer service and product offering.

Even though the benefits of using IRT in SCNs substantially outweigh the limitations, a range of limitations were identified throughout the analysis as well. These can be categorised as security, technological, legal organisational, contextual, cultural and social limitations. Security can be a limitation in terms of the fact that organisations need to ensure that their own organisational systems and their SCN members are sufficiently secured as there is an increasing level of key business information being shared. The technology has to be reliable enough and there has to be sufficient infrastructures in the relevant countries that are involved in the SCN. There can also be legal limitations in certain countries as well in terms of the requirements for organisational systems and the information that must be stored. Organisational limitations were identified such as the level of IT support that is required and the skills of employees. Finally, the contextual, cultural and social limitations will limit the adoption and adaptation of IRT, the language that will be used and the level of social interaction that may be required in the communication channel.

The remainder of this section will outline the key themes and recommendations that have emerged out of the analysis chapters. These key themes have been identified across the case studies using techniques suggested by a range of hermeneutic researchers (Gadamer, 1976; Klien & Myers, 1999) and case study experts (Eisendhardt, 1989; Holliday, 2002) and they will be discussed under the following headings: integration, visibility and information sharing; flexibility; personalisation; channel selection.

8.2.2 INTEGRATION, VISIBILITY & INFORMATION SHARING

The first key theme to emerge out of the research is the level of integration, visibility and information sharing that is now possible through applying IRT. Internet-technology provides a common platform for integrating intranets, supply chain-related systems, applications, facilities and information internally and externally across the SCN.

Within organisations, intranets can link a range of organisational, functional, departmental and individual web pages. At the heart of many intranets are ERP systems which are integrated to many other supply chain process-related systems such as portals, workflow management systems, DSS, DBMS, groupware, project management tools and many other applications etc. As a result of the integration, information can be shared between supply chain processes and activities and the progress of supply chain activities can be much more visible. Employee can more readily access information on supply chain activities, managers can monitor supply chain processes and activities more easily and it helps individuals, sites and teams that are collectively working on supply chain activities to share information.

Integration is also feasible between organisations across the SCN. There can be linkages put in place between organisational intranets, linkages to other organisations ERP systems, portals, workflow management systems etc. This allows more detailed information to be shared across the SCN regarding supply chain processes and activities. Organisations are providing more information (Hagel & Sacconaghi, 1996;

Rayport & Sviokla, 1995) to other SCN members. Suppliers are being provided with information on planning, demand replenishment, orders etc., customers are being supplied information on customer service and order tracking etc. and logistic providers are accessing order schedules and distribution information. Organisations are also gathering more information (Hagel & Sacconaghi, 1996; Rayport & Sviokla, 1995). Organisations can gather information on whether there are delays in the supply of goods and they have the capability to access information on customer orders or customer problems. Moreover, information is not only being shared that contribute and enhances operational supply chain processes but also strategic supply chain processes. SCN members are sharing forecasting, planning, R&D information that contribute to shaping the future direction of organisations. Furthermore, some SCN members systems may even be integrated in such a way that suppliers and customers can access information directly from each other as well.

Overall, the visibility and information that can be shared across SCNs pulls SCN members closer boosting total process efficiency and effectiveness across the SCN (Croxton, Garcia-Dastugue & Lambert, 2001). Supply can be matched with demand thus improving customer service (Rayport & Sviokla, 1995; Ward & Peppard, 2002). As the scale and the scope of supply chain processes and SCNs increase, integration can have even more profound benefits as it is more difficult yet even more important to share relevant information. The integration of key SCN members systems and information allows real-time information to be shared up and down the SCN. Many organisations share the opinion that integrated business processes and improved visibility along the SCN are important value drivers for implementing e-business (Dai & Kauffman, 2002).

Clearly, the level of integration, visibility and information sharing across the SCN needs to be carefully managed. This can be achieved in a number of ways. Firstly, there are often administration capabilities in web technology that allows organisations to monitor the facilities and information that different people and organisations are accessing and how often. This visibility allows organisations to better understand the linkages, facilities and applications that are most popular and to monitor usage for security purposes. Secondly, organisational intranets are normally integrated with

other SCN members to varying degrees. Key SCN members would be provided with a greater level of integration and information sharing than non-key SCN members.

8.2.3 FLEXIBILITY

The second theme focuses on the role of IRT in increasing the level of flexibility in the SCNs. Firstly, IRT increases an organisations' flexibility for potential SCN web linkages and the diversity in the information that can be shared and secondly it widens an organisation's flexibility in developing SCN relationships.

There are many ways in which the flexibility of intra-organisational and inter-organisational linkages and pathways in a SCN has been improved. Within an organisation, different supply chain processes and activities can now be linked together in many more diverse ways than what was ever feasible before. There is more opportunity for using the information outputs from one supply chain activity for inputs in another supply chain activity. This can enhance the performance of supply chain activities and the coordination between supply chain activities.

There is also much more flexibility across the whole SCN. There are more ways to access a contact point in an organisation's supply chain and there are many more potential linkages between different organisation's supply chains. Organisations have more flexibility in establishing linkages with different tiers of SCN members and linkages can even be established directly between other members of the SCN. The flexibility in inter-organisational supply chain linkages offer organisations more choice in the IRT they use to communicate, how much time they want to spend and how much information they want to access. This will probably depend on the supply chain activity or task being performed and the knowledge of the people communicating.

The information that can be shared across the SCN is much more flexible as well. Applications can manipulate the same information to provide different levels of detail to suit people's requirements at different points of the SCN. Information requirements will be different for various supply chain activities and tasks, for different employees

and for different organisations. For example, a manager in one organisation may require information presented as a high-level summary while an employee in another organisations that is immersed in the supply chain activity may require a substantial level of detail.

There is also much more flexibility in the relationships that can be developed across the SCN using IRT. Different intra-organisational and inter-organisational relationships can be pursued that were not possible before due to costs or logistical reasons (Warkentin, Bapna & Sugumaran, 2000). For example, virtual partnerships can be pursued with medium or smaller sized organisations and different tiers of suppliers and customers and virtual teams can be formed between globally dispersed employees, sites and organisations that were not feasible before. This type of flexibility is even more beneficial in supply chain processes of a greater scale and scope as people are more likely to be more globally dispersed and will be less able to build relationships face to face.

Finally, there is such a wide range of different types of IRT. Different types of technologies can be used to strengthen different aspects of SCN information sharing or relationships. There is the flexibility to use different technologies depending on what is trying to be achieved through the interaction, what stage of a relationship they are at or who they are communicating with. For example, EDI is often used to exchange data between SCN partners while video-conferencing is often used for developing aspects such as identity in key SCN relationships. There is more potential to use suitable communication channels for achieving more effective supply chain related communication

8.2.4 PERSONALISATION

The third key theme emerging from the overall analysis of the case studies is the level and the benefits of personalisation that can be achieved through the deployment of IRT. Daft & Lengel (1986) and Te'eni (2001) highlighted adaptiveness, personalisation or customisation as being one of the most common dimensions that communication channels are evaluated on and emphasised how effective

organisational communication places great importance on relevant, useful and easy interpretation of information. IRT can clearly be used for these purposes by providing appropriate levels of personalisation and access to web links, information, facilities and applications that suit different people and organisations across the SCN.

This section will summarise how personalisation can be achieved at all levels of the SCN through IRT. Firstly, organisations are manipulating and personalising their intranet to suit their overall business strategy, the type of organisation that they are, the industry they are in and the markets that they participate in by adopting an appropriate layout, level of formalisation, suitable cues and a fitting structure. Each function, department or site can develop their own personalised site that is linked to the intranet and designed to suit their ethos, role, activities and projects they are involved in and their staff.

Organisations should also consider personalising their intranet appropriately to suit their supply chain processes and linkages. Different types of organisations (e.g. manufacturers, service organisations, network providers) are likely to have different supply chain processes and activities and different linkages between their processes (Chaffey, 2002; Deise et al, 2000; Porter, 1981; Stabell & Fjeldstad, 1998; Ward & Peppard, 2002). Organisations may even consider IRT as an opportunity to re-engineer their supply chain processes and linkages (Rayport & Sviokla, 1995) and organisations need should be changing their focus from being a functionally-oriented organisation to a process-oriented organisation (Hammer, 2002). Appropriate applications and tools need to be developed for each supply chain process and activity and suitable linkages will have to be enabled through manipulating the www and integrating their supply chain systems. It should be noted though that one particular IRT that may hamper personalisation is the deployment of ERP systems. Standard ERP systems can enforce logic on organisational strategies and supply chain processes (James & Wolf, 2000; Johnston, 2002; Waller, 2003).

The intranet can also be personalised for different people and organisations involved in the SCN. This will include employees, managers and teams and will extend to other members of the SCN. Portals are one of the key IRT that are being used to develop personalised supply chain-related communication and interactions at all levels of the

SCN. The key benefits of portals are their ability to integrate content through a single interface, deliver content to targeted users, customise content and allow users to personalise the content while applying the appropriate level of security and access management. The analysis chapter demonstrated how portals were being used at each level of the SCN.

Individual employee's views of the intranet are being personalised through the use of portals (Newing, 2001). The portal is personalised with their name, job, salary, pension, and with information, facilities and applications to suit their needs depending on the supply chain activities that they are involved in.

Portals are also used to develop a personalised shared space (Lipnack & Stamps, 2000) for teams (intra-organisational and inter-organisational) of people working on supply chain activities and tasks. The portals are being developed with specific information about the team, team members, projects and team documents. Different information, tools and technologies can also be integrated onto the portal depending on the specific needs of the team. Tools can include anything from databases to bulleting boards to video conferencing. Team members would be given specific rights to the team portal depending on their involvement in the team and team projects. The personalised portals provide teams with a higher level of identity, common understanding and trust.

Finally portals are being developed to provide SCN members with tailored facilities, applications and streamline information and resources. Portals are providing SCN members with a stronger affinity and commitment with the organisations and the streamlined information is enhancing performance between SCN members. Key SCN members are being provided with more personalised and enhanced portals that gives them access to further web linkages, facilities, applications and critical business information. Non-key SCN members are being provided with more limited levels of personalisation and access. Overall, portals assist in personalising the diffusion of information and interactions within and between organisations.

Many other tools and technologies also contribute to personalising SCNs such as profiling, cookies, data mining and data warehousing and software agents (Alshawi, Saez-Pujol & Irani, 2003; Maass & Muller, 2003; Wenger & Snyder, 2000). These technologies can gather information that can be used to personalise the interactions and information for different people and organisations across the SCN.

In conclusion, personalisation is definitely regarded as one of the ways forward in improving the effectiveness of SCNs. As the scale and the scope of supply chain processes increases it is even more vital that interactions remain personalised. Organisations need to look closely at the information requirements and skill base of people at every stage of the SCN and personalise the communication appropriately so that SCNs can be as effective as possible (Postma & Brokke, 2002).

8.2.5 CHANNEL SELECTION

The final, and probably the most important theme, focuses on the strategic selection of appropriate communication channels. There are many opportunities for organisations to apply IRT to supply chain processes, linkages and relationships across the SCN in terms of integration, visibility and information sharing, flexibility and personalisation. There are also many benefits that will encourage organisations to favour IRT such as cost, reach, availability, efficiency, flexibility, cost savings, enhanced customer service, reduced inventory, reduced paperwork, reduced timescales etc. However, strategic, tactical and operational managers should be made aware that IRT cannot be equally and as effectively applied throughout supply chain processes and SCNs.

Management require some guidance on when different IRT should be used in supply chain processes and SCNs. Consequently, this thesis has integrated various factors that have been identified throughout chapter five to seven as affecting the role of IRT and composed a strategic conceptual model. The model has been derived by analysing and categorising the various factors that have been discussed. Three categories of factors have been identified. The first category relates to the fact that there is such a broad range of Internet-related communication channels. The various features and

facilities provided by these different channels will substantially influence how suitable the technology will be in supply chain processes. The second category corresponds to the stage that the supply chain process is at. The role of different IRT will fluctuate throughout the different stages of supply chain processes. Thirdly, the remaining factors have been collectively categorised as factors that will impact the role of IRT throughout the remainder of the duration of the supply chain process.

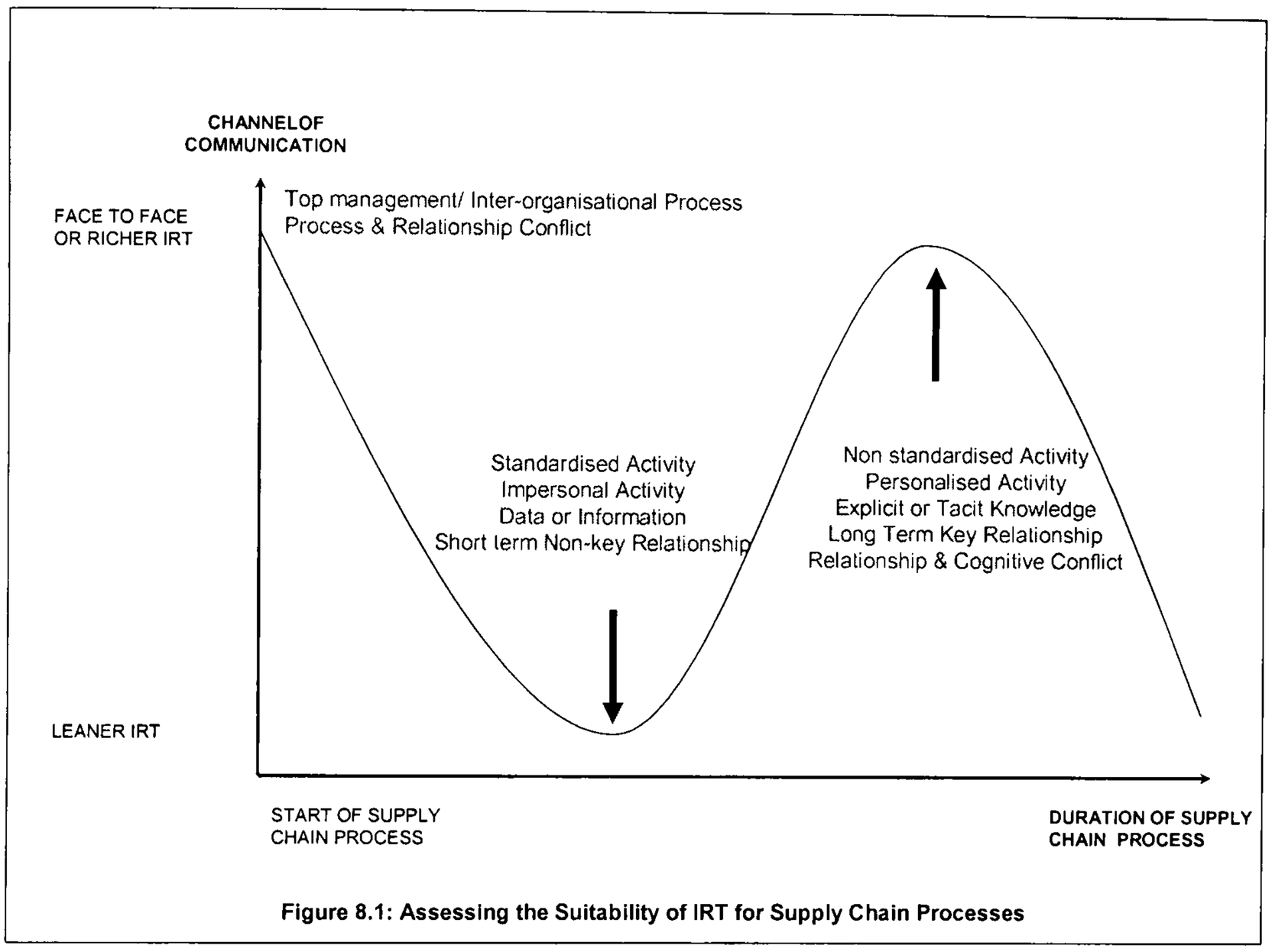


Figure 8.1: Assessing the Suitability of IRT for Supply Chain Processes

These different categories of factors have been integrated into a conceptual model which is illustrated on Figure 8.1 and aims to guide management in applying IRT to supply chain processes and SCNs. The type of communication channel is displayed on the vertical axis. The stage of the supply chain process has been illustrated on the horizontal axis. The various factors that affect the suitability of communication channels throughout the duration of the supply chain process are shown on the main part of the model. The remainder of this section will provide a detailed discussion of the various factors that affect the role of IRT. This will include their contribution to the conceptual model and their influence on the role of IRT.

The first main category indicated on the vertical axis is the level of richness provided by the communication channel. Communication channels can range from richer

communication channels to leaner communication channels. As outlined in chapter two, richer technologies have a greater capacity to convey richer information through enabling more feedback, a larger number of cues and a greater amount of personalisation e.g. face to face communication. Leaner communication channels are more limited in their capacity for feedback, the number of cues they provide and the level of personalisation. The various IRT discussed throughout the thesis vary considerably in the level of richness that they provide. For example, technologies such as video conferencing are richer in nature as they enable rapid feedback, provide a variety of cues and are personalised. Technologies such as EDI are leaner as they have minimal interactivity, limited cues and little adaptability.

The second and third category of factors will illustrate circumstances in which face to face communication channels or richer IRT are more suitable than leaner IRT or vice versa. The second category is the stage of the supply chain process and this markedly impacts the communication channel that is most suitable. From the empirical research and findings in chapter seven, it is evident that face to face communication and richer IRT are particularly useful at the early stages of supply chain processes for establishing partnerships, teams and interpersonal relationships and for laying out the goals, procedures and parameters of the supply chain process. Typically top management are involved at the early stages of supply chain processes especially in critical inter-organisational processes. They are characteristically involved in negotiating complex and higher stake issues. It is very important that top management communicate and negotiate through richer IRT at the early stages especially with key SCN members. Another reason for using face to face or richer interaction at the early stages of the supply chain process is to help resolve any process conflict at the start of the supply chain process and minimise any future process or relationship conflict throughout the supply chain process.

The third category of factors has emerged as influencing the suitability of IRT throughout the remainder or the duration of the supply chain process. These different factors were highlighted throughout chapters' five to seven and are illustrated on the main part of the model. Firstly, two key factors regarding the nature of the supply chain process were raised in chapter five. The first factor was about the level of standardisation in the supply chain activity being conducted. Less standardised

activities were highlighted as tending to be more suited to face to face communication or richer IRT and more standardised activities were coined as being more suited to leaner IRT. The second factor was regarding the level of personal interaction required in the supply chain activity. Supply chain activities requiring more personal interaction and emotional support were deemed more suited to face to face communication or richer IRT and those requiring less personal interaction as being more suited to leaner IRT. Consequently, depending on the nature of the supply chain activity, IRT may be suited to playing a central role in some supply chain activities while it may only be suitable as a periphery channel in other supply chain activities.

Chapter six also highlighted a factor that influences the suitability of communication channels throughout the duration of the supply chain process. This was related to the type of information that was being shared across SCN linkages for particular supply chain activities. Information has already been classified as data, information, explicit knowledge or tacit knowledge (Davenport & Prusack, 1998; Nonaka & Takeuchi, 1995; Von Krogh, Nonaka & Aben, 2001) in the literature chapters. The suitability of these different forms of information (from data to information to explicit knowledge to tacit knowledge) to different IRT can be placed on a continuum ranging from leaner IRT to richer IRT. Communication involving sharing data is generally more suited to leaner types of IRT while communication at the other end of the spectrum involving sharing tacit knowledge is more suited to richer types of IRT or face to face communication.

Finally, chapter seven highlighted a range of factors that were related to the relationship aspect of the communication that affect the suitability of different IRT. The first factor involved which SCN members the communication was with and the relationship that the organisation had with the SCN member. The focal organisation should be using an element of face to face and richer IRT communication channels to develop stronger relationships with long term key partners in terms of trust, common understanding, identity, compatibility etc. The organisation should however only need to invest in leaner IRT to sustain shorter term non-key relationships. A second factor which related to the development of inter-personal relationships and has been touched on was regarding supply chain conflict. The various types of conflict, including process, relationship and cognitive conflict, may arise at different times throughout

the duration of the supply chain processes. If these types of conflict arise then they should be harnessed using richer IRT or face to face communication channels.

These various factors that influence the suitability of different IRT throughout the duration of the supply chain process are illustrated on the main part of the model. Those factors beside the upwards arrow are factors that may lead to face to face communication channels or richer IRT being more suitable and those beside the downward arrow are factors that may give rise to leaner IRT being more suitable.

Overall, the conceptual model illustrates these three different categories of factors. There are also a couple of additional points that should be taken on board. Firstly, it is important to note, that strategic supply chain processes are likely to require a greater combination of richer communication channels overall which is likely to involve face to face communication and richer IRT. This is largely because strategic supply chain processes are more critical to organisations and they tend to involve a greater level of non standardised activities or activities that require personal interaction.

Secondly, many of the different factors highlighted in the conceptual model are interrelated. For example, supply chain activities that are more standardised are likely to have less conflict and will by their very nature be more suited to leaner IRT. Activities that are less standardised are likely to have more conflict and will tend to be more suited to richer communication channels. Also, inter-organisational processes and activities which involve top management are likely to generate more conflict as they are more critical and involve a greater degree of negotiation. These types of processes and activities will tend to require face to face communication or richer IRT.

A third point to note is regarding the fact that the most suitable channel of communication will probably change over time as different factors come into play. Different IRT should be used in peaks and troughs at different times throughout the duration of a supply chain and supply chain processes. It should be noted that Figure 8.1 has been composed to simplify the understanding of the different factors that should be taken into account when applying IRT to SCNs. The influence of each factor is shown at either extreme in terms of the most appropriate communication channel. In reality, though it is not normally as extreme or as clean cut as this.

There are also a number of external factors that should be noted as well as impacting which communication channel can practically or feasibly be used. These external factors will include issues such as the location of the different people, sites or organisations that are involved in the supply chain or supply chain process. They will also involve technological issues such as the quality of the infrastructure that people have access to. There are also many cultural and contextual issues that will impact the role of IRT such as how much the people communicating will be influenced by the communication channel that is normally used, how hi-tech the industry is that the organisation is in etc.

A final point to note is that organisations should take the various factors on board that have been highlighted through the model and establish a suitable mix and pattern of communication at the early stages of supply chain processes and follow regular patterns throughout.

In conclusion, this conceptual model provides a framework for managers to use in deciding how to strategically apply IRT to SCNS and supply chain processes. All of the factors outlined will influence the successful application of IRT to supply chains and supply chain processes. The model illustrates the range of factors that must essentially be taken into account when deciding which communication channels are likely to be most suitable in certain circumstances.

MRT is the theory that has been most widely used, to date, to examine factors influencing channel selection (Daft & Lengel, 1984; Daft & Lengel, 1986; Dennis & Kinney, 1998). The findings of this research support MRT to a limited extent. For example, these findings recognise that equivocal situations or those involving certain types of conflict are more suited to richer communication channels while non-equivocal situations are dealt with efficiently using leaner communication channels. These findings also recognise, for example, that top management negotiation and decisions involving higher stake issues will require richer communication channels. However, there are numerous flaws in the theory. One obvious shortfall of the theory is the limited number of factors that they deem to influence media choice. In reality, the factors influencing media choice can be so much more vast and circumstantial.

Factors that are important in one situation may be less important in another situation. This section has succeeded in highlighting a range of factors that reappeared in each of the cases and were closely tied to selecting communication channels for SCNs and in particular supply chain processes.

In conclusion, Section 8.2 has highlighted the synthesised the overall findings of the research and highlighted the key recommendations. The following section will explore the implications of these recommendations for academia and industry and in particular for different sized organisations.

8.3 IMPLICATIONS OF RESEARCH

This thesis has contributed to the existing e-business literature on IRT and supply chains. The research has involved conducting a unique set of case studies, pursuing novel research questions, pursuing an in-depth analysis and identifying a key set of emerging themes, recommendations and theoretical propositions.

This research is relevant to industry and academia. The research will provide knowledge and guidance to managers, consultants, IS specialists and academics with specific interests in technology and supply chains. To date, there has been much speculation about the field of e-business but very little practical research has actually been undertaken. This research provides a rich insight into how organisations can actually apply IRT to pursue a range of opportunities and benefits across their SCNs. In particular, it has been demonstrated, how IRT can be used to achieve integration, visibility and information sharing, flexibility and personalisation. This will allow organisations to achieve a more coordinated and coherent SCN and improve the performance of their SCNs. These generalisations should help to provide a richer insight and more balanced understanding of the potential of the technology.

Furthermore, the research has provided a conceptual model that will guide practitioners and academics on the most strategic way of applying the different types of IRT throughout SCNs and supply chain processes. The model highlights a range of factors that will affect the performance of different types of IRT at different stages of

supply chain processes. It is critical that this model is taken into account for organisations to achieve the maximum benefits from IRT and greater performance-related success. The conceptual model should serve as a guide to organisations, not be overwhelmed by the technology and assume it is the best channel of communication in every situation. It will direct people to consider the application of the technology more strategically and carefully.

The case study strategy adopted was interpretive and qualitative in nature. It focused on the subjective experiences of SCN members and the context and the dynamics of use of IRT in SCNs. The research strategy aimed to generate, expand and generalise emerging tendencies and promote analytical propositions. The key tendencies and recommendations were outlined in the previous section. There was evidence of many of these tendencies in most of the organisations.

All the organisations studied showed substantial evidence of the application of IRT to enabling and operational supply chain processes and they all were all either using it for strategic supply chain processes or they planned to use it for them. They had all developed their SCN linkages in terms of intra-organisational and inter-organisational integration and in terms of information sharing and visibility. The most advanced organisations had developed their linkages the furthest in terms of establishing direct linkages between other SCN members. All the organisations had also all advanced their intra-organisational and inter-organisational SCN relationships in terms of strengthening and enabling different relationships to develop. Again the most hi-tech organisations were most advanced in personalising relationships with key SCN members. The various factors affecting the strategic application of IRT were corroborated and integrated from the various case studies.

The recommendations have emerged from the empirical study and are clearly applicable to other similar larger and medium sized organisations that are involved in complex SCNs. The thesis is not suggesting that the organisations should necessarily pursue all of these recommendations though. It is promoting these recommendations as key opportunities and benefits that can potentially be pursued by organisations implementing IRT. Organisations should however, carefully consider their own individual circumstances and pursue the ones that are appropriate and applicable to

their organisations and industries. Aspects of the recommendations are also likely to be applicable to SMEs but perhaps to a lesser extent. The role of IRT in SMEs is one area of future research that the thesis has suggested is required later in the chapter.

8.4 OBJECTIVE ACHIEVEMENT

Key areas that required further research were recognised throughout the literature review conducted in chapter 2 and 3. By the end of chapter 3, the overall research and five main objectives were clearly identified and a conceptual framework was formulated. To recap, the aim was to explore the emerging role of IRT in SCNs. The five main objectives that embraced this research were outlined in Figure 1.1 and the conceptual framework is illustrated in Figure 1.2. The purpose of this section is to reflect on the achievement of these aims and objectives.

The overall aim has been achieved throughout the thesis by exploring the role of IRT in SCNs. The first objective involved critically evaluating the role of IRT in supply chain processes and activities. The author closely studied a mixture of enabling, operational and strategic intra-organisational and inter-organisational supply chain processes through the case studies. By analysing the supply chain processes in detail, an understanding was gained of the opportunities and limitations in using IRT for supply chain processes and the suitability of IRT to different types of supply chain activities.

The second objective was to investigate the impact of IRT on intra-organisational and inter-organisational linkages across and between supply chain processes. This was explored in terms of how IRT has enhanced existing supply chain linkages and provided a greater diversity of linkages within organisations and across the SCN. These linkages were explored in terms of the information that can be shared internally and externally with SCN members. This objective was therefore very much related to, and achieved in parallel with the fourth objective.

The third objective involved analysing the uptake of IRT for developing relationships at different points of the SCN. The potential use of IRT for developing virtual

relationships (inter-organisational partnerships, inter-organisational and intra-organisational teams and interpersonal relationships) were studied in terms of providing opportunities for enhancing the quantity and quality of the relationships across the SCN.

Finally, the fifth objective was to evaluate the benefits and limitations in applying IRT across SCNs. The benefits and limitations in applying IRT to SCNs were outlined in all of the analysis chapters. The benefits and limitations of using IRT were studied in terms of supply chain processes in chapter 5, intra-organisational and inter-organisational linkages and information sharing in chapter 6 and in intra-organisational and inter-organisational relationships in chapter 7. Moreover various factors that may encourage or inhibit the use of IRT have been identified. Finally this chapter has taken all of these issues into account and provided a balanced evaluation of the overall benefits and limitations in using IRT in SCNs.

Overall the main aims and objectives have been achieved. The research strategy has provided a rich set of empirical data and the analysis and findings have advanced the knowledge in this field and provided a detailed insight into the role of IRT in SCNs. Nevertheless there were a few flaws in the study and these will be outlined in the following section.

8.5 LIMITATIONS OF RESEARCH

The researcher made every attempt to make the research strategy as rigorous and robust as possible. A number of measures were taken to ensure case study validity (Yin, 2003). Firstly, the research involved a number of different case studies, various people were interviewed wherever possible and the case studies entailed as many different data collection methods as possible e.g. semi-structured interviews, formal reports, presentation, system demonstrations etc. Moreover, the case studies were completed by checking the case study findings with different participants to ensure there were no misinterpretations.

However, the research conducted still had some limitations which should be highlighted. First and foremost, it would have been useful if the researcher had been able to interview suppliers, customers and logistic providers as well as the focal organisation in all of the case studies. This would have provided more perspectives on the various issues under discussion. This was possible in a couple of cases. In case study D, the researcher was able to interview representatives from an engineering company and a representative from a logistic service provider who was responsible for transporting goods for them to their customers. In case study E, the researcher had the opportunity to speak to employees of the automobile organisation as well as the opportunity to interview representatives in one of the dealerships that order and sell cars from them. This provided insights from organisations at different stages of the industry SCN and enabled the researcher to gain information on their different perspectives on how IRT had contributed to the development of supply chain processes. Overall this contributed to a fuller understanding of the cases.

In the other cases, it was only possible to interview members of the focal organisation. This was for various practical reasons. One reason was regarding the sensitivity of this information. Some of the organisations would not have divulged information about their individual suppliers or customers and did not want the researcher contacting them.

A second limitation was respondents being inclined to highlight the benefits of the role of IRT in their SCN and supply chain processes rather than dwell on the downsides. The researcher had to keep pressing for the downsides in the technology. A slightly biased picture has possibly still been provided. Another limitation was regarding the time period that these case studies were conducted over. The case studies were largely conducted over the duration of a year. It would have been better if they could have been conducted at roughly the same time. This would have contributed to the researcher's ability to make comparisons between the case studies. Obviously by the time the last case study was being conducted the first case had dated a bit. As all the case studies were being developed and analysed by one person though it was not possible for the research to be undertaken any more quickly. However the researcher did make every effort to maintain contact with interviewees and update the

case studies to reflect further developments in the organisation's infrastructure and supply chains.

A final limitation was evident. Most of the organisations studied did not want it revealed who they were. The decision was taken to keep all participating organisations anonymous. Therefore, any information that specifically indicated who the organisations were was omitted from the case study findings. In some cases this restricted the comments and observations that the researcher could make. Furthermore, some of the information, documents or presentations that were accessed were retained for information only and were not actually publishable. Again, this was for sensitivity reasons.

Despite the limitations of the research strategy, the case studies provide a series of rich and informative information, which have enabled the research in this field, to be developed further and new ideas and issues to be taken forward.

8.6 FUTURE SUPPLY CHAIN NETWORKS

Throughout the case studies, organisations were questioned on the future direction of the role of IRT in their SCNs. The strategic importance of SCNs in the success of organisations is increasingly being recognised. Therefore, organisations are continually looking for ways to improve their SCN through technology. The organisations highlighted a number of aspects that they anticipated focusing on in the foreseeable future.

Firstly, organisations are persistently seeking new ways in which IRT can be applied to their SCNs. Organisations are finding that they are in-undated with requests for changes and additions to their intranets, developments in supported tools and technologies and new supply chain applications. These are being requested from different levels of employees, different functional areas within the organisation and from different SCN members. However, it is clear that any further developments must be carefully managed. Organisations need to focus on ways of adding value to supply chain activities and more importantly the linkages between these activities. A number

of organisations have enhanced particular supply chain activities but the linkages between supply chain activities still need to be further developed so that the overall supply chain or SCN will operate smoothly.

Secondly, organisations are striving to improve their intranets and supply chain-related systems so that information is easier to find and is available to the relevant people. As the intranet and supply chain systems grow in size and complexity, this will be something that organisations will have to work at increasingly harder. Aspects that will help information management include things like consistent and user friendly web pages and navigation and the increased use of technology such as portals, search engines and intelligent agents. Also, Mulgan (1991) stressed the importance of consistently formatting and structuring information so that it is more easily used. Moreover, it is important to develop a culture of strategically managing content posted on the web so that it is always up-to-date and relevant.

Organisations will thirdly, continue to look to incorporating new, more sophisticated technologies into their SCN infrastructures. Organisations will do this in a quest to remain a cutting edge organisation, to gain the benefits that the technology provides and as a result of pressure from other SCN members. In particular, mobile technologies and radio frequency identification (RFID) tags are expected to be the next technologies that will play a key role in SCM.

Mobile technologies are already being applied in certain supply chain activities. Organisations are increasingly recognising that mobile technologies can be deployed in a variety of business areas, from operations support, marketing and sales to SCM (InterForum, 2002). This was illustrated through the empirical research. Mobile technologies are becoming even more advanced though. Organisations such as the one in case study C will soon be able to use mobile and wireless technologies in customer service and support to connect to remote customer sites and see the layout of components in a machine while looking at wiring diagrams or maintenance procedures. Organisations will continually be seeking out new applications for mobile technology as they offer business benefits such as remote access to the Internet and organisational intranets and improved flexibility.

A further technology that is provoking huge interest, is radiofrequency identification (RFID) tags. They support real time tracking of tagged goods throughout SCNs (InterForum, 2002). The tags are attached to products and emit signals containing detailed information such as what type of product it is, when and where it was made, where its components come from, when they might perish and they can be used to track the product through the factory floor, to the warehouse, the distribution chain, the retailer and then to the point of sale (Harvey, 2003).

The strategic benefits of RFID tags are plentiful including the ability to track products in real time, reduce stock shortages and monitor sales systems more closely and efficiently. Organisations are also using the tags to build reverse logistics into their SCM strategies e.g. the capability to launch a product recall (Dempsey, 2003). This is something that particularly affects the food manufacturers and pharmaceutical companies, who must have the capability to create and withdraw specific batches of product from anywhere in the world at a moments notice. They also make it more difficult for goods to be stolen while they are in transit and they provide goods with a unique identify that will make it difficult to counterfeit (Moran, 2003).

In the retail industry, in particular, there is greater pressure being placed on suppliers to incorporate RFID tags into their products and this may drive a massive industry change. Pilot schemes have been undertaken in the food retail industry by organisations such as Tesco and M&S. The tags in Tesco were attached to high value goods and took pictures of customers as they took them off the shelves (Harvey, 2003) while the tags in M&S provided accurate information on colour, size and style of products, location of individual items and an overview of stock levels. Both schemes created a lot of controversy, however. Although the retailers are using the tags to improve visibility in the SCN, consumers are concerned that the tags represented an infringement of privacy. Wal-Mart has also requested that their 100 biggest suppliers begin fitting RFID tags by 2005 and be using RFID tags by 2006 (Harvey, 2003; Niemeyer, Pak & Ramaswamy, 2003).

Obviously, RFID tags are starting to make an impact on retail supply chains and as they decrease in price, improve in efficiency and make notable impacts on supply chains, organisations will be looking to implement the technology more broadly in

their organisations (Niemeyer, Pak & Ramaswamy, 2003). There are so many potential opportunities for using RFID tags for improving supply chain visibility and information sharing. This could provide a huge amount of intelligence and may lead to significant developments in operational and strategic supply chain processes. The main factors that have held back thee adoption of RFID tags to date have been the price of tags, hardware and IT infrastructure and physic-related problems with the tags. Once these factors are overcome, further applications areas are likely to be initiated in other industries.

A fourth area that organisations anticipate concentrating on in the future is security. Security is really an ongoing concern for all organisations and especially for organisations using the Internet and those developing inter-organisational SCN linkages. Supply chains and SCNs are of critical importance to the success of organisations and they realise that by making key supply chain activities and information available on the web, they are making themselves particularly vulnerable. Therefore, organisations are always focusing on developing the sophistication of their security measures.

Finally, organisations realise that they need to appreciate the importance of not being overwhelmed by future developments in technology and assume that the technology will always be more suitable for supply chain communication, interactions and information sharing across SCNs. As more and more countries become more technologically advanced it will be easier for the Internet to become a standard communication channel across all subsidiaries of a global organisation and between SCN members. However, there will still be situations where technology is not as suitable as face to face communication. Organisations need to ensure that people still talk to each other and technology does not pose a barrier to organisational communication. Overall, it is likely that technology will continue to play a key strategic role in SCNs but SCN communication will involve a balanced mix of different forms of communication channels.

8.7 FUTURE RESEARCH

Substantial findings and contribution have been outlined throughout the chapter which have explored the role of IRT in SCNs. The field of IRT and SCNs is however still progressing and further advancements will nevertheless need to be explored. There is a variety of future research that should be pursued in the role of IRT and SCNs.

Future research should probably involve a combination of qualitative and quantitative research. Qualitative and quantitative research could take a variety of forms. For example, firstly, it would be useful to undertake further case studies or surveys with organisations that have become more and more advanced to identify if the themes and tendencies identified in this study are actually happening and to also develop the theoretical and conceptual frameworks further.

Secondly, it would be useful to study a large organisation in depth that has implemented the recommendations highlighted in this study and have taken a more strategic approach to the role of IRT in SCNs. This could be studied form an ethnographic or action research perspective.

There are also a variety of areas that future research could focus on. It would be useful to academics and practitioners if further research identified any additional emerging innovative applications of IRT in SCNs. In particular, the impact of emerging technologies such as RFID tags and mobile technologies on SCN linkages and information sharing will have to be explored.

Other issues that will need to be resolved are the uncertainty regarding the benefits of the role of IRT in SCN to all SCN members. For example, there has been debate over whether technology imposes more discipline on suppliers than customers. Rather than it being used as a means to fostering collaboration to improve products and cut costs, it has been used mainly as a tool to increase leverage with suppliers and drive down prices for the customer at the top end (Moran, 2003). Consequently, suppliers have become suspicious of technology SCM initiatives (Thomas, 2003) and they are not very trusting of their customers.

It would also be beneficial if the long term impact of IRT on aspects of SCNS such as relationships were pursued. Many previously human handled supply chain processes and supply chain linkages are being automised using IRT. Future research could explore the lasting impact of technological linkages on personal relations in terms of trust, cohesiveness and common understanding.

Finally, it would be helpful if research was conducted on the role of IRT in SMEs' supply chains and the implications that this has for SCNs. Section 8.3 highlighted that some of the findings could perhaps not be generalised equally as well to SMEs as large organisations. SMEs, however, also play an integral role in large organisation's SCNs. Academics and practitioners need to, therefore, understand the role of IRT within these types of organisations as well and the impact it could have on the overall SCN.

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APPENDICES

Appendix I: Outline of Case Study Questions

ORGANISATIONAL

- What industry is the organisation in?
- What size is the organisation?
- Where is the organisation based?
- How many sites does it have?
- How is the organisation structured?
- What products and services does the organisation offer?
- What are the key processes in the organisation's supply chain?
- What are the main organisations in their SCN?

TECHNOLOGICAL INFRASTRUCTURE

- What information and facilities are on the organisation's corporate site available externally on the Internet?
- What information and facilities are available on the organisation's intranet?
- What other tools and technologies are available on the intranet?
- Who has access to the intranet?
- What information and facilities are available to external organisations?
- What are the benefits and limitations of the technological infrastructure?

SUPPLY CHAIN PROCESSES

- What are the main activities involved in the supply chain process?
- What types of information are required for the activities?
- Which people/ departments/ organisations are involved in the process?
- How has the process and activities within the process been developed with IRT?
- What types of IRT have been used and what types of information and facilities are available?
- Who is allowed access to the Internet-based systems for this process?
- Are the web-based process systems linked to other organisational systems and supply chain processes?
- Are the web-based process systems linked to other organisations systems?
- Were any cultural issues taken into account when developing the internet-based systems?

EVALUATION

- What are the benefits and limitation of using IRTs for the supply chain process?
- How has the mix of communication methods used for this supply chain process changed?
- How has IRT impacted the information available in terms of accuracy, level of detail, timeliness and frequency?
- How has IRT developed internal and external relationships necessary for the operation of the supply chain process?
- Is there still the same level of collaboration, level of trust, passing on of information etc?
- Are there any aspects of the supply chain processes that don't work as well using particular IRT?
- What aspects of the supply chain process could still be improved?

Appendix II: Case Study A

TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are on the organisation's corporate site available externally on the Internet?**

The corporate site provides general information about the organisation including its background and history, the structure, key business units, careers, ethics and code of business, commitment to health and safety, awards, sponsorship, events and investors. There is also information about all the products and services that the organisation offers. Some products can be purchased on-line using the corporate site. Customer support is available for purchased products and services. As well as product manuals, facilities are available for registering products, checking order status, returns policy, warranty information, repairs status etc.

- **What information and facilities are available on the organisation's intranet?**

The corporate intranet is customised for each employee using portals. When an employee logs in, it would say for example, "Welcome Joe Smith" and the employee can pick the facilities and information that they want to view.
The following information and applications are available via the intranet.

Corporate Site
New stock prices etc.

HR Website
My Job/Career (Job Description, Salary Structures, Training & Education)
My Worklife
My Benefits (Incentive Plans, Shares, Stock, Travel Assistance
My Finances
My Homelife (Employee Discount Programme, Employee Purchase Schemes Employee Consultation Systems)
HR Forms
Manager's Corner
Systems and Transactions
HR Policies
Ethics

Procurement System
This is getting investigated in detail later in the case study.

Desktop IT Website
Information
New developments
Architecture
Standards
Services (Printers, Instant Messaging)

Ticketing System
The organisation runs an on-line ticketing system for employee's that have problems with their IT hardware or software.
The system allows employees to log on and create a ticket and provide information on the type of system that is causing problems e.g. desktop and a description of the problem. This will register on

the system and be picked up by someone in IT. The employee that has registered the problem and employees of IT can view the progress of this problem at any time. Information will be stored online, regarding the date the problem was logged and any progress or work done on the problem.

There are also many business applications e.g. financial systems.

- **Who has access to the intranet?**

All employees can access the intranet although there are some aspects of the system that employees may have different permissions for.

- **What other tools and technologies are available on the intranet for supporting collaboration?**

Major collaborative teams will probably have a project web page with information on the project's mission, goals, team members, project schedule, work progressed etc.
Smaller teams would not tend to set up a web site.

All teams generally use a file repository system for their projects - Compass. This is available on-line and is used to store project documents and share information. Different team members may have different permissions to the system.

Some teams use an Electronic Work Requirement System. This can be used to monitor the status of a project. For example, an IT project would use it to store a description of the project, requirements for the project, proposed move to test date, proposed move to production date, implementation date, start date and information on the progress of the project. Documents would be attached from the Compass system and relevant documents such as Test plans would have to be approved on-line and signed off by relevant people.

Other teams may have templates and forms available on-line to all team members

Netmeeting is used all the time by many teams. This lets team members see what is on each others screen and allows members to make changes e.g. to a presentation or a document. Normally they use the phone along with Netmeeting.

Video conferencing is not used as much.

PROCUREMENT PROCESS

- **Background Information**

The global purchasing of non-production related products accounts for billions of expenditure. The organisation introduced a web-based procurement system as they were finding the existing paper-driven system time consuming, costly and cumbersome. Employee purchasing was uncontrolled and at the same time, language barriers, currency exchanges, and cross-border regulations were discouraging them from doing business with potential trading partners around the world. In today's accelerated business world, speed, efficiency, and cost control are critical. The new web-based procurement system was designed to create a totally integrated global electronic requisitioning solution and to enable the organisation to trade with suppliers worldwide via the Internet.

- **What are the main activities involved in the procurement process within your organisation?**

The process involves the following activities:

Sourcing: New trading partners and suppliers are sourced world-wide. Information is gathered about what the organisation needs to buys how much they require and whether it can be bought globally or regionally etc.

There are 2 levels of sourcing:

Approved/Preferred suppliers are sourced by a central team of Procurement Specialists (also called Commodity Administrators).
or
An employee puts in a request for a vendor to be approved.

The organisation would normally source a collection of suppliers, then the supply of products would be put out to auction and the suppliers would submit offers for supply. Alternatively, if the employee sourced the supplier, the organisation would need to consider their credentials before deciding whether to approve them or not. The procurement specialists would continually review their suppliers.

Negotiation: Prices and terms are negotiated and catalogues are set up etc.

Requisition: An employee fills out a requisition form with a list of products that they would like purchased. At this stage they are not approved yet. The employee may suggest using a supplier that is not on the system. The Procurement Specialist would decide if that supplier should be approved or offer an alternative supplier.

Approval: The requisition needs to be approved by an authorised person.

Ordering: Once the requisition has been approved an order can be generated and sent to the supplier.

Fulfilment: The order is fulfilled

Receiving: The employee acknowledges that they have received the order.

Invoices: An invoice is sent to the organisation from the supplier.

Payment: the organisation pays the supplier for the supplies.

- **What technology was used to build the procurement system?**

The system is accessible from the organisation's intranet. It is based on an ARIBA Procurement system. This is one of the leading hosted-environment B2B electronic procurement application providers (see www.ariba.com for technical details). The procurement system was customised to suit the needs of the organisation. It makes use of open standard technologies including Java, XML, HTML, and cXML (Commerce XML is a template that has a fixed structure that is designed for commerce e.g. an order form).

The procurement system is also linked to the organisation's Oracle financial system, a web based Signature Authorisation List (SAL) tool which contains the upper values of requisitions that people can approve, a workflow system, EDI system and e-mail.

- **How have activities within the Procurement process been developed with the introduction of the web-based procurement system?**

Sourcing: This is done out with the procurement system. A team of people manually gather information on different suppliers.

Negotiation: Having determined that they have a strategic supply source, the organisation will assess the supplier's level of competence and compatibility with the e-procurement system and then strike a deal with them. A strategic team would then be set up that would meet face to face to

work out the business process e.g. what form is required to do certain things etc, are they going to use EDI or e-mail etc. This is a critical stage in the procurement process and the procurement system would not work without this. It would involve lots of meetings and e-mails. It is also very much an ongoing process as they continually need to negotiate prices, arrangements and contracts based on the previous years spend.

If the supplier's products can be turned into a catalogue then this would be set up on the web-based procurement system. The catalogue would include things like part number, part description, coding etc. The coding refers to the type of product it is. The catalogue would be loaded onto the system by the organisation or alternatively by the supplier on ASN (ARIBA Service Network which is quite new. It is a portal that lets suppliers and customers exchange documents).

Requisition: Everything from the requisition stage to the payment stage of the process has been automised on the web-based procurement system. Any employee can use the system. The system has already been programmed to automatically set up all employees as users, through the HR system. The information fed into the procurement system will include the name of the employee, their user id and their ID structure. The procurement system holds details of all vendors (suppliers). All vendors have a unique number. Employees can find out exactly which suppliers they can use and then electronically submit a requisition.

Approval: The ID structure is crucial to the approval part of the procurement system. It is referred to as the 'Reporting Tree'. When an employee puts in a requisition, a copy of it is automatically directed to the next person in their reporting tree. If this person has enough rights, they can approve the employee's requisition. If they don't it is directed to the next person up the tree. It goes up the tree until they find someone who has enough approval rights to approve the requisition.

The procurement system has an approval engine that is pre-programmed with the organisation's approval rules.
Managerial approval: A requisition is channelled until it reaches a person that has the authority to approve the value of the product e.g. a £2000 requisition needs to reach a manger that can approve that much
Financial approval: Based on the amount and what the commodity is you may require financial approval e.g. the organisation may be clamping down on certain products.
Commodity approval: The final type of approval is commodity approval and this may be required depending on the type of commodity e.g. if an employee was buying a computer they may have to get someone from desktop services to check that they are buying something to a set standard.

The requisition appears when the approver logs onto the system and they either agree or disagree to process the requisition. In the past employees would have had to wait for it to be signed off by a manager manually. The APPROVAL WORKFLOW "replaces all the walking around".

Ordering: When the manager authorised the requisition, a purchase order is automatically sent to the supplier via an e-mail or EDI. EDI can be integrated into the procurement system. It is the best option for the organisation but it requires quite a lot of work to set it up between the organisation and the supplier. It normally depends on the transaction volume and a little bit on spend as to whether or not they invest money in EDI. The organisation would need EDI for something like stationary, for example, as the amount of transactions is vast.

Fulfilment: Order is delivered.

Receiving: When the employee receives the order they can log onto the system to confirm they received it.

The purchase order and receipt extract goes from the procurement system into the Oracle financial system. The Oracle financial system can monitor accounts receivable and accounts payable.

Invoices: Depending on the supplier, the invoices may be done on paper, EDI or by e-mail.

Payment: The bulk of the payments are done through Electronic Funds Transfer. Some are done using procurement cards. These are a bit like credit cards but the card is lodged with the supplier.

There is a help desk that deals with any queries about the system and there is a help facility that is part of the system. Data Analysis can now be more easily done that will identify trends, track spending, and forecast for strategic planning. Warranty issues are not dealt with by the system Also, arrangements for returned and damaged goods is done manually.

- **What information is available on the procurement system?**

The procurement system displays catalogues of company products that the organisation already has price agreements for. An employee would have two options:

- Submit Purchase Request
- Review Previous Purchase Requests

The 'Submit purchase request' would take them into a list of all the products they can request. The list does not show who supplies the product. This is irrelevant to the employee. When an employee submits a requisition, it may contain products from many different suppliers. When the order goes out it is split up into separate purchase orders and sent to the relevant suppliers.

The 'Review previous purchase requests' would let them view what they had submitted previously and check the status of current requisitions/orders.

The organisation is looking into setting up more advanced forms that gather information from the buyer when they are searching for a product. Generally when you are buying something you normally start with a vague idea of what you want to buy. However, you want to be able to ask for something general, be given more information then be a little more specific about what you want and so on. As you learn more you gain a better idea of what you are looking for. It is through this process of filtering that you find a suitable product and then are able to create a requisition.

- **Who can access the procurement system?**

Everyone on the HR list can potentially use a web browser to use the procurement system. Only 10% across the organisation actually need to use the system and they are based all over the world.

- **How has IRT developed any collaboration required throughout the procurement process?**

The main stage of the procurement process that involves collaboration and team work is at the sourcing and negotiation stages. This is seen as being critical to the success of the system.

There are approximately 20 people involved in sourcing the suppliers throughout the world. They are referred to as procurement specialists. In Europe there are 4. Sourcing suppliers involves forming a regional team, producing and sending out RFP, analysing responses, supplier presentations and selection. Finally once selection is made the supplier will have to be implemented.

The procurement specialists communicate with each other daily. The methods of communication used vary between face to face, teleconferencing, netmeeting, e-mails and phone calls. The communication is often about things like supplier service levels, pricing, RFP or contract negotiations. They meet face to face for regional and global team meetings that take place a few times a year. One of the procurement specialists that I interviewed did not really feel isolated or restricted by using these methods of communication. Through meeting face to face with other procurement specialists at certain times of the year and through using other communication methods, they have generated a secure working relationship.

The procurement specialists also have to communicate with the suppliers using various methods. They tend to get together with the supplier for tasks like supplier presentation and negotiating terms.

- **What information and facilities are available to external organisations?**

Suppliers are provided with a portal through the Ariba Service Network which allows the supplier to access the product catalogues. They are not allowed to make changes to the catalogue, though, for security reasons.
They can also use it to exchange business documents such as EDI-based invoices.
Suppliers also have access to the organisation's ERP system. They can use this to view the status of their account, what has still to be paid, what's been approved for payment and what's not been approved.
This provides benefits to the supplier and the organisation. It saves the organisation time as it stops the supplier phoning as much. They only phone if there is a problem now. The supplier, on the other hand, can plan financial matters better.

- **As some of the users are from a different country, were cultural issues taken into account when designing the system?**

Firstly, everyone in the organisation just about speaks English. It is a pre-requisite for many of the jobs. Therefore, the system is set up in English although some of the product descriptions etc. may be in a different language if the supplier is from a different country.

When designing the system, a multi-cultural core team was established. The team spoke to people from different functions in different countries. The team had to determine real legislation in each country (not perceived legislation that has formed through the rules that have been adopted through the years). For example, in France invoices need to be numbered in sequential order. In some countries, the organisation needs to keep hard copies.

Cultural needs had to be taken into account when designing the system and an element of customisation had to be done for certain countries. From a change management perspective, they also had to be very careful that cultural issues did not hold the project back. Therefore, the project had to be driven as part of a purchasing process review rather than as an IT project. They got a high level of corporate sponsorship and built commitment throughout the organisation through a structured communication programme. Once the project was up and running they continued to push the system.

EVALUATION

- **Has the Procurement system been more or less successful than anticipated?**

At the early stages it was less successful than anticipated. After about a year it became much more successful than expected.

- **What are the benefits of using internet-related technologies for the procurement process?**

  - Procurement can be streamlined. If the system is implemented correctly, an organisation can potentially make a 30% saving. The organisation has found the following benefits:

  - Employees now know exactly what stage their requisitions are at as visibility has improved.

  - Employees can get their requisitions processed a lot quicker. Speed and responsiveness has substantially improved.

- There is a single-unified view of an aggregated catalogue. The knowledge available about all the products is now in one place. Employees don't need to waste time searching for information.

- The system provides the organisation with more coordination and control over the work population's expenditure, the suppliers they can use and authorisation levels.

- They now use a smaller number of suppliers that have been checked for quality and cost. Before the procurement system was implemented, the organisation probably used about 40,000 suppliers. Now the organisation uses in excess of 5,000. There are only about 10 set up on the procurement catalogue in Europe and 50 throughout the world but about 55% of procurement is done using the suppliers on the catalogue.

- Consistent processes and policies.

- The company has made substantial cost savings.

- Through data analysis facilities etc, there is access to more detailed information.

- Routine processes have been automised and streamlines enabling procurement specialists to use their time on more strategic activities such as selecting suppliers, negotiating deals with suppliers/team work, evaluating supplier performance etc.

- The procurement system is linked to the company's financial system. A manager can, for example, check purchases against budgets. By electronically integrating one part of the value chain with another, the organisation is gaining even greater benefits.

Further benefits are illustrated in the section after next.

- **What are the downsides of using internet-related technologies for the procurement process?**

  - The organisation has had to change the way they do things but once employees have learnt the new system they are glad that things have been changed.

  - It would be useful if the system accommodated returned and damaged goods. At the moment if goods need returned the employee has to return it to the supplier and they need to inform accounts themselves. This is being looked at though.

  - People don't always have the same flexibility and authorisation to use 'personal favourites'.

- **In what way would you say that the communication relating to the procurement process has changed (e.g. in terms of timing, the method used, the speed at which it takes place the level of detail)?**

  - There is now a uniform communication method for procurement. Before the system came about many did not even know how to go about purchasing something and if they did they were going around chasing people to authorise requisitions.

  - The level of detail about the expenditure is greater. The system keeps track of the times that people did things like when they put in a requisition or they approved or rejected a requisition. Employees can also add comments into the system when they do things.

  - Communication can take place from anywhere in the world at any time. Employees can log onto the system globally, put in a request and have it approved by someone on the other side of the world. They no longer need to wait until they hand their request over to the relevant manager. In this respect the system offers a lot more flexibility.

– The communication process can take place quicker. The system saves time. Employees are no longer having to waste time walking round and looking for the relevant manager to approve a requisition.

Appendix III: Case Study B

TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are on the organisation's corporate site available externally on the Internet?**

  The external site provides information on the following aspects of the organisation:

  – Company Profile: What they do, markets they are in
  – The three divisions within the organisation
  – Dedicated website for customers providing information on products, services and special sections for domestic, small and medium sized companies and large businesses.
  – Values & Strategic Aims
  – About the executive and non-executive directors and the overall executive team.
  – What they have done for the community in terms of learning, sponsorship, charitable initiatives and rural care.
  – On environmental issues such as the international environment vision, global climate change, air quality and awards and recognition they have received.
  – Investments: Company's performance and share prices
  – Media: latest news headlines and news releases
  – Career opportunities
  – Library of documents, webcasts and presentations

- **What information and facilities are available on the organisation's intranet?**

  A corporate wide group initially developed parts of the intranet. They looked at corporate wide activities and information requirements.

  Some general information available on the intranet includes:

  – Corporate documents
  – Corporate policies
  – News and announcements
  – HR information e.g. job vacancies
  – Health & Safety

  The internet technology has also been used to advance the business-to-workforce processes that operate within the organisation. A key aspect of this initiative was to introduce an element of employee self-service wherever possible in the organisation's core administrative systems. The sorts of areas that this has been applied to include:

  – Holiday booking and recording
  – Sickness recording
  – Travel booking
  – Visitors centre online booking and shopping
  – Expenses
  – Catering services bookings
  – Maternity pay ready reckoner
  – Car tax calculator
  – Online business timetables

Employees can use it for self-service applications like booking rooms, communicating times of meetings, distributing the latest press releases. Training facilities are also available.

As well as this, each group/department developed material for their own departmental site, available on the intranet.

Secure and effective interfaces to existing operational systems were essential to the success of the initiative. For example, the expenses and sickness recording systems have been successfully interfaced to the corporate payroll system.

Overall, the organisation's service has been developed and improved to provide continuous, secure and fast Internet access and many servers have been replaced.

- **Who has access to the intranet?**
  Some parts of the intranet are accessible by all employees while other parts are only accessible by some employees. For example, some groups are sharing information on the intranet that is confidential and has only to be shared between people in their particular group.

- **What other tools and technologies are available on the intranet?**

  Other tools and technologies available on the intranet include e-mail, audio conferencing, video conferencing and bulletin boards.

- **What information and facilities are available to external organisations?**

  There are restricted amounts of information on the organisation's intranet that is available to externally authorised organisations. Some examples of information that is available to external organisations are:

  – Gas and electricity invoices
  – Weekly and monthly reports that provide essential information on the electricity market.
  – Peak Demand forecasts
  – On-line access to half hourly metered data plus a range of graphs to assist analysis.

  Many large external, industrial and commercial customers can access this corporate resource.

SUPPLY CHAIN PROCESSES

- **What are the main supply chain processes that have been developed by Internet-related technologies?**

The main activities that are supported by IRT in the organisation are sales and billing for residential customers, invoicing for large customers, management reporting and internal use.

A major resource of the organisation is their assets for electricity distribution. These assets need to be regularly inspected. Asset inspection has not been put on the web but is has been developed using mobile technology and telecommunications links.

Although the organisation has made a lot of headway with Internet development, they are a number of activities that have not been developed. They don't for example have any kind of e-procurement system

- **In order for these supply chain processes to function, what activities need to be undertaken and what information needs to be communicated?**

Sales & Billing (Residential Customers & Small/Med Businesses)

The sorts of tasks that need to be undertaken are setting up new customers, amending existing customers, taking meter readings, sending bills to customers and making payments.

Invoicing (Large Customers/ Business to Business)

With the larger customers, the organisation is involved in setting up service and contract agreements, sending billing information and again settling payments. In addition to this, larger customers are looking to have information on the electricity market and gain access to peak demand forecasts etc.

Management Reporting

The management team are involved in business forecasting, business planning, decision making and they need to resolve problems. Managers of the organisations and large customers need to be kept up-to-date on a range of issues such as general information about the electricity market, faults in the networks and assets and warnings about variations in the electricity supply.

Asset Inspection

Engineers need to inspect and monitor the condition of the organisation's assets. Assets include substations, pole mounted transformers, overhead lines and underground cables.

- **How have the processes and individual activities within the processes been developed with the introduction of the Internet?**

Some of the main changes that have been developed are outlined below.

Sales & Billing (Residential customers & Small/Medium Businesses)

This can now be done with individual customers on-line and off-line. The organisation is making full use of all the sales channels available, to deliver services to residential customers.

An on-line web-site is available which is integrated with the central billing system. Through using the on-line system, customers are entitled to annual discounts. They can have access to 7 days a week communication. Customer information can be inputed on-line, customers can enter their own meter readings at least every 90 days and they can create and pay gas and electricity bills when it is suitable. Customers gain access to up-to-date, accurate account information.

Invoicing (Large Customers/Business to Business)

The organisation serves many large business customers including local authorities, water companies, manufacturers and national retailers. Typically, these large customers buy multiple energy services for multiple sites.

Initially, the services or contract agreements that are set up with larger organisations are done face to face and often involve a team of people.

However, once the service agreements are set up, the organisation has developed an Internet Invoicing Service that serves the larger organisations. This is a business-to-business extranet application that allows large customers to obtain secure access, through Internet technology, to their detailed billing information. The Internet Invoicing Service is designed especially for organisations with more than 25 sites. The organisation recognised that customers require

advanced billing services that takes into account the customer's group structures and provides appropriate billing detail.

Customers can view and analyse the invoices or statements on-line or download the information directly onto their local systems. These can be downloaded in excel, lotus or csv format. They can also customise extracts of the invoices to interface with their own system. This enhanced availability of information supports automated validation, payment processing and management and financial analysis. In addition to presenting current billing information, the service maintains a 15 month history. At present the service is used by 26 major customers operating at some 16,000 sites.

Larger customers can also gain access to online reporting information which is outlined in the next section.

Management Reporting

These services are available to certain levels of management and selected services are available to authorised customers. A major factor in delivering a set of successful management information services are the series of workshops that explored and captured the managers and large customer's reporting requirements. The main requirement was – to deliver the right information at the right time in the right format.

Network and Assets Fault Reporting: A major area that has been developed and improved with the use of internet-related technologies has been network and assets fault reporting. The organisation manages and operates extensive networks for electricity distribution in Scotland, England and Wales. The assets maintained include 15,000 substations, 25,000 pole mounted transformers, 16,000km of overhead lines and 46,000km of underground cables in an area of 23000 square kilometres. The monitoring and correction of faults in the network is co-ordinated by a large bespoke Trouble/Outage Management system.

Given the scale of the network operation, an information solution was required to give the organisation's managers an up-to-the date-minute picture of all activities being addressed in emergency situations. This would support accurate and timely provision of information to customers and the media.

A web-based Management Information System (MIS) has been developed that provides current-state reporting on faults. The MIS system links directly to the Trouble Management faults database and extracts fault and resolution information within real-time, on-demand and in pre-scheduled snapshots. The MIS system users can also add additional reports to the initial functionality. The reports are delivered directly to the web browsers of authorised users, in MS Word format. As a result no additional installation effort is required on Client's PCs.

Peak Demand Forecasts: As one of the main functions of the organisation is to provide electricity, another main area that they wanted to develop was to provide more timely warnings and alerts to managers and large customers about potential variations in the supply of this electricity at particular times.

The Internet has been developed to accomplish this and provide up-to-date real-time information that help managers in the organisation and to help large customers forecast and plan for the future. Since the price of electricity fluctuates every half hour, organisations are provided with half hourly meter readings plus a range of graphs to assist analysis. All information is updated daily and is downloaded in easy to use Excel format. In the winter period, day-ahead peak demand forecasts are provided. This information is very important to big users as they may adjust their production accordingly e.g. if it is predicted that the price may be cheap in the middle of the night then they can adjust their production to better suit this. Or, if there was going to be excess power going about the network, then they should be informed. Once electricity is produced it needs to be used up or it is wasted so they could be given the opportunity to use some of it up.

General Information:
General information about the electricity market is provided. Weekly and monthly reports on the electricity market are useful for customers who need to effectively manage their energy utilisation.

Asset Inspection

In order to provide support to engineers inspecting assets and facilitate central activities such as work scheduling, the organisation have implemented mobile computing technology.

The system provides inspectors with accurate information and guidance whenever they are working in the region. Inspection jobs are prepared at regional operational centres and allocated to specific field engineers. The information is downloaded remotely by the engineers onto their portable PCs using a standard telecommunications link. The engineer's portable PCs have a 'pen and tablet' construction. Thus the asset details can be displayed and overlaid onto maps that have been pre-loaded to the PC from a central Geographical Information System (GIS) database. By clicking on appropriate symbols an engineer can retrieve status information and record the inspection report in mandatory fields and free text. In addition they can capture information on the tablet, using optional features such as sketches or a digital camera interface. Updated asset information can then be transmitted back to the regional centre using the standard telecommunications link as was used for job allocation.

The organisation is looking at potentially using the web for some aspects of this system.

- **Are there any other organisations involved in these parts of the supply chain e.g. suppliers or customers?**

The main aspects of the supply chain that have been developed involve, either, customers (large and small), the management team or internal employees.

EVALUATION

- **What are the benefits of using internet-related technologies?**

The overall benefits of the Intranet system to the organisation have been:

- Improved efficiency in communication and productivity
- Centralised communication/ everyone knows where the information is.
- Everyone is receiving real-time up-to-date information.
- It is easily extended by the addition of extra servers when required.
- Cost savings in the respect that users of the information no longer need to have several systems on their desk. They don't need to get lots of different licences etc.

Benefits to Residential customers:

- Residential customers can now easily make on-line comparisons with competitor's offerings.
- The organisation offers an internet-only tariff, whereby a customer is entitled to reduced tariff prices in exchange for a self service approach to meter readings, billing, payments etc.
- There is also electronic integration between the web-site and the Contact Centre application so that the contact centre can better handle any enquiries and meet customer expectations. They can have the customer details in front of them on-line as they are communicating with the customer.

Benefits of Internet Invoicing:

- The larger customers are provided with automated loading of billing data into their own energy management software.
- End to end processing of monthly statements have also been reduced from several days to under two hours and full bill validation is conducted at all levels. It therefore saves customers a lot of time and money.
- It means that these customers can have a long term vision and be able to publish energy spend on corporate intranet.
- Overall there is much more detailed billing information provided to the larger customers. This billing data does not only reduce costs for the organisation but also adds value to the customers. It is also more likely to promote earlier settlement of debts and therefore improve cash flow.

Benefits of Management Information System:

- The organisation had the option to extend the existing Trouble Management System. However development costs involved in developing an Internet system are substantially less than for extending the existing Trouble Management System.
- The management information system provides scheduled reports, summarises faults and is available on a 24x7 basis.
- Overall, the system means that it is much easier to provide management with reports etc. that they require, business critical information at times they need it and to enable them to make effective business decisions.
  For example, say there was a problem in the network. There is a storm across the country. Managers can be pre-warned of hot spots if they are informed on-line. They can more effectively manage resources. If a hot spot is the Borders they could assign employees from Central to the Borders so there is additional cover.

Benefits of web-enabled employee self service:

- There has been minimal installation effort required to install client PCs and as a result of these developments the organisation is starting to move away from paper storage and bulk data entry and towards electronic authorisation. There is less chance of inaccuracies, it is much quicker and the information is always up-to-date.

Benefits of mobile computing solution for asset inspection:

- Asset information and inspection results are sent to and from central databases without the need for transcription.
- Inspection job schedules are planned and delivered to engineers in the field. Engineers can address inspection requirements in unfamiliar parts of the region by using the readily available geographical details and gazetteers.

- **What are the downsides or problems with implementing and using internet-related technologies?**
  - Not really problems with it being slow etc.
  - People forgetting passwords.
  - If the network goes down there is a major problem as everything is on the system and therefore inaccessible.

- **In what ways, has the nature of employee's work changed with the introduction of the Internet?**

  Employees:
  The nature of individual employee's jobs across the organisation has not as a rule radically changed. The majority of employees use the intranet for sending e-mail communication, searching

for general organisational information or arranging meetings and booking rooms. So it is useful in that it is a central resource.
The intranet however has not been fully integrated into the organisation. There are many functions and activities that could be developed.

Managers:
Employees that it has probably impacted more are managers as they receive information vital to their jobs on-line. The information is now timely and as frequent as a situation changes.

- **In what way has their daily communication changed in terms of:**

what methods they use A lot of e-mail is now used for daily tasks such as sending reports, booking rooms etc. The www is used frequently for accessing information.

the frequency of the communication: 24 x 7 basis

the timing of the communication: The information they receive is more useful as it is timely. It is up-to-date when it is received.

the content/level of detail of the communication: As well as being more timely, managers receive more detailed and in-depth information.

Appendix IV: Case Study C

TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are on the organisation's corporate site available externally on the Internet?**

The corporate site has information about the organisation including a general background, their business operations, contact information and financial information e.g. investors, annual reports. There is information about all their products and services and related information like warranty information, product recalls and special offers etc. Technical support is available and downloads. There is also many other services supporting on-line shopping including setting up an account, order and delivery, inventory, invoices and payments and maintenance and service.

- **What information and facilities are available on the organisation's intranet?**

The organisation has one of the world's largest intranets that has involved consolidating organisational home pages, functional home pages, site home pages and millions of web pages. It was rated the number one source of information within the company.

It provides information on:-

- the organisation
- the structure,
- the business their in
- products and services
- Corporate documents
- PR/Communication
- Travel Information
- Industry News
- Sales and Marketing
- Human Resource Issues

There is a number of applications available including:-

- Employee lookup directory: This is the most commonly used intranet application. It was originally designed to replace the company's phone directory. However it has become an authoritative tool on how to find the right people to get the job done. It provides multiple search criteria including skills, projects, business interests and team data.

- Instant Messaging: This internal application currently supports over 2 million instant messages daily, with more than 205,000 unique users every week (over 105,000 logged-on simultaneously). This provides users with a summary of which colleagues are online and available to talk, meet or answer a quick question via an instant message.

- An application for users to choose from 300 channels for internal and external news feeds. Each user can filter out news pertinent to their own position and interests.

- Managers can use an application to view a snapshot of employee activities, skills development, expenses etc.

- Facilities to plan meetings. E-meeting is any meeting involving participants who are not all in the same place. The e-meetings services will help you decrease decision cycle time, reduce travel expense and disruption, and reach your customers more effectively. Employees can

determine the best way to meet e.g. via a conference call, webcast or using electronic whiteboard.

- The Human resources function has a functional web-site for providing complete access to career and financial information, health and life, insurance benefits, and expense applications.

- There are also applications for e-learning. In 2001, the organisation saved $395 million by delivering 43% of all employee training via distributed learning. As well as cost savings to the organisation it has benefited the mobile workforce. With increasingly complex customer businesses, many employees have to work beside clients. This method of learning means they can still access training without having to come back to the organisation's site for it. There is access to thousands of courses and learning events.

- A further areas it has been used for is e-procurement. IRT have been applied across the whole buying process, including the ability to select suppliers, place orders and handle payments online. What once took 30 days now takes one.

- **What other tools and technologies are available on the intranet?**

  - Lotus Notes: An e-mail and database tool with the in built capability of a web browser. It can also be used for calendaring, to-do features and sharing templates.

  - Internal Instant Messaging: This is an efficient messaging service that employees use to send quick questions to co-workers sitting down the hall, to colleagues in another time zone or for conducting worldwide team conference chats.

  - E-meetings: There are various forums for e-meetings. Web conferences provide shared visuals, and are used along with an audio conference. Webcasts are live events intended for a mass audience, and are viewed either at your workstation using a media player or via the TV network. Audio conferences ("teleconferences" or "conference calls") are the most familiar type of e-meeting. Video conferences offer the capability of seeing other participants while looking at presentation material.

  - Facility for users to synchronize the server copy of their mail, calendar and address book with their mobile device and server copy of their data.

  There are a number of initiatives and developments under way for further develop facilities.

  - An application designed to bring employees together for an innovative, global online brainstorming event as one team. This has been piloted with the 60,000 employees who now make up the new Business Consulting Services Division. Through this application, employees will have the opportunity to meet, share experiences and to develop a sense of community, while generating best practices and developing winning customer solutions. The employees from BCS will explore five crucial business topics impacting the BCS operating model, as well as explore the characteristics and qualities that define a leading technology and services company.

  - There is currently a pilot on allowing Lotus Notes email access to and from a handheld computer. They are also looking at providing a web browser on the device.

  - There is also a new tool currently being piloted within Europe that has the power of a Thinkpad and uses mobile communication technology to connect to the internet and intranet. There is high expectation for this tool and how it will change the way that customers can be supported.

- **Who has access to the intranet?**

  The information available on the intranet is limited to employees. Employees cannot access all parts of the intranet. They have restricted rights depending on their position within the organisation.

CUSTOMER SERVICE & SUPPORT PROCESS

- **What role does the Customer Service and Support function play in the organisation?**

  The Service and Support function is primarily concerned with looking after machines etc. that they have sold and providing spare parts. They are not concerned with the likes of outsourcing etc.

- **What activities are Customer Service and Support involved in?**

  Customer Service and Support deal with large enterprises right down to individual customers.
  The main areas that they are responsible for include:
  - Warranty Service for desk PCs, portable PC' and Servers. They are not concerned with mainframes etc. (other organisations provide support for this).
  - Up and Running Support. For example a customer may be having trouble starting some software.
  - Extended Help for certain customer. Some customers may choose to pay for this.

- **What types of information do they need to communicate and what types of information do they need to receive?**

  This varies considerably depending on the problem that the function is dealing with.
  e.g. they could be passing on instructions to click on this and click on that.
  e.g. they may be guiding customers through web pages.
  e.g. they may be sending files to them or sending something on a diskette
  They put as much information as they can on the web-site that they think is relevant. This is based on the types of questions that come in.

- **How has Customer Service and Support changed with the introduction of the Internet?**

  Traditionally much of the support was provided over the telephone and through face to face visits. Now a lot of the work is conducted over the Internet. They now have people that are employed to purely put information on the web.

- **What types of Customer Service and Support are provided over the Web?**

  A lot of the customer service and support activities are conducted over the web.

  There is a technical support web site that has been set up for customers. Primarily this is a self-help facility. Customers can decide what language they want to view the web-site in. They can then use it to report problems that they are having with products, access different types of support or track the progress of ongoing support.

  Customers can also access information on general tips, tricks and knowledge about known faults with various products. They can use it for information on warranty issues regarding products, to access discussion forums or to download installation information, parts information, publications, hot news or software. Customer's software and drivers can also automatically be refreshed over the web. This requires no user interaction at all. The customer's machine dials into the network and they get downloaded automatically.

  There are two different paths that customers can access the customer support and service through. They can either go in as an experienced user or as un-experienced users. The experienced user can

access it using a quick path while the less experienced user can walked through the system step by step using an on-line assistant.

The technical support can be personalised for different customers. Through customer profiling the web-site would be customised to provide an appropriate level of information. One of the main criticisms in the past was that too much information was available and it therefore took more time and effort to find the information that they were looking for. This is done by a cookie in the machine. By using customer profiling, it can save the user time when they go in (saves them clicks and frustration). Also, occasionally, customers that are owners of the same machine can be sent pro-active e-mails. The organisation tries not to use this much, though, as some customers don't like it.

There is also the technical capability for employees in Customer Service and Support to actually access remote customer PCs and take control of them. For example, the customer could be looking at their PC and an employee based at different location could be moving their mouse.

- **What technology has been used to set up Customer Service and Support tasks on the Web?**

  Apart from the web technology, a database drives the external site available to customers and it also drives the internal site. The majority of the information on the database is available on both sites except for some restricted information that is only available internally.

- **Do different sized customers have access to different facilities on the Web?**

  Larger organisations (larger accounts) that have set up some kind of partnership with the organisation have their own dedicated web-portal. The information that is available on the portal varies from customer to customer. It is generally tailored with the customer's logo, filled with approved product configurations and prices, systems and accessories and spare parts. It can also include a list of the products and services have been bought, when they were bought, number of repairs carried out, number of claims etc. Service order and progression tracking is available and service and warranty notification can be sent electronically to service teams. Warranty upgrades that have been negotiated and agreed are also available. The list is extensive.

  A full list of the information that is stored is restricted to mainly sales teams. Some of the information is actually sold back to the customer.

  Otherwise, all other customers have the same level of access.

- **Likewise, do suppliers have access to portals?**

  Yes there are portals for supplier as well although they are not as extensive as the customer portals. One thing that the organisation constantly tries to tease from suppliers is information on competitors. The suppliers don't have access to actual customer information, as this is kept confidential.

- **Finally, do logistic companies have access to any kind of portal or information so they can, for example, plan the delivery of spare parts better?**

  The organisation works with logistics companies to agree processes for which spare parts are required to go through. The organisation normally set out the requirement to which they will negotiate with companies and this will be based on the service offerings that the organisation are offering their customers. Little customer information is passed onto logistic companies.

- **Is the Customer Service and Support system linked to other systems?**

The key factor necessary for success is that all applications are fully integrated and that various parts of the enterprise system communicate with each other. Supply chain management, procurement, support and service, customer relations management and knowledge management all need to be fully integrated to ensure that the customer gets a seamless experience. For example, a call centre representative should be able to talk to a customer whilst looking at previous orders and delivery details for that customer and also details of any correspondence that they have had with other employees.

- **How does the E-support and E-service cater for people that communicate in different languages and are from different cultures?**

The acceptance of the technical support web site depends largely on their language capabilities. The web-site started in English and was then translated into French, German, Spanish, and then Italian. More recently, it has been translated into Chinese, Japanese and Portugese.

The number of people using the web facility in English has stabilised now. The acceptance of the English language was very high in countries such as Germany. However, it was not accepted as well in countries such as France, Spain and Italy. The way forward to try and attract more customers appears to be through translating the web-sites into other languages.

The web-sites in different languages are nearly all the same. The organisation is trying to create uniformity. They have had to make one or two things specific to certain countries whether it has
--
been for legal reasons or because they sell slightly different versions of a product in different countries.

- **Are there any aspects of customer support and service that don't appear to work well over the Web?**

Although more and more people are using the technical support web-site, it is not accepted by all customers. This is for a range of reasons:

Some people are just not comfortable using the Web (there is still always the need for the telephone). Some people still feel they want to talk to someone for encouragement and support. Other customers are not using safe web-sites. While others, may not have found a solution to their problem. For example, they may have adapted the software to the extent that they could not use the automatic software refresh and therefore they need further advice from an expert.

Therefore, there still needs to be the opportunity for customers to telephone Service and Support. All customer requests via the phone are handled by Remote Technical Support Centres by agents. They may be able to remotely diagnose and fix problem. More and more problems can be fixed remotely. If required though they may have to send an engineer out. Engineers are available 24 hours a day in different languages. The engineer can also be over the phone.

- **Are there any others aspects of support and service that may be developed over the Web in the future?**

The organisation is always looking for ways in which the site can be further developed and enhanced to become more and more acceptable to the customers.

It is anticipated that eventually the organisation's products will be able to automatically connect themselves to the technical website when they are not working correctly and try and diagnose what is wrong without any user intervention at all. Also, many customers find that their products are not working after they have changed configurations of the machine. The products will eventually be able to reconfigure themselves to the last working state.

At the moment, facilities to track all problems are available in the US. These facilities enable users to do all reporting and tracking over the web. In the UK, users mostly have to call the support and service centre if an engineer does not turn up, for example. However, these facilities will be available in the UK by the end of 2002.

To date, automatic service entitlement has been semi-automated. When an agent is on the phone to the customer and as they enter the customer details in to the web, the customer's warranty support will automatically be checked and listed.

Looking into the future, it is anticipated that engineers will be able to fix problems using mobile communications. They will be able to connect to a remote centre through a portable PC wired on a belt connected to a wireless headset. They will be able to do things like view pictures e.g. location of the components in a machine, look up the availability of parts, look at wiring diagrams or look up maintenance procedures. The engineer on the customer's site will have a camera that will let him take a picture and transmit this to remote engineers to gain their assistance in fixing problems. The technology is available at the moment but unfortunately the bandwidth is not satisfactory yet.

Relationships with logistics companies still remain a problem. Obviously in some situations, the organisation needs to deliver spare parts to the customers. This has to be done quickly and cost effectively. At the moment the customers and the organisation are not happy with this. The service is too slow and too expensive. The logistics companies need to cooperate more closely with the organisation. This is an area that needs to be developed.

EVALUATION (FROM A CUSTOMER SERVICE & SUPPORT PERSPECTIVE)

- **What are the benefits of using internet-related technologies for Service and Support?**
  - Enhance customer service by providing a quicker, more accessible service.
  - Cut costs e.g. there are less on-site visits
  - Consistency (central pool of information)
  - Every agent does not need to be updated individually.
  - Access interactive automation support
  - Access support (manually) e.g. if a customer gets so far with a problem and then gets stuck, they can link up with an agent via a live connection. The agent can then take over and finish solving the problem rather than the agent having to start from scratch.

- **What are the downsides with using internet-related technologies for Service and Support?**

  Some countries don't have a good infrastructure. They have poor bandwidths connections. The US is so far ahead they sometimes forget. Sometimes the US need to be slowed down, and reminded of this, so that they don't take alternatives away that are suitable to these countries.

  Security can be a problem in that some customers are not happy for you to take remote control in case somebody could be accessing their machine and downloading information from it. Security is however in place that prevents this.

- **In what ways, has the nature of employee's jobs changed within Service and Support with the introduction of the Internet?**

  Employees dealing with phone calls find it easier to find the relevant information.
  Many customers are using the self-help facility. Often the telephone calls are problems that could not be resolved using this facility and therefore tend to be more difficult problems. Thus employees are required to have a greater level of skills and know products inside out, supporting systems and databases. It can make their job more interesting. The employee dealing with a problem takes

responsibility for the case (own the case). They increasingly require knowledge of multiple languages.

- **In what way has their daily communication changed with customers in terms of:**

  : what methods they use
  More and more of the support is provided electronically, especially using e-mails.
  However, some customer requests are still done over the phone. This may be because the customers could not find a solution electronically or simply prefer using the phone.
  Where the problem cannot be fixed electronically, engineers may have to go out to the site and deal with more severe problems (face to face contact).

  : the content/level of detail of the communication
  When using other methods of communication, they need to be very careful when it comes to the content of the communication that they don't throw information away. They need to capitalise on opportunities for gathering information. For example, it is helpful to them to pick up the trail that the customer may have followed when trying to solve their problem using the on-line assistant. There are methods in place for this to happen. When the customer sends an e-mail regarding their problem, the trail that they had already followed would be swept up and attached to the e-mail. The phone will not do it yet but if they were both to use a shared web-site while on the phone they could achieve the same thing.

  : the frequency of the communication:
  Customers communicate with the organisation a lot more frequently than before, using a variety of methods. Communicating via the Internet takes away the embarrassment or fear of asking small, silly questions.

  : the timing of the communication
  On-line service is a 24 hour service available 7 days a week, available anywhere in the world.
  The phone service is not a 24 hour service. They tried this for a while. However, they decided that it was sufficient to operate the phone service in normal working hours in each country.
  Again for a while there was 24 hour capability in the way of e-mails. All e-mails would go into one database and there were three major centres that could deal with them. Now they are moving towards more geographical centres and aim to get back to the customers within 24 hours.

- **In contrast, do they feel as if technology has contributed to them losing out on information (perhaps through there being less face to face interaction)?**

  Customers should gain in the amount of information that they can obtain. It is normally a psychological problem rather than a practical problem with the people that don't like using the web. Some people just don't like using the web and want to have voice-to-voice communication. Some things are actually done better using the e-mail. For example, rather than trying to explain something over the phone, it may be easier to attach it to an e-mail and send it.

TEAM WORK

- **Are employee's involved in more or less teamwork?**

  Employees are involved in a lot of teamwork. The amount of team-working probably increased prior to the development and integration of the Internet but the Internet has certainly made team working easier.

- **For what tasks is team-working necessary in the Customer Service and Support function?**

  This particular function/ process is by far the biggest user of virtual teams in the organisation. To meet customer's expectations and gain customer satisfaction, it is essential for those at the front end (call centre agents) of the service spectrum to integrate and collaborate with those at the back end (engineers) sharing information, knowledge and experience.

- **Can you give an example of teams that have been formed and where the people are generally located?**

  The teams can take place in different dimensions.

  Sales and support teams exist throughout each of the countries that their products are sold. These teams are based within organisational sites or they work from home but have a high level of collaboration with colleagues throughout the world. The teams may cross geographical boundaries and can operate in different time zones. Although they may never meet, they can all access the same information and tap into the same experience. From time to time they will need to contact each other to help with particular problems.

  Employees are also allocated to different teams by the language they speak, the location they are based at and depending on the product they specialise in. For example, the people that support laptops in different countries are in a team. Aligned to these teams are support engineers who will go and repair products on customer premises or in a depot environment.

  To a certain degree there are also more informal teams that exist between people in different departments. An employee in the Customer Service and Support department may need to tap into the experience of someone from Manufacturing for instance. They cross organisational boundaries. These teams may be set up and disbanded regularly but they are for all point and purposes teams.

  In addition to this, there are teams aligned to large corporate customers providing specialist support based on the product mix that the customer has installed. Again there are engineers aligned to these accounts who are of a higher skill level who can be based within the customer premises or within one of the organisation's sites. This would be dependant on the service level that the customer had purchased and the geography of the country e.g. a 15 min fix time would have an engineer based on site, whereas a 4 hour fix time may be based within an organisational site.

  The culture in the department is very much one of sharing knowledge and information. The individual's ability to share knowledge and experience is recognised by managers.

- **How often do they meet face to face?**

  These teams meet very seldom face to face, for example call centre staff never meet engineers, yet maintain high levels of communication that has built up trust etc. Sales and support probably meet a couple of times a year but almost never meet the other teams they collaborate with. There are a few exceptions where face-to-face activity is essential.

EVALUATION (FROM A CUSTOMER'S PERSPECTIVE)

- **What different types of technology do customers use to communicate with the Service and Support function?**

  Normally telephone, e-mail, Internet and still a few use the fax.
  WAP phones have not really taken off. In order for this to work the organisation would have to create a special version of their web-site that was compatible with them. There are not enough people using them to make it cost-effective.

- **What do they feel the benefits are in using internet-related technologies for Service and Support?**

  Availability
  More information that is easier to access than over the phone.
  They are in control of their own situation. They can do it when they want.

- **What do they feel are the downsides with using internet-related technologies for Service and Support?**

  Always want it to be easier to find the information to solve their problem. The organisation is always striving to find ways to organise the information easier and make it easier to find.
  Sometimes they want to discuss things with someone face to face or verbally. It may just be for general advice or reassurance. They do not always find the web satisfactory.

- **Using the Internet, do they feel as if they can pass on and receive more relevant information?**

  More skilled/advanced users recognise that they receive more relevant information and that it is to their advantage. Some customers don't feel as if they can pass on information as well using the Internet as what they could if they were to speak to someone verbally. It is back to this psychological issue again.

Appendix V: Case Study D

FOCAL ORGANISATION - TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are available on the organisation's corporate site available externally on the Internet?**

  The corporate site has general information about the organisation including what the organisation does, the markets they operate in, the structure, financial results, shareholder information, share price data, important press releases, annual reports, presentations, bulletins and contact names and numbers. They also have a site for selling their engineering products.

- **What information and facilities are available on the organisation's intranet?**

  The types of information that is available on the intranet include corporate documents, corporate policies, news and announcements, HR information such as pension plans, job vacancies and health and safety information.
  Each function has a web site e.g. Finance, Quality, Sales, Purchasing and all departments have a web page they administer.
  Certain departments have staff lists available on the intranet.

- **What other tools and technologies are available on the intranet?**

  Other tools and technologies available on the intranet include e-mail, on-line diaries and team rooms are available through e-mail client. There is also PC Duo software that allows IT support to take control of user's PC or to view the details on the user's screen. There are no portal facilities set up.

- **Who has access to the intranet?**
  Everyone in the organisation that has a connection to the Internet (there are some employees that don't).

FOCAL ORGANISATION - BUSINESS DESPATCH

- **What activities and which departments are involved in the Business Despatch supply chain process?**

  Once the organisations' products are completed they are packaged. Small to medium supplies of products are packed internally while external packers are used for large shipments. Once the products are packed, the Shipping Department arrange the deliveries of all goods. The transportation of all goods is conducted by external logistic providers. All Paperwork is handled by the Shipping Department. The Projects Department contact customers to ensure that they are ready for shipment of goods and liaise accordingly with the Shipping department.

- **How have the activities been developed with the introduction of internet-related technologies?**

  Firstly, instructions to External Packers regarding packing products are handled via email and external packers have access to the organisation's systems via a portal. External Packers update the

organisation's internal systems with packing status and post photographs of the goods as received and as despatched on the network.

Secondly, logistics providers only receive paperwork with delivery instructions either in paper form or entered into their systems via dedicated PC's supplied by them. The logistic provider interviewed in greater detail later in the case study provide a MultiFreight system through their extranet which allows the organisation to view the status of their orders.

Employees can view despatch status of all goods.

The Shipping department has access to logistics providers systems to check delivery status.

LOGISTICS PROVIDER

- **Background**

  The logistics provider is one of the largest independent freight forwarding companies in Scotland. They offer customers a wide range of forwarding services utilising road haulage, rail, marine and airfreight transport. The core of their business is deep sea forwarding. They provide import and export services although the main part of their business revolves around the Export division. The organisation transports a wide variety of commodities including heavy engineering products, textiles, electronic equipment and wines and spirits.

  They offer a comprehensive range of related facilities which can be arranged via a selective network of Quality Assured Suppliers including warehousing/storage, export packing, bulk tank container fleet, commercial documentation, project management, domestic transport, insurance, container repairs, consular services and business and retail travel.

LOGISTICS PROVIDER - TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are available on the organisation's intranet?**

  The types of information that are available on the intranet include a memo board, phone book (for 4 locations that the company is based at/ all in UK), quality manuals, training information, documents (e.g. fax cover sheets), various tools like exchange rate calculators and department specific information (document store area for each department & message board).

  The organisation plans to implement SAP in the next year over their intranet. This is an enterprise resource planning system. They are interested in the modules for operations, sales, marketing, logistics and HR.

- **Who has access to the intranet?**

  Everyone in the company that has a web browser can access the intranet. Some employees have more rights than others e.g. those with certain rights can see what is going on in every department.

- **What information and facilities are available on the organisation's extranet?**

  MultiFreight System
  This is a windows-based application written in a 4th generation programming language called 'Progress'. It is a multi-modal freight forwarding package that has been developed to meet the needs of their clients. It allows customers to view the status of their orders. There are 4 or 5 stages

to a job. Some customers will be given access to the MultiFreight system. Alternatively, the information on this system can be very easily filtered onto a spreadsheet, presented as a customised report and sent via e-mail to the customer. Customers can pay £500 to get the information presented in a spreadsheet for all orders.

SOP (Sale Order Processing) System

One of the logistic providers' main customers is a whiskey distiller. They have a long and mutually beneficial arrangement with the organisation for decades. Due to competitive pressures from multinational forwarding agents and a drive within the organisation to obtain maximum value from its logistic providers, it was necessary to evaluate ways in which the forwarding operation could be streamlined in order to cut costs and enhance service levels. The logistics provider was given the workload of entering the shipping information into the organisation's sales package (SOP) and also the same information into their own MultiFreight system.

Data Transfer System (SOP to MultiFreight)

Consequently, given the level of data entry involved in both systems, there were regular transcription errors and a vast amount of time wasted. Recently, a data transfer system was developed and implemented to connect the two systems and automatically transfer data from the SOP system to the MultiFreight system. There is a FTP leased line set up between both organisations. The FTP protocol creates the interface. The logistics provider is eventually looking at having other companies using the system. They don't have leased lines set up with them so they will need to use the Internet.

LOGISTICS PROVIDER - LOGISTICS SERVICES

- **Describe the nature and scope of the Logistic services provided.**

As indicated the core part of the organisation's logistic services revolve around exporting. This involves the logistics provider delivering goods for other organisations to overseas customers. Exporting embraces a range of activities including:

- Warehousing
- Haulage: Movement of goods from warehouse to port
- Handling H.M. Customs documentation e.g. Bill of Lading
- Booking and arranging feeder vessel
- Transhipment of cargo
- Claim liability coverage
- Delivery to consignee's premises

The logistics provider is responsible for picking up goods from the warehouse, delivering them to the port (deep sea port) and booking the feeder vessel. The logistics provider has offices at two major handling ports in the UK and they are in continual negotiation with the major shipping companies to obtain the best freight rates possible. Once the containers are on the ship, the logistics providers' role ends. At the other end, the importing agent takes over (this may or may not be the same logistics provider). Some companies issue pre-alerts to the importing company. This logistics provider does not really to this.

Although the logistics provider is involved mainly in exporting, they are involved in some importing. They use the 'Customs Freight Simplified Procedure' (CFSP) to import goods into the UK. These procedures involve:

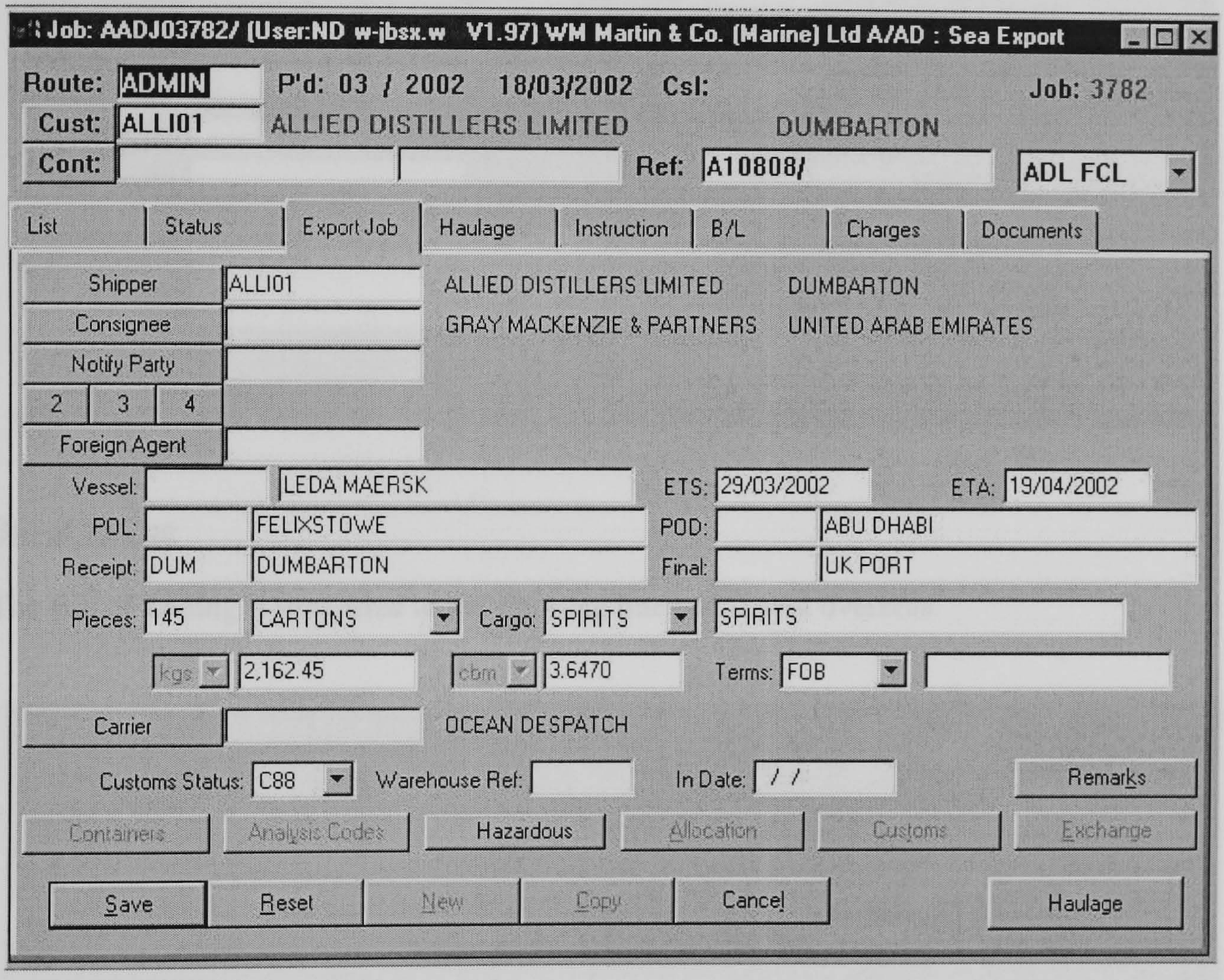
- Assisting in classification
- Managing deferments
- Arranging import licence
- Control IPR (Inward Processing Relief) Records

– Control Period Entry Requirements.

- **What information needs to be communicated in the operation of these logistic services?**

Export Jobs

The Form below illustrates some of the types of information required for requesting logistics services. Each order is effectively a job whether it is an export or import. Most jobs that they deal with are exports. Some of the details that must be stored for each job include customer details, the organisation receiving the goods, details of the cargo and carrier details.



Consignee: Organisation buying the good.
Notify Party: Any other interested party like the bank for instance.
Foreign Agent: Importing agent.
POL: Port of Loading.
POD: Port of Discharge.

Haulage

The hauliers deal with the movement of the goods from the place to the port. The logistics provider need to keep track of all communication with hauliers including e-mails, communication over the logistic system and faxes. Any faxes are sent using Zetafax which automatically links into the logistics system so that the content of all faxes can be viewed on-line.

Job: AADJ03782/ (User:ND w-jbsx.w V1.97) WM Martin & Co. (Marine) Ltd A/AD : Sea Export

Route: ADMIN P'd: 03 / 2002 18/03/2002 Csl: Job: 3782

Cust: ALLI01 ALLIED DISTILLERS LIMITED DUMBARTON

Cont:

Ref: A10808/

ADL FCL

List | Status | Export Job | Haulage | Instruction | B/L | Charges | Documents

Type: Number: Seal: UCN:

Pieces: 145 Cargo:

kgs 2,162.45 cbm 3.6470

Collection:

Haulier:

Ref: 0000 Date: / / Day:

Delivery:

Ref: Date: / / Day:

Empty Coll:

Ref:

Printed: no Print Collection Note

Special Instr: DELIVER BY 1500 22.03

Hazardous 1 of 1

Reefer Add Collection

Save | Reset | New | Copy | Delete | Cancel

Bill of Lading

The Bill of Lading is presented to the shipping line and is sent overseas.

Job: AADJ03782/ (User:ND w-jbsx.w V1.97) WM Martin & Co. (Marine) Ltd A/AD : Sea Export

Route: ADMIN P'd: 03 / 2002 18/03/2002 Csl: Job: 3782

Cust: ALLI01 ALLIED DISTILLERS LIMITED DUMBARTON

Cont:

Ref: A10808/

ADL FCL

List | Status | Export Job | Haulage | Instruction | B/L | Charges | Documents

Shipper ALLIED DISTILLERS LIMITED Consignee GRAY MACKENZIE & PARTNERS

Notify Party Foreign Agent

HBL: AADJ03782 OBL: CCL Bill

Orig: 03 Copies: 06 Cont No:

Seal: Line Ref:

Ship: LEDA MAERSK Close Out: Enter Charges

Receipt: DUM DUMBARTON POL: FELIXSTOWE

POD: ABU DHABI Dest: UK PORT

Frt Pay: GLASGOW DOS: 29/03/2002 ETA: 19/04/2002

Update | Reset | Cancel

Marks and Numbers | Description of Goods 1 of 1 | Pieces: 145 CARTONS

kgs 2,162.45 cbm 3.6470

PE/CRN:

Hazardous Supplr: ALLI01

Insert Notify2 3 4 Containers

Marks and Numbers	Description of Goods
CMP ABU DHABI P397664	OPEN LOAD 40 CARTONS BALLANTINE'S FINEST BLENDED SCOTCH WHISKY 3 YR OLD - 75X12 43o 30 CARTONS CANADIAN CLUB OTHER IMPORTED SPIRITS 6 YR OLD - 75X12

First | Prev | Next | Last

Save | Reset | New | Copy | Delete | Cancel

- **How have their activities been developed with the introduction of internet-related technologies?**

  Before everything had to be keyed in manually several times so that it could be presented in different formats. For example, some of the information required on some documents is required in others. Rather than waste time re-keying, the system automatically presents the information in different formats.
  Often the customer was typing it into their system and then the logistics provider was re-typing the same data. This could lead to inconsistencies. For each container that is entered into the system they are probably saving 5 minutes.
  The logistics provider can also use internet systems provided by other companies for communicating with their customers. For example, they use the CNC Train system (Channel Tunnel).

- **Does the logistics system cater for customers from different countries that speak different languages?**

  The system does not cater for international countries.

- **What kinds of customers use the service?**

  They have a variety of customers (large, medium and small organisations). The customers are from a variety of industries including the whiskey, textiles, engineering and electronic industries.

FOCAL ORGANISATION - EVALUATION

- **How have relationships and communication developed with logistic providers following the introduction of internet-related technologies?**

  The on-line system is used for as much information as it provides. Further contact is via phone, fax or email.

- **What are the benefits of using internet-related technologies for the business despatch process?**

  Internet-related technologies improves the efficiency of certain aspects of the Business Despatch process e.g. provides reports on the transportation of customer goods. It creates opportunities for simplifying the movement of goods.

- **What are the downsides of using internet-related technologies for the Business Despatch process?**

  Obvious downsides in the automation of the process is that many of the deliveries to third world countries can only be tracked to foreign port.

- **Are there still problems with the Business Despatch process in the organisation?**

  There are still poor relationships with the logistics providers. Problems in the Business Despatch process regularly emerge such as customer orders being delivered late, deliveries going to the wrong place or deliveries going missing. They are not resolved quickly enough and there is still a lack of coordination between the organisation and the logistic providers.

LOGISTICS PROVIDER - EVALUATION

- **What are the benefits of using internet-related technologies for logistics services?**

  Aiming to get customers to speak to a machine rather to people. Trying to streamline the operation. Allows problems to be detected sooner.
  Data transfer system has contributed to a saving of approximately six salaries.
  The logistics provider has to put in tenders for delivering logistic services to their customers. They will often be in competition with a number of other companies. It appears to be almost essential that the company has plans to use Internet technology.

- **What are the downsides/problems of using internet-related technologies for logistics?**

  Speed
  Perhaps the cost in initially setting it up.

- **Are there any areas of the logistics system that could be improved?**

  They could have designed external interfaces on their logistics system that were more general. The Data Transfer system has been designed with the whiskey distiller in mind. About 90% of the system has been tailored towards this company. The whiskey distiller accounts for about 40% of their business. So there account is vital to them.

- **In what ways, has the nature of employee's work within Logistics changed with the introduction of internet-related technologies?**

  The main impact has probably been the availability of e-mail. Many documents and bookings are sent via e-mail.

- **In what way has their daily communication changed in terms of:**

  : what methods they use (face to face, e-mail, video-conferencing etc.)
  They use a variation of e-mails, phone and faxes. The phone is still the dominant method of communication. Certain documents are now in pdf format so it is easier to communicate electronically. Employees in export and imports rarely meet up with customers face to face. However, a manager will periodically have face to face meetings with customers for negotiating deals etc.

  : the content of the communication
  In many ways the content and level of detail of the communication has not changed much with the introduction of the Internet. They were very much influenced by legal requirements for shipping goods etc. With regulations changing in the EU it has been made easier to transport goods and there is less paperwork required.
  You could say however they have more details on the history of communication between themselves and customers.

  : the frequency of the communication
  This has increased with the upsurge of e-mail and the ease at which employees can now do things. They can easily get status updates now for customers, generate reports, pull daily spreadsheets out of the system with orders etc.

: the timing of the communication
The timing of the communication has not really changed. Most customers are Scottish based. The e-mail server stops at 8:00pm at night. Although the Track and Trace site is available 24 hours a day it is only updated 9 till 5.

- **Using internet-related technologies, do they feel as if they can pass on and receive more relevant information?**

  They are not necessarily receiving and passing on more information. They are more cutting down on the time it takes to generate and pass on information.

- **Do they feel as if internet-related technology has contributed to them losing out on information (perhaps through there being less face to face interaction)?**

  Generally, employees can loose out on information. It is almost too easy to use the e-mail internally. They loose out on information that may have been passed on if done face to face.

- **Do employees find they are involved in less or more team-work?**

  Employees generally do tasks individually. Although they are in a departmental team.

OVERALL EVALUATION

The success of the linkages with the logistics provider and their main customer which is a whiskey distiller is mainly due to the excellent relationship between them, the level of initial face to face planning and collaboration and the technological infrastructure put in place.
The logistic services provided to the engineering company have not worked quite as well. There have been problems with orders being late, going missing and going to the wrong place. There is a lack of coordination between the logistic provider and the engineering organisation and problems are not being resolved quickly enough. It probably does not help that the organisation uses different logistics providers for exporting and importing and they change which providers they use. They are not getting the same opportunity to build up solid working relationships with the logistics provider.

Appendix VI: Case Study E

TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are on the organisation's corporate site available externally on the Internet?**

  The corporate site contains general information about the organisation including organisational background, corporate brands, values, board of directors, executive officers, investor's information (e.g. company reports and stock statistics), governance policies, latest news and careers. There is also information about all their vehicles and services. For example, there are multimedia demonstrations and information about financing options, features and design, environmental concerns, insurance, warranty and rental.

- **What information and facilities are available on the organisation's intranet?**

  A vast amount of general facilities and information are available on the organisational intranet that all employees can access. For example, there is information about the organisation's vision, mission, strategy, products, services, business ventures, structure etc. There are links to corporate documents and industry news. Furthermore, lots of training materials and facilities are available over the intranet as well.

  Human Resources have a web-site that has information on pensions, medi-insurance schemes, maternity programmes, sports clubs etc. Employees can do things like view their staff appraisal, order their next company car and claim expenses on the intranet. There are procurement systems accessible as well via the intranet for non-production related goods and production-related goods.

- **What other tools and technologies are available on the intranet?**

  Engineer employees use the Intranet to capture and store engineering information on a corporate and worldwide basis. There is technology that makes it possible for engineers in design centres all over the world to share information concurrently. It plays the role of a virtual design centre that brings engineers together to solve problems and launch better products faster. There are also tools available on the intranet that can be used for global product analysis and verification operations. Test requesters and test executors can track products all over the world.

- **Who has access to the intranet?**

  Everyone in the organisation has access to the intranet. However, some facilities and information are only available to relevant employees. For example, certain sales and marketing information is restricted. Sales and marketing information is gathered on customer viewpoints of the order fulfilment process and simplified graphs are created based on this data which illustrate the level of customer vehicle handover satisfaction. It would only be certain levels of management, sales and marketing personnel that would be able to access this information to compare satisfaction levels in different areas.

ORDER FULFILLMENT PROCESS

- **Background Information**

The main aim of the order fulfilment process is to deliver the vehicle the customer wants, when it is required. Dealerships purchase cars from the manufacturer and sell them on to end customers. The order fulfilment process has been developed in recent years using Internet-related technologies in an attempt to optimise the service. The most recent advancement concentrates on the interactions and communication between the dealerships and the manufacturer which subsequently impacts the level of service provided to end customers.

In order to understand the developments in the order fulfilment process due to Internet-related technologies, it is critical to understand the various stages a car goes through in manufacturing. Each stage is referred to as a pool. In total, there are eight pools. The stage that each car is at, in each pool, is outlined below:

Pool 1:	In stock with dealers
Pool 2:	In delivery system to owning dealer
Pool 3:	Just before gate release to dealer
Pool 4:	Left factory and arrived at Vehicle Handling Centre
Pool 5:	Left factory and on-route to Vehicle Handling Centre
Pool 6:	Between serialisation and gate release to Vehicle Handling Centre (**Locked**)
Pool 7:	Unsold/Uncontracted **Committed** orders laid out for production
Pool 8:	Unsold/Uncontracted **confirmed** orders not yet serialised

All the pools put together make up the pipeline of a car. The order pipeline of a car would take around 16 weeks in a worst case scenario.

It is also important to understand the different statuses that a stock unit can go through in the order fulfilment process. The status of a stock unit can be cancelled, order, locked in plant, in transit, delivered, registered or reserved. A fuller description of each of these is given below:

Cancelled:	Orders that have been cancelled by the dealer.
Order:	Orders that dealers currently have. These orders can be unconfirmed open (still to be confirmed by the system), unconfirmed accepted (been confirmed by the system but can still be amended in every aspect by the dealer), confirmed (been confirmed by production and dealer can only make constrained amendments) or committed (been committed to a build date and dealer is further constrained in changes they can make).
Locked in Plant:	Units that are locked in plant have already passed through the unconfirmed, confirmed and committed stages in the vehicle build process and are now ready for build.
In Transit:	Units that are currently gate released but not delivered to the dealer.
Delivered:	Vehicles that are delivered to the dealer but not yet registered.
Registered:	Vehicles that have been registered

The main aims of the ordering system are to streamline the order fulfilment process and build a mix and volume of vehicles in stock to better suit demand. This will be achieved by improving the information that is available to dealers on which cars are at which stages in the pipeline and where they are located. Before, a dealer would try and manually locate a vehicle to meet their customer orders. However this was a timely exercise and would invariably lead to orders being placed for cars which were lying unsold at other locations. This system however enables them to easily view unsold cars online that are at different stages of their pipeline: planning stage, production stage or built and in storage. It enables them to tap into this information and snatch cars to meet the

demands of their customers. This will improve customer service in terms of how quickly they can get the cars to the customers and allow dealers to accurately match customer requirements.

The ordering system also aims to cut down on the cars in stock and therefore reduce costs. This not only includes the stock in Vehicle Holding Centres (VHC) but also within dealers as well. Currently, there are an increasing number of older (and potentially obsolete) vehicles in stock, which can only be sold with significant discounts and increased market support. By enabling dealers to view all stock and it's status, they can tap into this stock and have it transferred to other suitable customers before it becomes too old and loses its marketability.

- **In order for the order fulfilment process to function, what activities need to be undertaken and information needs to be communicated?**

Dealer Business Planning: Roughly 3 months prior to production, the management team along with brand (marketing) teams will look at what each dealer's sales mix has been for the last 3 weeks and the last six months, their objectives and discuss future promotions. They will then forecast a suitable mix and volume of vehicles that should be allocated to each dealer and this will be negotiated and agreed with individual dealers.

Order Dressing: Once it has been decided how many cars each dealership is getting, the specification of each car needs to be decided. Although the Dealer Principle would make the final decision on the finer specifications of the cars, input would be given from brand teams and brand specialists.

Customers place orders: When the customer comes into the dealership and places an order, the dealer has to firstly check their own dealer stock. If they don't have it in stock then they may need to check other dealer's stock etc. If the car was in Pool 1 of another dealer it would be physically transferred after agreement. Otherwise they would check other pools for suitable cars. Failing this they would have to place a fresh order.

Call-Offs/ Snatches: Dealers need to be able to call off confirmed orders and they also need to be able to tap into other dealers orders if customers are looking for a particular car that they don't currently have available.

Delivery: The organisation and the dealers need to be able to monitor the delivery of vehicles. They need to be able to find out exactly where cars are.

Payment: Payment needs to be made from the dealers to the organisation for vehicles. Vehicles are paid for on adoption (when vehicle is sold or when Time Expired Adoption period has expired). Sometimes payments may need to be reimbursed.

Damaged Goods: Damaged goods will have to be reported. They are sent to approved dealers for repair and inspected by the RAC. Usually vehicles damaged en route will be retained as Dealer Vehicles or Dealer Rental. It is highly unlikely that retail customers would receive one. In many cases, the dealer will need to make alternative arrangements for orders which may involve going through the process of re-ordering or snatching.

- **What departments are involved in the order fulfilment process and which other organisations?**

Internal departments are involved in the process including Management, Sales and Marketing and Production. Dealers are obviously involved in the process as well. By looking at the main activities involved in the ordering process it is easier to see the level of involvement of each player and better understand the types of information that are required.

- **What technology was used to build the web-based ordering system?**

The ordering system was developed using Internet technology. The system is linked to a number of different databases. There are 3 different databases for each year of vehicle.

- **How have the activities within the order fulfilment process been developed with the introduction of the web-based ordering system?**

Dealer Business Planning: People involved in the planning stage can use the system's status reporting to enable them to see what cars each dealer has in the pipeline at the moment and what cars they have had.
The Status Reporting displays a detailed analysis of each dealer's stock units, summarising all of the dealer's stock units, by model and by 'order status'. The analysis can also be filtered down to a more specific search to look at the stock units for specific models of cars.

Order Dressing: Initially a batch of vehicles would be ordered centrally. Dealers then have the 'window' to dress the orders using the ordering system.

Customers place orders: About five years ago, when dealers were looking for particular cars for customers that they did not have in stock, they had to lift the phone and make endless phone calls and look through endless stock sheets in order to locate a suitable car. Now dealers can use the ordering system to find vehicles. Using the system, they only need to input the required specification and the pool they wish to access. The specification includes things like the make of car, the body style, engine size, transmission, colour, trim etc. Once the details have been inputted a list of all vehicles that match these details. They are displayed by location. The higher north the dealership is that the vehicles belong to, the higher up the list the vehicle will be.

The system will display all unsold/un-contracted units (stock, pipeline or VHC). This means that as long as a vehicle is in stock and is not contracted to a customer then any other dealer can view the vehicle through the ordering system and potentially request transfer. If a vehicle is contracted to a customer it will not be accessible in the system to any other dealers.

If no cars are found then the dealer would need to go into Pool 8 and order a new car themselves. In this case the car would take about 15 or 16 weeks.

Call-Offs/ Snatches: Once vehicles have been located, the system can be used for:
- calling off orders for cars that have been sold or contracted to customers.
- snatching unsold ordered cars
- changing specifications of existing orders.

The system is much more flexible and these activities can now more easily and effectively be done. Before when a car was ordered, the specification was written in stone once the order had been made. Now however the dealer can make changes to the order as it progresses. They can check the system to see which pool the order has reached and request changes. If an order is in Pool 8, full amendments can be made. If an order is in Pool 7, amendments can be made to the colour or trim.

Dealers can also snatch other dealer's unsold orders without contacting the dealer. Any vehicles that are lost to a dealer as a result of another dealer snatching show up immediately on the ordering main menu.

Delivery: There is a system for monitoring the delivery of cars. Using this system, vehicles are tagged and any time the organisation can find out exactly where their vehicles are. However this is not directly linked to the ordering system and is not accessible to dealers.

Payment: Again there is a different system set for automatically transferring monies. Payments are automatically taken out of dealers accounts for cars and money repaid where necessary. The system is highly transparent.

Damaged Goods: The dealer will get a report over the web of non-delivered damaged vehicles. If it is actually delivered to the dealer damaged then they will assess it for damage and report back. Likewise they will notify headquarters using the web.

All letters and reports that are sent out by the organisation are posted over the web now e.g. credit/debit reports or non-delivered vehicles.

Other Facilities:
There are a number of other facilities that are available on the ordering system including an Age Analysis feature. There are strict guidelines regarding the average age of vehicles held in stock. Using this, dealers can more effectively manage the age profile of their stock units. They can click on an age analysis hyper-link to show a breakdown of the dealer's stock units (delivered units) into a series of date ranges. These can be displayed by dealer order number or by days since delivery.

The system also has the facilities to identify any Ghost vehicles. These are vehicles that are shown on the system as a stock unit, but the dealer denies that the vehicle is still available. This could be for a range of reasons. For example, the vehicles could be assumed delivered but they were in fact scrapped or stolen or the vehicle was returned as a sub-standard vehicle.

There are also a number of miscellaneous functions like being able to display important broadcast messages. For example a broadcast message could be about improvements that have been made to status reporting.

- **Who can access the web-based ordering system?**

Internally, management teams and marketing, sales and production personnel can access the system. There are different levels of users set up for the ordering system within the organisation. Basically, the type of user that you are set up as will depend on your role within the organisation and the facilities that you need to use.
Exclusive dealers would have access to most of the ordering system. Some dealers are not completely exclusive to the organisation. They sell cars for other manufacturers as well and would have access to a more limited ordering system.

EVALUATION – FOCAL ORGANISATION

- **What are the benefits of using the internet-related technologies for the order fulfilment process?**

  – Quicker communication and better retention, dissemination and sharing of corporate knowledge.

  – Improved efficiency.

  – Inventory has been reduced by over 60% in the last 5 years in the UK.

  – As the stock has been reduced, there is less compound space and a reduced number of plants required and therefore there is less damage and costs for storage and security.

  – Individual dealers are also reducing their stock from something like 1000 units to 300 units but they still have to ensure that they have enough stock for the following six weeks (Optimal capacity is dependent on the sales rate etc).

  – The age profile of dealer's stock has been reduced (By removing ghost vehicles and identifying vehicles that are ageing from 30 days in stock). This reduces the risk of obsolescence and the need to take drastic action in order to get rid of stock.

  – Reduces the need to take drastic action to get rid of stock and therefore resources can be targeted elsewhere.

  – Improved functionality and flexibility.

- VDM opens up the virtual stock by permitting you to tap into other Dealers UNSOLD orders to 'contract and capture' or 'amend, contract and capture' a suitable order without contacting the owning dealer.

- More chance of delivering the right vehicle at the right time to the right customers. Customer requirements can be better met.

- By providing summarised information and graphs over the intranet, it saves employees time. Before they wasted time churning through bits of paper trying to collate and analyse figures.

- When a car is sold to the customer the salesman sells up starting with the basic price and adding extras onto the price. The customer can build the car they want on the computer. Customer choice has increased dramatically.

- **What are the downsides of using internet-related technologies for the order fulfilment process?**

  - If the system goes down then they don't have access to any information. This leads to major problems.

EVALUATION - DEALER

- **For those employees involved in the process, in what ways has the nature of their work changed with the introduction of Internet-based ordering system?**

  Basically, the same tasks are still undertaken in the ordering process that were undertaken before but many of these tasks that were previously done manually can now be done on-line.
  Employee's work can be done much more quickly, efficiently and accurately. Response times have greatly improved.

- **What would you consider to be the main benefits and downsides of the Internet-based ordering system?**

  The main benefits are the availability of information and as indicated the system has improved speed, efficiency and accuracy.
  The only problem is that all the ordering information is stored on the system so dealers have become very dependent on the system for information. If there is a fault with the system e.g. the Server is down, then this causes problems for the dealers. Also sometimes the system can run very slow. Again this can be very frustrating, if for example, the dealer is trying to check for the availability of a car for a customer.

- **When carrying out tasks related to the ordering process, do you consider that daily communication has changed in terms of:**

  the methods used to communicate (face to face, e-mail, video-conferencing etc.)
  A vast amount of information is available via the Internet/Intranet and it is widely used for distributing information and sending e-mails.
  The phone is used less now for matters regarding the ordering process but it is still used for many other things.
  Less and less faxes are required.
  No video conferencing is used by the dealers.

  the content of the information

As the Internet system is so easy to use, much more information is distributed electronically. For example, things like the advertising template of pictures can now be electronically distributed and marketing newsletters. Also information can be gathered and manipulated from the system that was not available.
The e-mail system has been set up with filters so that dealers rarely, receive information that is invaluable to them. Within the dealers, it has been set up so that when an employee receives an e-mail, the sender will be sent a receipt letting them know this.

the level of detail of the information
Much more in-depth information is available and information can be more easily manipulated. For example, chassis listings can be generated using spreadsheets and e-mails. Facilities are then available in the spreadsheet package that enables dealers to filter out chassis that they are specifically interested in. Facilities like this have been simplified and automated for dealer use.

how often information is distributed
It is so easy to communicate now that communication takes place much more regularly.

the accuracy and level of currency of the information you send and receive
Information communicated is more up-to-date and timely. If a new program was to be launched, for example, details of the program would now just be sent out to all relevant people via an e-mail. Before, it often took several days for information on new programs to filter through.

The only thing is that parts of the ordering system shut down between 8pm and 8am. This is occasionally a problem if dealers are working late and trying to process orders etc.

- **Using the Internet, do you feel as if dealers can pass on and receive more relevant information or do you feel as if technology has contributed to dealers losing out on information (perhaps through there being less face to face interaction)?**

The ordering system definitely enables dealers to pass on and receive more relevant information. They are able to communicate more frequently and easily. However the Internet has definitely has led to less face to face interaction. For example, a couple of years ago, a manager would have visited certain dealers twice a month. Now, however, they probably visit about every 2 or 3 months. This does restrict the information being passed on that would have been traditionally been passed on by 'word of mouth'. In passing the manager may have said, "By the way that's a good offer" or ""Did you see that note about….." or they may have discussed the way in which they might display certain vehicles. For certain tasks and bits of information it would still be useful to have this face to face interaction.

- **Are there any aspects of the order fulfilment process that you think could still be improved?**

  - There are only 10 days of the month that new orders can be entered into the system. The rest of the time you can only amend or snatch orders. The rational behind this is that really with the new snatching system etc, dealers should not need to put in new orders out with these periods. Occasionally dealers do and it would be useful if the periods that they could do this were extended.

  - It would also be useful if dealers could make amendments to orders up to a later date and the system was even more flexible. However, there are constraints from a JIT perspective and this is reflected in the ordering system.

  - Order tracking could be improved. At the moment you often have to make a judgement call on how long you reckon a particular order may take. It would be useful if the system gave accurate information on the average lead time of a product, any possible delays etc. At the moment if there was a supply constraint on say fog lights, it is unlikely that this information would filter through to the dealers and it may only be once they start phoning up regarding an order that they would find this out. Ideally, alerts or bulletins should be passed over the system informing dealers of likely problems.

DEALER BUSINESS PLANNING

- **Who is involved in Dealer Business Planning?**

  Organisation's Management team
  Organisation's Brand (marketing) teams
  Dealer Principle General Manager
  Dealer Sales Planning Manager

- **Where are all the people involved in Dealer Business Planning located?**

  Members of the management team and brand teams are based at different locations in the UK. Dealer Principle General Managers and Dealer Sales Planning Managers are based at individual dealer branches.

- **How often does the Dealer Business planning take place?**

  Monthly

- **What information do they use to plan?**

  In order to plan ahead they use information on marketing programmes and offers planned, historical sales, customer buying trends, opportunities and product life cycles.

- **What information do they produce as a result of the planning process?**

  How many of each car should be ordered for each dealer.

- **How often do they meet face to face and to do what?**

  The Management team and Brand (marketing) teams would certainly meet face to face once a month. Depending on the relationship with individual dealers, the Sales Planning Manager and the Dealer Principle General Manager may attend.

- **What other modes of communication do they use, how often and what for?**

  Every week they will be monitoring the sales to date. They would be continually communicating and discussing issues using e-mail, telephone and video conferencing.

Appendix VII: Case Study F

TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are on the organisation's corporate site available externally on the Internet?**

The corporate site includes information about the organisation including its role, vision, markets they are in, types of customers they deal with, career opportunities (e.g. current vacancies, industrial placements), education material, media, information for investors (e.g. company profile, reports, announcements, key financial data, presentations, shareholders services), environment and government affairs (e.g. regulation), health and safety and contact names and numbers.

- **What information and facilities are available on the organisation's intranet?**

The intranet has a Corporate Home page, Location/Site Home pages, Business Function Home pages as specified by the business and a standard menu system.

The sorts of information and facilities that are included are as follows:

- Reports e.g. Annual Report
- Telephone book
- Human Resource facilities e.g. code of conduct, staff welfare
- Information for graduates
- Safety Guidelines
- Procurement facilities including a catalogue of products which employees can order from and a list of supplier telephone numbers.
- Energy Review
- Communications e.g. PR, company results, news stories archive, media briefs, investor relations, people on the move, the big picture.
- Work Management Processes – This is a system that links every business unit in the business together. It is like an ERP system.
- Shared Services e.g. Administrative support, Human Resources
- Operational Experience e.g. Employees in an Engineering site in the UK may share experiences with someone in another country
- Engineering
- Business Improvement
- Information Management Department
- Site interface

Lots of general information is posted on the intranet like job vacancies, travel information, plant performance, staff discounts etc
There are also departmental web-sites.

e.g. Engineering Web Site

Engineering Home Page
Plant modification System
Station Information
Quality Assurance
Project Information
Safety Review
Local Business Plan

e.g. IMD (Information Management Department) Web Site

Information Security
IM Quality System
IMD Service Management
Regular IM Outage Slots
Approved Equipment
BCS Professional
Development Scheme
Strategy & Architecture Homepage
IMD Newsletter
Strategy & Architecture Workshop 2002
Application Support

- **What other tools and technologies are available on the intranet?**

  There are a number of tools and technologies available on the intranet including video conferencing and bulletin boards.
  Teams that exist within the organisation and with other organisations would set up web pages as well. These include information about the each team including information the team's vision, mission, remit, the profiles of team members, roles and responsibilities, project planning information and group work program. Team members also have shared spaces on the intranet that only they are able to access. This would include information on the progress of the project, meetings, drawings, electronic task files and links to necessary databases and applications. These are restricted to team members.

  The intranet has been used as a tool to standardise systems /processes across the business units to ensure benchmarking and replication of best practices.

- **Who has access to the intranet?**

  All employees can access the intranet.
  Some areas of it are restricted e.g. Engineering may be restricted from non-engineering specialists.

- **What information and facilities are available to external organisations?**

  Large industrial and commercial customers only have access to the corporate site available on the internet. The organisation cannot provide them with any further information or facilities due to Commercial and Intellectual Property Right (IPR) considerations.

SUPPLY CHAIN PROCESSES (ENGINEERING FUNCTION)

- **What are the main supply chain processes that the Engineering function is involved in?**

  Provision of all materials goods and services to support the company's operational plant and associated activities.

- **In order for the processes to function, what activities need to be undertaken and information needs to be communicated?**

  Provision of materials goods and services
  The various steps are:

- Specification of Requirements (Completed by a Suitably Qualified and Experienced person with appropriate design authority)
- Budget approval/authorisation
- Tendering Process (review of approved supplier list, invitation to tender, review of tender)
- Raise acquisition
- Place contract
- Contract Management (Budget accruals to match invoicing, etc.)
- Sub processes (Purchase, Receipt, Installation, Commissioning)
- Contract close out

The system to Acquire goods and Services (AGS) covers literally everything that the company purchases from external suppliers (operational plant equipment e.g. pumps, heat exchangers, resin beds, etc. to office supplies to paper fax machines, photocopiers etc.).

It also covers all contracts for external contractor support – so if a contract is placed with a contractor /agency for any project etc – it is placed and managed through AGS.

SQEP stands for a Suitably Qualified and Experienced Person. There is a SQEP register and for an individual to have the required SQEP status they must have obtained the appropriate level of training and have the associated designated authority. Can't approve or raise items in AGS without appropriate SQEP status

- **How has the overall process and individual activities within the process been developed with the introduction of internet-related technologies?**

  - Specification of Requirements: The suitably qualified engineer writes out the specification and then puts it on the document control system on the intranet. All other parties have access at that point.
  - Budget approval/authorisation: This is done electronically on the intranet.
  - Tendering Process: This is linked to the electronic approved supplier list which included previous pieces of work undertaken by the supplier, indicators of previous performance e.g. on-time, kept to budget, quality of work, how contract went etc. Every piece of work has a review at the end and the information gathered from the review is fed back into the supplier list. If a contract goes really badly then there is the facility to remove the supplier from the list.
  - Raise acquisition: This is done electronically on the intranet
  - Place contract: This is done electronically on the intranet
  - Contract Management (Budget accruals to match invoicing, etc.): This is done electronically on the intranet
  - Sub processes (Purchase, Receipt, Installation, Commissioning): This is done electronically on the intranet
  - Contract close out: This is done electronically on the intranet

The Acquire Goods and Services (AGS) process has been developed following the introduction of the company intranet. The system allows each stage of the process, for acquiring goods and services, to be conducted electronically.
This has led to a paperless system – electronic approvals etc.

- **What departments are involved in the process and are there any other organisations involved e.g. suppliers or customers?**

  The supply chain and associated AGS system has nominated organisational leads – Procurement and Contracts being the co-ordinating function. The only external involvement is the participation of suppliers in maintaining status on the approved supplier register.

- **Has the automation of AGS impacted relationships with suppliers of goods and services?**

  It is only the front end of the relationship that has been automised e.g. financial aspects. The day to day management of the contract (technical interface) is still handled face to face by the relevant engineer.
  The level of the contract will determine who is actually involved in interacting with the supplier. Most contracts are left to the responsible engineer. However, high spend contracts and big projects have managerial and sometimes director input and negotiation.

- **Is the Acquired Goods and Services system linked to any other systems?**

  Yes, it is linked to the Controlled Documents Management System and the Budget Management system.

- **What other processes/activities are engineering involved in and do they use internet-related technologies for them?**
  - Support for operational sites: Everything to do with the operational sites is done centrally apart from the operation of the site. Central support function has design authority of plants, makes modifications to plants and devises strategies for plants etc. Things like modifications to the plants are done via the Intranet e.g. operating instructions for the plant can be changed using the controlled document management system.
  - Quality Assurance: The intranet is also geared up to deal with Quality assurance issues. For example, the approved suppliers list and the records system that are necessary for these processes are also facilitated by the intranet
  - System Safety Review
  - Specific Projects

- **Is collaboration or team-working required at any stages of the supply chain processes and to what extent is this supported?**

  Team work/collaboration is required throughout the process – within the bounds of designated/lead roles. The AGS Supporting Reference, details all required company interfaces.

- **Are there particular types of supply chain processes/activities that are more suited to team-working?**

  All necessitate team working to some extent – however the co-ordinating functions such as the AGS coordination group are particularly dependant on a local team working approach.

- **Can you give a few examples of teams that have been formed?**

e.g. within one function-
AGS co-ordination team. They meet face to face for meeting etc. but have resources available electronically.

e.g. with more than one function
Operational experience Feedback Team. Each business unit and operational site has a member in this team. They meet face to face quarterly. At other times they communicate using intranet, bulletin boards and video-conferencing and the telephone occasionally.

e.g. with the organisation and other organisation(s)
The company participates in many forums with other organisations including customers and suppliers. Commercially sensitive.

- **Has the intranet made it possible to establish new links externally or internally?**

  No new external links

  Internally, it has facilitated links. For example, the Operational Experience Feedback allows operational sites to very quickly share their operational experiences with other similar operational sites. Operational experience feedback is now far faster. Benchmarking and replication of best practices has been enabled. Also allows quick comparison of the various operational business units individual performance against a variety of criteria.

EVALUATION

- **What are the benefits of implementing and using the Intranet for the supply chain processes?**

  Speed: electronic system has reduced timescales and required internal manpower resource associated with all stages of acquiring goods and services.
  There is internal company document to support this along with estimates of savings resulting from the AGS system.

  Electronic record – audit trail
  Live budget monitoring on placed contracts
  Defined accountabilities for all steps.

- **What are the downsides or problems?**

  Potentially restricts the pool of external suppliers approached by the organisation to tender for new work. The immediate focus is on the companies within the external approved supplier list of AGS. This relies upon a proactive approach from potential new suppliers and SQEP initiating the new task / work item to ensure a fully competitive tendering process.

- **In what ways, has the nature of employee's work changed with the introduction of the Intranet?**

  Employees have access to far greater amount of information than would previously have been the case/ or possible. They can view budgets, progress on reports etc. throughout the company.

  Employees are better informed on company business objectives.
  Better informed on HR and staff welfare issues etc.

  Far less paper work so less time spent on administrative tasks – as a result of streamlining of QA systems, communication between sites, document control etc.
  For example, electronic review, approval and issue of documents. Electronic signatures are sufficient for all aspects of verification and approval. The associated QA management systems and associated procedures have been significantly modified to adapt to intranet requirements.

- **In what way has their daily communication changed in terms of:**

  the methods they use (face to face, e-mail, video-conferencing etc.)
  the content of the communication
  the frequency of the communication
  the timing of the communication

Communication is a high priority within the organisation – with the focus on making best use of all means available.

The organisation recognise clear and simple communications forms a vital part of an effective working environment. Hence the intranet is one of the key communication tools.

However, the organisation always carry out important cascade briefs face to face.
A weekly (min frequency) cascade brief is carried out. This provides information on range of topics. Some examples are:

– State of plant (summary of last 7 days operation for each power station site)
– Safety (any safety issues/incidents in the last week)
– Summary of company media brief (any items in press over previous week)
– Board Exec Team Issues
– Local Issues (such as good housekeeping, budget management, business planning updates etc.)

- **Using the Intranet, do they feel as if they can pass on and receive more relevant information or do they feel as if technology has contributed to them losing out on information (perhaps through there being less face to face interaction)?**

  Staff survey indicates that the technology has facilitated better communications internally and externally – seen universally within the company as being a positive development. Face to face interaction is still considered to be key - electronic communications are perceived as being a component but not dominant part.

- **Are there any other aspects that could be improved by developing the Intranet further?**

  There is a project underway to enhance and re-design the corporate intranet. Every day there are numerous requests for changes/additions to the Intranet. Clearly, a managed approach is required to professionally develop the intranet in a way that maximises return to the company. Several areas have been identified which require to be further developed.

Some of the objectives of the project are to:-

– Develop the Intranet templates to provide a more corporate and user friendly look and feel.
– Implement a Content Management system. This will allow users simple access to manage their own information. It has self managing capabilities and reporting features for gathering metrics. This will lead to up to date, user managed content.
– Incorporate agreed and approved Plug Ins to external information. This will enable information to be gathered from external sources (Web) like share prices, financial information or travel etc.
– Provide easier access to Corporate Information by design simplified web pages.

By meeting these objective the intranet should be able to:-

– **Improve knowledge sharing and best practice**
The organisation recognises that knowledge is one of the organisation's greatest assets and that it is essential that they share the knowledge and experience of their employees more effectively. The developed intranet aims to make knowledge sharing easier by delivering collaborative working tools, a standard navigation structure, the ability to view 'global' and 'local' information side by side, and a unified content management system. They need to help both locations and business functions share information fluidly, creating a 'learning culture' and a true 'fleet' approach.

The architecture of the new system will also make it possible for external content (either purchased or freely provided) to be integrated as required – there are a wide variety of information providers, and online applications which may add value if they were accessible to the

staff. The upgraded system will provide a platform for delivering such third-party content in a secure, robust manner.

– **Find information more easily**
The corporate intranet holds a vast amount of information in a wide variety of formats, ranging from unstructured information in e-mails, through semi-structured Word and Acrobat documents, to highly structured databases. This phase of the intranet project will deliver a solid search facility taking in a lot more of the available information. In addition it will provide an upgrade path to more sophisticated search and profiling tools in the future.

– **Give staff control over their own content while managing the information being added.**
CMS will enable non-technical staff to add content to the intranet system quickly and easily, making sure the information they 'own' is accurate and up-to-date. Moreover, the information that is being added will be managed and controlled. At a 'content' level, the new CMS will offer a basic level of workflow management, meaning that new content can be authorised by the appropriate manager before going live on the system. At the 'data' level, the advanced facilities offered by the new database platform (Oracle 9i) mean that they will be able to store, serve and archive information in a more efficient way. It will also allow the organisation to produce proper audit trails to satisfy regulatory and change management requirements.

– **Making the information relevant**
With such a vast quantity of information available, one of the key challenges is to deliver each staff member the information which is of most use to them. This means content should be placed at the top level which is pertinent to their location, their job function, and their place as part of the global team. By consolidating the information and the technology platforms, the developments aim to increase personalisation of the content.

– **Creating a 'fleet' look and feel**
The business had recognised the value in taking a 'fleet' approach and part of this is having a common set of values and a single identity. The intranet will be used to help to promote the 'fleet' approach by adopting a common 'look and feel' across all areas of the system – wherever the staff member is located and whatever their job function, when they are using the intranet they should feel that they are clearly and visibility in the organisation's brand environment.

– **Stop re-inventing the wheel**
The developments also aim to avoid a lot of resource wastage. Under the current system, a considerable amount of resources is being spent on development work which may actually be duplicating that taking place at another location or in another business function. By pooling the development work into a central system, the aim is to make the entire process more efficient and hence cost-effective.

– **Foundation for the future**
Looking at further possible self-service applications. Applications in HR are especially powerful but a wide range of other possibilities are under investigation including Procurement, Finance, IM and Facilities applications.

Appendix VIII: Case Study G

TECHNOLOGICAL INFRASTRUCTURE

- **What information and facilities are on the organisation's corporate site available externally on the Internet?**

  The corporate site includes general information about the organisation including their vision, mission statement, history, locations, news and events, employment, community investment, investor relations (e.g. annual reports, stock information), research, environmental concerns and sponsorship. There is also information about their products and services including catalogues, downloads, technical support, documentation, special offers and case studies. This is backed up by support and training e.g. online resources and tools, forums, course catalogues. Products and services can be purchased online and there are contact details available for members of the sales team.

- **What information and facilities are available on the organisation's intranet?**

  The information and facilities on the intranet is organised into three main categories: News, Life and Work.

  Some of the information and facilities available within these categories are as follows:

  - Diaries
  - E-mails
  - Reports (e.g. a breakdown of all the phone calls made by individual employees in the department illustrating internal office calls, external office calls, mobile calls)
  - File functions
  - Print functions
  - Organisational Policies
  - HR Performance Review
  - Individual staff reviews
  - Stock Prices and also advice on what they should do. This adds value to the information.
  - Organisational Strategy
  - Organisational Structure
  - Access to organisation's radio through the Net e.g. announcements
  - Business Information
  - Industry News (There is a link to the Internet to get relevant news)
  - Employee Benefits and Services
  - Pay/Salary Ranges
  - Learning
  - Careers Services
  - Name Finder
  - Staff List
  - Security Alerts
  - Travel Information (e.g. places to avoid at the current time)
  - Marketing Information
  - Quality Tools

Everything on the intranet is set up not only to provide a list (like a manual system) but with added value. For example, if you find an employee's name you can then click on it to automatically send them an e-mail.

There are a variety of tools and applications are available as well. Some desktop applications are:

- Netscape Messenger (All employees are being encouraged to use this)

- Logo Website (Organisation's Logo is available on this)
- Database and Decision Support Tools
- Productivity Tools
- Capital Asset Management System
- Schedule Building Application

Each function has its own website as well:

Example: Manufacturing Engineering

The Manufacturing Engineering's website provides information on the following:

- Who's Who (includes a picture of everyone which is even more important now with employees hot desking)
- What's New
- Products
- Projects (A list of all the projects the dept is currently running with a list of associated costs, return on investment)
- Documents
- Tools
- Process Times
- Other Links
- Layout Drawings (Drawings relevant to projects are stored here. Could be viewed as an acrobat file on Drawing Office)
- Layout Projects
- Metrics (e.g. Performance metrics provides a list of all corrective actions that need to be taken with regards to products. Every action would be given a tracker number)

From the functional site you can also load up various tools.

Example: Heatmap

This is a new tool that is useful for reporting product failures. In the past, product failures were reported using spreadsheets. It could mean that managers had to search through 1600 of rows of data to find. There are different colours on the product grid indicating the level of product failure, with a particular product. Green indicates good reports while red indicates there have been particularly bad problems with a product. Red areas need to be analysed in more detail. Managers can zoom in on the red areas. Failure can be analysed in terms of product codes, product names, areas, who owns it or where the issue lies. There is a search engine available for users to look at particular areas in detail and managers can use this tool to locate the details behind issues very quickly.

- **Who has access to the intranet?**

All employees can access the intranet. Most information is available to all staff. The organisation operates an open policy. Although in order to comply with data protection laws, some information does need to remain confidential.

All employees are supplied with a card which is a digital id. The card can be plugged in and operated on any machine that has an OS and a Browser. This gives them access to the information and facilities that they need. This includes everything on the Intranet, all their files, e-mail etc. They access an employee portal which can be tailored to meet their needs.

- **What other tools and technologies are available on the intranet?**

There are various tools and technologies available for supporting collaboration.

For example, every team has a team portal page on the intranet. The team portal page contains information such as the team's vision, mission, purpose, strategy, members, structure, contact numbers, responsibilities, goals and tasks, costs, return on investment and risk assessment. They also provide details of meetings, agendas, working session notes, earlier session notes and pointers to related information. Project schedules are available, process flows, work progressed, estimated timelines and assumptions and there would be links to any relevant drawings, files, databases and other necessary organisational resources. The portals would be most detailed for the most important projects and there would be different rights to the portal depending on the employee's involvement in the project. Even if the team are based closely together they find the intranet easier for readily accessing team information and pulling up necessary documents or resources when the team meets.

People can also collaborate using video conferencing (using phone line/ conference phone /presentation /audio). By the end of the year, teams will be using web meeting (through PC rather than phone line). It has the same capabilities as video conferencing e.g. make live changes to presentations, but the lines are different and as a result cheaper.

- **What information and facilities are available to external organisations?**

Portals are provided for suppliers, customers and logistic providers. The portals enable the most effective deployment of content and web services through a single interface with appropriate security and access management. Using the organisation's infrastructure, a portal provides the ability to integrate specific content the ability to deliver it to targeted users, the ability to customise content aggregation, the ability to allow users to personalise their view, facilities for authentication and authorisation and administration facilities (for managing customisation, logs, usage etc.)

<u>Example: Supplier Portal</u>
Preferred suppliers are given access to the supplier portal. Operating expenses are reduced by providing web-based content and services on the portal as it makes it easier for suppliers to do business with them.

Different suppliers will be granted different levels of access. Key suppliers will be granted greater authority and may get access to things like the organisation's supplier web i.e. the prices that the organisation has negotiated with other suppliers for components. Suppliers may want to tap into this information.

Suppliers will also get different levels of access to the organisation's applications. These are amongst the most important things available on the supplier portal. There are potentially sixteen applications available. For example, Application A is for Execution Planning, Application B is for Merge in Transit, Application C is for Demand Replenishment, Application D is for Performance Management etc. The supplier's portal can be customised with these applications depending on their level of authority. For example, Supplier 1 may be able to customise applications A to E while Supplier 2 may able to customise applications A to F.

The applications provide key business information. For example, the Supplier Portal Application gives them access to the organisation's forecasts so they can determine when they will need to supply them with components. 30 day forecasts, 60 day forecasts and 90 day forecasts are available.

Other things on the portal include personal information, bookmarks, upcoming events, suppliers of interest, links to education and trade magazines.

"They like to give as much information as possible to suppliers as they often know how to save the organisation money"

Example: Customer Portal
Preferred customers have access to a portal as well. The portal can be used for various activities. Customers can obtain support information e.g. if a customer has an issue with a product they could get information about the product on the portal.

The organisation can use the portal to manage equipment on customer's sites. They can also use it to monitor the customer's usage of the product e.g. they can monitor exactly what the customers use their products for and recommend new equipment when it becomes available. The organisations can actually sort out problems with customer equipment before the customer even knows that there is a problem.

Specific customers can view shipment contents online.

Example: Logistic Provider Portal
Information and applications are provided to logistic providers with a degree of sensitivity. Certainly the organisation's main logistic providers would be provided with enough information to 'Merge in Transit' i.e. Pull together a five line order and deliver it in one go to the customer.

The supplier, customer and logistic providers' portals track the amount of users, number of visits, applications used, level of authorisation etc.

MATERIALS DEPARTMENT

- **Background**

The organisation faces many challenges in terms of supply chain management including shortening lead times and time to market, improving quality and responsiveness, speeding customer time-to-deployment, reducing costs and inventory exposures and providing better information and visibility. The Materials department plays a critical role in supply chain management. It is responsible for the acquisition of materials for manufacturing, from suppliers. Procurement spend is approximately 50% of revenue. To try and meet the challenges surrounding supply chain management, the organisation spent around $2.5 million and 16 months to introduce a web-based supply chain solution which syncs real-time customer orders with material acquisitions from more than 80 suppliers.

- **What are the main supply chain processes and activities that the Materials department are involved in?**

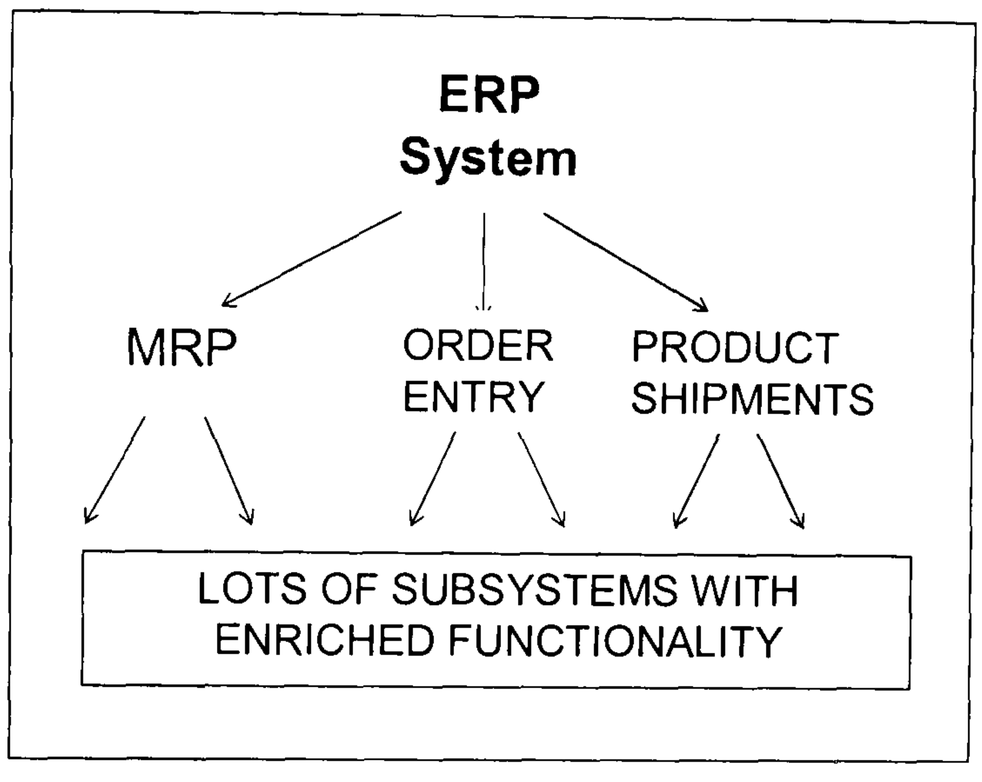
The Materials Department are involved in the following processes.

Business Forecasting
Monitoring Customer Demand
Providing Cost Information
Material Requirements Planning
Material Replenishment
Tracking production of products
Order Fulfilment

- **How have the supply chain processes been developed with the introduction of internet-related technologies?**

Originally, the organisation focused on using Internet-related technologies for internal enterprise applications. The focus progressed to establishing point solutions with suppliers, customers and logistic providers. Most recently, it has progressed further by establishing direct two-way communication links between all of these stakeholders providing an end to end solution. The organisation is now in a position that is has developed a supply chain system, based on a common web-based platform which is aimed at automating and integrating all major supply chain processes and major suppliers, customers and logistic providers. It was designed in 98/99 and implemented in 2001.

The supply chain system uses a range of technologies including, for example, XML (for purchase order messaging), Portal Server (for managing security) and Oracle (the basis of the ERP system). The ERP system is at the core of the supply chain system and it is linked to a number of sub-systems which have enriched functionality. All systems are fully integrated.



Supply chain processes such as Material Requirements Planning can be vastly improved. It is much more accurate and responsive to forecast changes. The planning cycle can be reduced from 3 weeks to 1 week.

Material Replenishment can now automatically work to order. As the sales are entered as orders the materials can be automatically replenishing that are required for the orders.

- **What other departments are involved in these supply chain process and which other organisations e.g. suppliers or customers?**

Suppliers

The organisation purchases materials from a range of suppliers. Probably though, the top 40 suppliers on their list actually accounts for about 95% of those supplies. For the key components supplies, they aim to work with a few, select suppliers, developing long-term relationships and using the technology to strengthen these relationships. They aim to develop close, rewarding relationships with key suppliers. Supplier links are normally set up for 2-3 years. There are high switching costs so they try and not switch. They generally have different suppliers they deal with for different market segments. For the suppliers they purchase materials from, they source suppliers using a Joint Design Model, draw up an improved vendor list and then periodically benchmark new suppliers.

Key suppliers have access to a supplier portal. The supplier portal is a secure web-based business communications channel that connects the organisation and its suppliers. Via the portal, suppliers have access to critical real-time information, data and applications for planning, fulfilment, execution and demand replenishment. Suppliers have real-time visibility of customer orders and these orders trigger automatic purchase orders for necessary materials.

Supply chain inventory is reduced as suppliers can make decisions based on knowledge of actual customer demand. The system reduces inventory for the organisation and suppliers and reduces the reliance on warehouses.

External Manufacturers
They deal with external manufacturers for the purpose of designing products collaboratively.

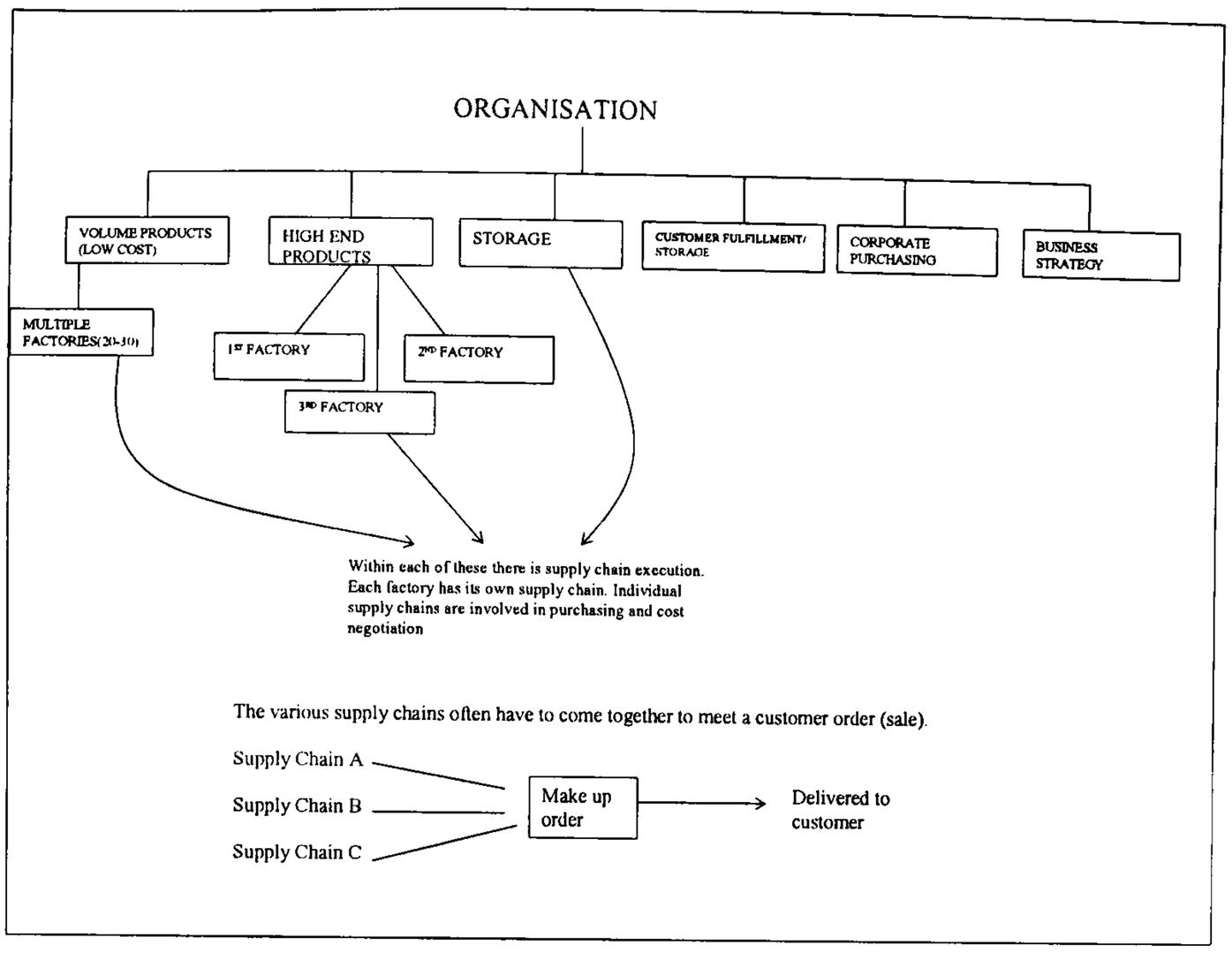
Corporate Purchasing
This function is responsible for purchasing certain commodities. They need to develop and maintain relationships with suppliers and they will try and influence things like product design. Also a key procurement strategy that the function is involved in at the moment is dynamic bidding (especially in the US). This is an important method to reduce cost. For example if the company needed disk drive space, suppliers would be informed that a bid was taking place, the auction would open for only 10 minutes and suppliers would make their bids. It means that suppliers need to make split second decisions. The majority of this takes place in the US.

Local Purchasing
Purchasing also takes place within individual factories. Overall, the organisation finds that face to face communication is important for interacting and developing relationships with key suppliers. You can invest and invest in technology but face to face interaction is till vital. Key decisions regarding the different suppliers that they will use and the negotiations that take place are still made by executives and management team. They will get together from the different companies.

They operate a scorecard system to measure supplier performance. The suppliers are scored on cost, quality, availability, strategic capability and technical capability. If they score 85 or above, they are marked green, if they score 70-85, they are marked yellow etc. If they ever go below a certain amount, then they would terminate their business. Sometimes the score of suppliers is very similar. In that case, often the experience of working with a supplier, relationship or generally the way they do business will make the final decision.

Customers
The organisation has a range of customers that place orders with them and are obviously involved in order fulfilment.

Logistic Companies
The organisation deals with 3rd party logistic providers for transporting orders to the customers. They have access to some of the organisation's facilities e.g. scheduling orders, distribution. Even if a customer has ordered a number of different products, they want it all to arrive in one box. Not in bits and pieces. Therefore, the organisation is trying to move towards integrating the order in the factories rather than in distribution.



- **Is collaboration or teamwork required in any of the supply chain processes and to what extent is this supported?**

Very much so.

They are involved in collaboration at a number of stages including:

- The design of products
- Planning to forecast (18 months): What will we sell? Planning is undertaken globally in California by a team of people. They use a number of qualitative inputs to help them plan their forecasts including rolled up sales forecasts and product business teams (sales, marketing & design). Supply plans are drawn up which authorise purchasing to go ahead (MRP and Material replenishment).
- Negotiating supplies of products from suppliers
- Working with suppliers to meet customer orders

EVALUATION – MATERIALS DEPARTMENT

- **What are the benefits of implementing and using internet-related technologies for these processes?**

Benefits:

Maintain profit margins and significant cost savings
Reduced customer lead times
Improve quality and responsiveness
Better inventory planning and reduced excess and obsolete materials
Provide better information and visibility
Share information in common format (particularly between companies)
Speed of decision making and transactions

- **What are the downsides of implementing and using internet-related technologies for these processes?**

Drawbacks:

Complexity can be a problem. For example, the replenishment of materials is automated but sometimes they are looking for flexibility in none-standard scenarios.
People not talking to each other.

- **For those employees involved in the process, in what ways has the nature of their work changed with the introduction of internet-related technologies?**

  Eliminated a lot of manual repetition (no real value)
  e.g. manually releasing order to shop floor.

  Employees can concentrate on exception reporting
  e.g. maintaining and adjusting parameters in systems
  e.g. check for trip wires

- **In what way has their daily communication changed in terms of:**

  the methods they use (face to face, e-mail, video-conferencing etc.)

  It is easier to access information using the intranet.

  Face to face communication is still vital.

  E-mails are heavily used. This can be a problem though (75 out of 150 are not important at all). Many people send attachments with spreadsheets for example instead of just highlighting the key points in the e-mail. They should think about who they are sending it to. Developments in the intranet system have cut down e-mail though as there are tools on the common environment that automatically transfer intelligent information to the relevant people. This means that they no longer need to send as many e-mails to get a lot of the information. The company operate a 'publish and subscribe system' (once information is published, people subscribe to see the information).

  Telephone usage is down.
  Fax is almost obsolete.
  Video conferencing is used for global meetings etc.

  the content of the communication
  The content of the communication is much better. You can access information in more easier, flexible and different formats.

  the frequency of the communication
  Speed is not a problem at all.

  the timing of the communication
  On-line up-to-date communication.

- **Using the intranet, do they feel as if they can pass on and receive more relevant information or do they feel as if technology has contributed to them losing out on information (perhaps through there being less face to face interaction)?**

  Employees mainly find the intranet beneficial. Much more relevant information is available.
  Although there are still times when they feel as if they loose out on information. When something is automated you can feel out of control. Any changes that are made to the system are much more subtle and IT support must be more sophisticated.
  Fewer people know the answer (personalised information). Can be a problem if people move on and the organisation looses its knowledge base.

- **Which method of communication is favoured with customers and suppliers?**

  Face to face/ Electronic?
  Culture is a factor e.g. Japanese companies often respond better to face to face communication. Often though, it depends on whether it is a customer or a supplier. The organisation is more likely to go to the lengths of face to face communication with customers.

- **Are there any other aspects of the process that could be improved by developing the Intranet further?**

  Make sure you learn something before you move onto the next system.
  Take an evolved approach.
  It has been essential to incrementally introduce the system into the organisation. Often the technology is available but people would resist the system if it was implemented overnight.

TESTING PROCESS

- **In order for the testing process to function, what activities need to be undertaken and information needs to be communicated?**

- **How has the overall process and individual activities within the process been developed with the introduction of Internet-related technology?**

In order to present an insight into the two questions above, the Testing Engineering Manager provided a demonstration of the Engineering section of the intranet, primarily concentrating on testing. He focused on the information, tools and applications, available through the Engineering Function web page.

General Information
Who the managers are, engineers etc
Infrastructure information e.g. backup
Documentation e.g. projects

There are quick links to many web-based tools and applications:

Livelink:
This is a project management tool that includes project schedules, reports, documents etc. Everyone that is involved in a project can update it. For example when they complete their task, they can update the schedule.
Many projects are cross-departmental.

Service Desk:
This is a facility that is used by Engineering, IT, manufacturing and Testing. It is used for reporting problems on product lines. If a problem arises, a ticket is raised electronically. The ticket is placed in a queue on the service desk system depending on its importance. There is 100% traceability on the tickets. At any time, you can find out what the problem is, who logged the problem and who has done what with the problem. The tickets can be transferred between departments, as required. Therefore, if a ticket has been sent to Engineering but it is actually an IT problem, then it would be transferred electronically.
The Testing Manager showed the system working. There were currently 3 problems on the shop floor.

Test Platform:

The web is used to drive all the testing of the products manufactured on the lines. For example, when a motherboard is slotted into a computer it is connected up to a computer for testing. Testing is conducted at every stage.
They operate a flexible manufacturing system on the shop floor. The shop floor is made up of many manufacturing cells. Each cell is made up of a number of manufacturing lines.
The manufacturing cells are very flexible. Any cell can be adjusted to test any product.
There is an assembly area, test area and a pack out area which are managed by computers.

Monitoring Tool

This tool is used to monitor what is getting tested on each cell.
UK employees have the capability to monitor UK cells and US cells and vice versa. This can be useful for comparisons. If there are problems with a product on a UK line, you would expect the same problem on a US line.
Information is available 24 hours a day. This means that if you know that a test will finish at a set time, then you could log on from home when the testing was due to finish and check that there have been no problems.
Problems can be diagnosed on-line and fixed on-line.

Solve

This tool is available for more technical and design-related engineers. It is used for resolving technical issues.

Test Supervision System (TSS)

This is useful for a manager's perspective (production supervisor). It provides an overview of the whole shop floor. It highlights things that are failing, bays not getting used etc.

Build master

Data Repository of the whole shop floor. This shows you the zone status of everything.

Change Management System

Any changes that are required in the shop floor are submitted via this application.
This could be in terms of design, validation or release. This system is linked to Buildmaster.

CAMS

Order equipment

Metrics

This provides the yield Metrics of each product and each process
Utilisation Metrics
Service Desk Metrics e.g. Downtime, fail reasons, corrective action, whether or not it was infrastructure-related or product-related.

Other information included:

Software: Test Architecture
Change control
Test Processes
Documentation specific to site engineering

All manufacturing instructions are on-line e.g. in the past people on the shop floor looked up instructions manually. Now all instructions are available on-line.

EVALUATION – TESTING PROCESS

- **What are the benefits and downsides of using internet-related technologies for this process?**

  Benefits

Automation: reduces amount of human error, training and support. Substantial cost savings.
Interface/Ergonomics: Very easy to use

Potential Drawbacks

Security: By making information available on the web, security is likely to be a greater risk. Although, there are obviously firewalls.
If the Web server goes down it is problematic although there is backup.

- **Using internet-related technologies, do they feel as if they can pass on and receive more relevant information or do they feel as if technology has contributed to them losing out on information (perhaps through there being less face to face interaction)?**

  Information has only really been gained. Not lost.

- **Are there any other aspects of the process that could be improved by developing the Intranet further?**

  Future Developments/Problems to Overcome:
  A few potential developments were mentioned:

  – Give visual picture of server performance e.g. yield, number of service desk tickets, utilisation
  – There are hundreds of reasons that a product can go wrong. It would be useful to have a web-based tool with process flows to guide people to the route of a problem.
  – A main issue is gathering relevant information for decision making. At the moment there is potential overload of information. Information appears in many different formats. There are lots of ways in reaching a decision or building a data argument. All too late, people often realise that they are actually talking about the same thing but they have maybe gone about it differently. Before, the focus for engineers was developing tools to get the information. Now all the necessary applications are available now, and the focus is on interpreting data correctly. It is all about knowing what query to ask or what report to run. They are looking to resolve things before they have become an issue (proactive) rather than after they are an issue (reactive).