

DOCTORAL THESIS



Information management for viable organisations

Gary Preece

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Doctor of Philosophy

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Thesis Summary

Information Management for Viable Organisations

The recent global ‘credit crunch’ has brought sharply into focus the need for better understanding of what it takes for organisations to survive. This research seeks to help organisations maintain their ‘viability’ – the ability to maintain a separate existence and survive on their own. Whilst there are a multitude of factors that contribute to organisational viability, information can be viewed as the lifeblood of organisations. This research increases our understanding of how organisations can manage information effectively to help maintain their viability.

The viable systems model (VSM) is an established modelling technique that enables the detailed analysis of organisational activity to examine how the structure and functions performed in an organisation contribute to its ‘viability’. The VSM has been widely applied, in small/large companies, industries and governments. However, whilst the VSM concentrates on the structure and functions necessary for an organisation to be viable, it pays much less attention to information deployment in organisations. Indeed, the VSM is criticised in the literature for being unable to provide much help with detailed information and communication structures and new theories are called for to explore the way people interact and what information they need in the VSM.

This research analyses qualitative data collected from four case studies to contribute to our understanding of the role that information plays in organisational viability, making three key contributions to the academic literature. In the information management literature, this research provides new insight into the roles that specific information plays in organisations. In the systems thinking literature, this research extends our understanding of the VSM and builds on its powerful diagnostic capability to provide further criteria to aid in the diagnosis of viable organisations. In the information systems literature, this research develops a framework that can be used to help organisations design more effective information systems.

Keywords: systems thinking, viable systems model, information management

Gary Roger Preece
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Dedication

Ronald Eric Preece
26th December 1915 – 12th October 2009
Rest In Peace

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Chapter 1

Introduction

1.1 Research Background

The significance that is placed on the role of communication and information in the present day has never been so high. The media and social commentators regularly point out that we are undergoing a ‘Digital Revolution’, are living in the ‘Information Age’ and are part of the ‘Knowledge Economy’. Whilst little consensus appears to surround such concepts (Lloyd and Payne 2003), the terms are founded upon the belief that we have entered a new period in history where information and communications are predicted to “*become the dominant forces in defining and shaping human actions, interactions, activities, and institutions*” (Alberts and Papp, 1997, pp. 2). There is no agreed exact date on when this period began, with authors offering a range of start points from the 1950s (Corbett, 2007) through to looser definitions, such as the “*concluding years of the twentieth century*” (Alberts and Papp, 1997, pp. 2). However, whenever it began, it is difficult to now ignore the impact that the spread of computer networks and information technology has had in much of the world. The internet has revolutionised the way people access information, enabling people to access information more quickly and conveniently than ever before in our history. As Corbett (2007, pp. 9) speculates “*when history is finally written, it will show that the computer has had the most wide-reaching and dramatic effect on man of any innovation or technology ever devised*”.

Having entered this period of information revolution, one of the implications cited by Stewart (1997) has been to transfer significant economic value away from the natural resources and physical labour of the old industrial age, to where substantial sources of economic wealth are now generated by information and communication. This shift appears to have begun in the United States of America in the 10 years that followed World War II (1939-1945). Papp, Alberts and Tuyahov. (1997) suggest that, during this time, the economy of America progressively moved from an industrial based economy to a service based economy. These authors state that, by the 1960s in America, the number of workers employed by the service industry was higher than the number employed in the old

industrial based work. During this time, information became a commodity in its own right and the distribution of it became a major factor in driving the economy in the United States of America (Papp et al., 1997). The trend of moving from an industrial based economy to a service based economy can now be seen across the globe, with ONS (2008) figures showing that around 74% of United Kingdom Gross Domestic Product (GDP) is now accounted for by the service industry.

It is this economic shift to placing a heavy importance upon information and communication that provided the initial impetus for this research. Having studied computer science at college and at university (Undergraduate level), the researcher has always had a keen focus on the way that technology is used to support the information requirements of users. In numerous coursework projects during this period of study, the researcher was set the task of developing database solutions to manage information. Of course, developing databases for hypothetical scenarios according to a coursework brief can not begin to replicate the complexity of real organisational life. However, the common theme amongst this teaching during this period was the underlying assumption that the computer provided the means to manage the information required. This gave the researcher a very technological perspective initially to information management.

This technological perspective remained until undertaking a dissertation for a Masters degree in operational research and management studies. The dissertation topic was chosen as it built upon the researcher's computer science background and coupled it with the more business management perspective gained from the teaching of the Masters degree. The dissertation, Preece (2006), explored the barriers and enablers for companies attempting to implement new information management programs across their organisations. It was identified in the literature review of this Masters dissertation that a number of information management program implementations fail to produce the results intended (Massey et al., 2002; Storey and Barnett, 2000). As a result, Preece (2006) aimed to find out why this was the case.

One of the interesting findings from Preece (2006) was that whilst technology was seen as an enormous enabler of information management (Arora, 2002; McCann and Buckner, 2004) there was a much wider range of issues involved in the success of an information management implementation than just information technology. Scarborough and Swan (1999) empirically illustrate this point, finding that many information management

implementations using a technology-driven approach have encountered problems. Further support of this finding comes from Karlsen and Gottschalk (2004) who show that information technology is not sufficient on its own to support information management. Carter and Scarborough (2001) suggest that these problems tend to occur when the social aspects of information management implementation are ignored. Therefore, information management should be seen as both a social and technological issue (Gao et al., 2002; Offsey, 1997; Sena and Shani, 1999). The Preece (2006) findings concurred with this literature and highlighted that a range of social issues from trust to organisational structure are also important to information management in organisations.

One of the more general problems identified in Preece (2006) was that organisations often lack a structured approach to information management. Instead, organisations frequently approach information management in terms of a number of smaller, often unconnected initiatives (Chase, 1997). Maier and Remus (2003) highlight that it is often the case that a small group of enthusiastic employees develop a new information management approach for a small, low risk business process. These authors suggest that once this solution has shown ‘quick wins’ it is more likely to gain acceptance in the organisation and grow incrementally to encompass other business processes throughout the organisation. However, this results in an ad hoc, piecemeal approach to information management in the organisation. This approach can often create problems with organisations struggling to bring together information distributed around different parts of the organisation. This creates what some authors, such as Shankar et al. (2003), call ‘islands’ of information to exist within the organisation. These islands of information are isolated from one another due to information being placed in different, non-unified information systems in the organisation, preventing users from other locations from easily accessing the information held.

The root cause of this piecemeal approach and isolation of information in different parts of organisations appeared to stem from the lack of an organisation-wide strategy for information management. Sunasse and Sewry (2002) and Wiig (1999) highlight the importance of a coherent information management strategy, with Sunasse and Sewry (2002) further suggesting that this needs to be aligned with the business strategy. This is further supported by McCann and Buckner (2004) who recommend that the information management requirements are linked to organisational goals. However, few of the organisations studied in Preece (2006) were found to actually be doing this.

The information management problems highlighted above from the work done by Preece (2006) provided a desire within the researcher to look at how organisations may better be able to approach their management of information. However, whilst Bryman (2001) and Iqbal (2007) recognise that personal experiences can often provide the initial stimulus for undertaking research, a development that affected the whole world was also experienced during the undertaking of this research – the global ‘credit crunch’. This global ‘credit crunch’ has brought sharply into focus the need for better understanding of what it takes for organisations to survive in the marketplace. Over the past year and a half, the difficult economic conditions have claimed a number of large household-name companies in the UK, including Woolworths, MFI and Whittards. There are, of course, a multitude of factors that contribute to organisational survival – finance, market share, personnel and technical resources to name but a few. However, the importance of information has already been discussed. Indeed, information can be viewed as the lifeblood of organisations, taking on meaning and value when supporting human activity (Checkland and Holwell, 1998). In light of recent economic problems and the importance of information and communication, increasing our understanding of how organisations can manage information effectively to help them survive in the marketplace became the key focus of this research.

1.2 Potential Approaches to the Research

There were a number of different ways this research could have been undertaken. This research could have been undertaken from an organisational behaviour/work psychology standpoint. In the past 20 years, cognition has been shown to be a key driver of team performance (Salas et al., 2010) and the role of communication in group or team cognition is certainly not a new concept (Keyton et al., 2010). This research could have built upon work by authors such as Warner, Letsky and Cowen (2005), who identified verbal and nonverbal communication as part of their cognitive model for team collaboration. This building upon their work could have been done through focusing this research on the cognitive processes of individuals and groups creating, sharing and using information. However, we have already seen the importance the role that technology now plays in communication and there was the potential for the technological aspect of the research to have been lost if there was too heavy focus on human cognition in this research.

To encapsulate this technological aspect, this research could have been undertaken from a computer science standpoint. There is significant literature in this field dedicated to information storage, retrieval and sharing in databases (e.g. Wang et al. 2009; Hasson et al., 2008; Lin, Huang and Hsu, 2007; Castelli et al., 1998). This research could have built upon this existing literature to analyse existing database technologies and develop new approaches to database design and techniques. However, as already discussed, computer science views information in a way that it can all be coded and turned in to bits and bytes within a computer system. We have also already seen that too heavy reliance on technology can lead to organisations failing to manage information effectively. To help organisations reach the goal of effective information management, it was decided that an approach was needed that took a more social perspective than the very technological view of computer science.

As a result of this, the research domain of information systems was turned to. Information systems is a research discipline that is seen by some to focus on the interplay between the social and technical aspects of information technology (Mansour and Ghazawneh, 2009). This appeared to overcome the problems of the two potential research domains highlighted above through considering both the social issues and technological issues involved in organisational information management. However, the identity of the information systems discipline is subject to significant scholarly debate (Agarwal and Lucas, 2005; Benbasat, and Zmud, 2003) with authors arguing exactly what counts and what does not count as information systems research. Whilst the identity crisis that seems to have befallen information systems research is incidental to the main objective of this research, there appeared to be potential in some of the work by those who classify themselves in the information systems research community for this research. Through examining the information systems literature, it appeared to provide approaches and techniques that could be useful to investigate organisational information management for this research.

Seng et al. (2002) highlights that it is important for organisations implementing information management programs to identify what users need to know, plan how it should be created, acquired, stored and made accessible and where the responsibilities lie for these processes. There are a large number of methodologies in the information systems literature that aim to help structure this process. These include STRADIS – Structured Analysis, Design and Implementation of Information Systems (Gane and Sarson, 1979), SSADM – Structured Systems Analysis and Design Method (CCTA, 1990), YSM –Yourdon System

Method (Yourdon Inc., 1993), MERISE (see Avison, 1991 for an overview), JSD – Jackson System Development (Jackson, 1975) and IE – Information Engineering (Martin and Finkelstein, 1981).

Of these approaches, SSADM (CCTA, 1990) is the most common, with widespread adoption throughout the public and private sectors (Downs et al., 1988). It is claimed that in the UK it is the most popular third-party development methodology (Middleton, 2000), with previous figures suggesting it holds around 41% of the market share (Springett, 1993). SSADM provides a very structured approach for developing information systems encompassing seven stages that follow a ‘waterfall’ lifecycle. A waterfall lifecycle is a sequential process where progress takes the form of flowing downwards through each stage (Royce, 1970). The waterfall approach is often criticised for its inflexibility (Middleton, 2000; Spence and Carey, 1991; Parnas and Clements, 1986) with each stage requiring to be completed prior to moving on to the next stage. Verner and Cerpa (1997, pp. 3) point out that “*there will almost always be changes throughout [software] development leading to additional development work and rework*”. Middleton (2000) shows that many projects modify SSADM in practice, indicating that the prescriptive approach it takes is found difficult to apply by users. One of the major criticisms of SSADM is that it takes a very narrow analytical view and only concerns itself with analysing whether the proposed information system will meet the business requirements, rather than analysing those business requirements in the first instance (Checkland and Holwell, 1998). Despite these criticisms, the success of SSADM in its widespread adoption is that it provides detailed structure and standards (Avison and Fitzgerald, 2006) to the otherwise complex task of information system development.

One of the aspects of the SSADM approach that was potentially useful to this research are techniques called data flow diagrams (DFDs) and entity relationship diagrams (ERDs) that are used within the methodology (Avison and Fitzgerald, 2006). DFDs graphically depict what data will flow into, be stored in and flow out of an information system. ERDs depict the entities that an information system will record information about and their relationships to other entities within that information system. This research could have potentially used these techniques to help structure the exploration of how organisations can manage information through using them to model how information is handled within organisations.

An approach that overcomes some of the limitations of SSADM highlighted above is MERISE (see Avison, 1991 for an overview). MERISE is the most common information system development methodology in France (Avison and Fitzgerald, 2006). Whilst the approach is prescriptive to an extent, MERISE is much less prescriptive than SSADM, with Quang & Chartier-Kastler (1991) advising a pragmatic approach to be taken, with MERISE being customised and adapted as required. MERISE also places greater emphasis on the early planning stages compared to SSADM, with it including a strategic-level of analysis of the organisation as a whole, helping to create an overall information systems strategy (Avison, 1991). However, like SSADM, MERISE is primarily focussed on the computational design of the information system. Similar to the DFDs and ERDs detailed above, MERISE graphically models information flows between various actors and the environment, which again could have potentially been used to help structure the exploration of information management in organisations through creating models depicting how information is handled within organisations.

Another approach that includes examination of the strategic level of the organisation is Information Engineering (Martin and Finkelstein, 1981). Similar to MERISE, Information Engineering involves looking at the organisation as a whole and determining its information needs based on the organisational strategic objectives. Further similarities with MERISE come in the form of the approach being adaptable depending upon the requirements (Yaghini, Bourouni and Amiri, 2009). Information Engineering models the interaction between data and activities performed and, as with the graphical modelling of SSADM and MERISE, these modelling techniques could have been used in this research to structure the exploration of how organisations can manage information through using them to model how information is handled within organisations.

However, Checkland and Howell (1998) argue that such approaches from the information systems literature, as described above, concentrate too heavily on the data processing aspect and fail to provide in-depth exploration of the people and processes which the information system needs to support. Avison and Fitzgerald (2006) support this criticism and highlight that these approaches are therefore missing a critically important aspect of information systems development. As a response to such criticism, Montilva and Barrios (2004) believe a different view – known as ‘systems thinking’ – should be taken for information systems development which they argue provides a wider and more complete picture of the organisation, helping build an understanding of the components and the

relationships within the organisation. It was here again that personal experiences provided direction for the research as the researcher had previously studied for a Masters degree in operational research, which had exposed them to this systems thinking approach. From the initial understanding that this course had provided, and through conducting the research in Preece (2006), it appeared that systems thinking might be able to provide a broader, more integrated understanding of organisational information management, overcoming the more narrow view of the information systems approaches discussed above. This idea eventually formed the basis for this research.

Chapter 2 will introduce this systems thinking approach in much more detail but essentially it is an analytical approach that analyses situations as a whole, rather than focusing on a certain aspect, which provides a much broader and deeper understanding of phenomena. The approach was developed in the late 1940s as a response to the inadequacy of the traditional scientific method for studying biological phenomena (Flood and Jackson, 1991). At the time, it had become evident in biological science that isolating elements of biological phenomena and studying them independently was unable to explain the behaviour of complex organisms. As a result, systems thinking was developed which, through examining phenomena as a whole, enables analysis of the relationships between the parts of the phenomena to provide a much deeper understanding. This new approach aided the study of complex biological phenomena and it was not long before systems thinking was applied to studies of other types of phenomena, including organisations.

Systems thinking has been applied to analyse a wide range of organisational situations (see Jackson (2009) for an overview). Since its conception in the late 1940s, a range of different systems thinking approaches have been developed and these are reviewed in Section 2.1.3. These different systems thinking approaches are often categorised as either ‘hard’ or ‘soft’ approaches. ‘Hard’ systems thinking is defined as involving the application of systematically ordered thinking to well-structured problems that have desirable outcomes which can be defined (Checkland, 1983). In contrast, ‘soft’ systems thinking is defined as imposing a level of organisation to complex, ill-defined situations involving human beings (Checkland and Scholes, 1990). However, this ‘hard’ and ‘soft’ categorisation of systems thinking approaches is not quite so clear-cut. There are some systems thinking approaches at the extremes of being categorised as hard, such as operational research methods, and soft, such as soft systems methodology. However, some systems thinking approaches fall inbetween these two extremes. One approach that does is viable systems modelling which,

given its philosophical underpinnings, as discussed in Section 2.2.2, is applicable to instances with definable desirable outcomes, as in hard systems thinking, and is also sensitive to the complexity of human subjectivity, as in soft systems thinking. Communication is a very social activity involving human interaction and, as a result, this research naturally positioned itself towards the systems thinking approaches that were capable of handling the ‘soft’ side of situations.

The selection of the systems thinking approach used for this research is discussed in detail in Section 2.1.3. However, two approaches in particular stood out when reviewing the different systems thinking approaches available. One of these was soft systems methodology (Checkland, 1981; Checkland and Scholes, 1990), which is by far the most popular ‘soft’ systems thinking approach taken by practitioners and researchers (Munro and Mingers, 2002; Mingers and Rosenhead, 2004). Soft systems methodology (SSM) is an approach that uses various techniques to explore perspectives and provide structure for debate amongst stakeholders to explore how to improve situations. As shown in Section 2.1.3, SSM has also been extensively developed to study information in organisations. As a result of its predominance and ability to analyse organisational information, SSM was seen as the most natural choice for this research. Indeed, as Section 2.1.3 shows, the research was originally planned with the use of SSM in mind.

However, following a thorough review of the different systems thinking approaches available in Section 2.1.3, it was a different systems thinking approach, viable systems modelling (Beer 1979; 1981; 1985), that was ultimately selected for this research. Viable systems modelling (VSM) is an established modelling technique that enables the detailed analysis of organisational activity, providing a structured approach to examine how the structure and functions performed in an organisation contribute to its ‘viability’ – the ability to maintain a separate existence and survive on its own. The VSM provides a set of conditions which, if met, is said to ensure the survival of an organisation (Beer, 1979). It was noted earlier in Section 1.1 that the ‘credit crunch’ has led to many organisations struggling to survive, so this survival element of the VSM approach is particularly relevant to the issues facing organisations in the present day. This claim of VSM that it provides the sufficient and necessary elements for the continued survival of an organisation is by far the strongest claim made by any of the systems thinking approaches available (Schwaninger, 2006) and, as discussed further in Section 2.1.3, was one of the key reasons for ultimately selecting VSM as the approach for this research.

1.3 Research Contributions

VSM has been widely applied, in small/large companies (Beer, 1979; Ben-Eli, 1989; Brocklesby and Cummings, 1996; Schwaninger, 2006), industries (Britton and McCallion, 1989; Shaw et al., 2004) and governments (Beer, 1981). However, whilst the VSM concentrates on the structure and functions necessary for an organisation to be viable, it pays much less attention to the way information is deployed in organisations. Indeed, Schwaninger and Ríos (2008) criticise the VSM for being unable to provide much help with detailed information and communication structures and call for new theories to be explored about the way people interact and what information they need in the VSM. In response to this, it is these aspects that became the focus of the investigation in this research, in order to contribute to our understanding of the role that information plays in organisational viability. Therefore, this research focuses on the following question:

*What are the roles that information
plays in sustaining viability in organisations?*

Through answering this question, this research makes five key contributions to the academic literature. These contributions are fully explored in Section 10.1. In the information management literature, this research provides new insight into the roles that specific information plays in organisations. Tsuchiya (2007) writes that, although very little research has so far been carried out and has only just started on this topic, using the VSM to explain information management can be more helpful and natural as it connects information directly with organisational viability. This research contributes to knowledge in this area through showing what information should be managed by organisations in order to remain viable. This research also highlights the impact that different types of information have on other types of information in organisational settings. This helps to show the value of information management to organisations through providing understanding of how different types of information can effect organisations.

In the business school literature, this research contributes to knowledge through applying a standardised methodological approach – microanalysis by Strauss and Corbin (1998) – in a different way. The approach was adapted to enable the empirical testing of a model, whilst

minimising the potential for that model to bias the analysis. As a result, the new approach provides a combined unstructured and structured approach to qualitative coding to empirically test a theoretical model. Through doing so, the research provides new understanding about the qualitative coding process, enabling future research conducted in business schools seeking to empirically test a theoretical model through qualitative research to adapt the Strauss and Corbin (1998) approach in the same way as undertaken in this research. This research also contributes to the business school community through opening up the VSM to academics and practitioners who have previously been unable to access this very complex model or, perhaps, been put off by some of the difficult to read literature that surrounds it.

In the systems thinking literature, this research extends our understanding of the VSM. This research provides understanding of the information that needs to be managed within the VSM and where it should be managed. Furthermore, this research provides in-depth analysis of the role that communication channels in the VSM play in handling information flows in real-world organisations – something shown in Section 10.1.4 to be given, at best, only cursory discussion about within the current literature. This research further extends the VSM by identifying new types of communication channels within the model.

In the information systems literature, this research develops a framework that can be used to analyse organisational information systems. In Section 2.1.3, it is highlighted that there is currently limited support available for information systems researchers wishing to use the VSM to analyse information systems. Through providing a framework to support information systems research, this research significantly increases the utility of the VSM for information systems researchers, enabling them to now use the approach to conduct rigorous analysis on the requirements, design and use of information systems in organisations.

In the project management literature, this research increases our understanding of the application of the VSM to analyse project teams. Chapter 2 demonstrates that the VSM has been applied mainly to companies and that there is little currently in the literature about applying the VSM to project teams. Section 9.1 posits whether this is due to the unsuitability of the VSM to be able to handle the unique characteristics inherent in project teams. However, this research contributes to knowledge through showing how the VSM can be used to rigorously analyse and manage project teams.

In terms of the practical implications of the research, one of the contributions of this research is to make the VSM easier for practitioners to use. One of the criticisms often made of the VSM is that it is difficult for practitioners to apply. This research helps to condense the relevant theory, allowing practitioners to more easily grasp the principles of VSM which are needed to understand how to successfully apply it. However, the core contribution to practice of the research is that it provides a structured approach which enables practitioners to diagnose information-related problems in organisations. Furthermore, the approach enables practitioners to design effective information management processes to overcome these problems. Real-life examples of the capability of this practical contribution are provided in Section 10.1.6.

1.4 Thesis Structure

This research is broken down into a number of parts. Chapter 2 is dedicated to introducing the reader to the VSM. The chapter begins by introducing the research domain of systems thinking in which the VSM sits. The history of systems thinking is first described before introducing some of the key concepts within systems thinking. This section then moves on to describe the relationships between different systems thinking approaches and how the VSM was selected from the range of systems thinking approaches available. Chapter 2 then provides a detailed account of what the VSM is. So as not to overwhelm the reader with too much information all at once, this section builds up the VSM step-by-step, introducing each element of the VSM using the original principles and axioms set out by Beer (1979). Chapter 2 then moves on to examine how the VSM can be applied as an analysis tool and discusses a number of real-world VSM applications detailed in the literature.

Chapter 3 builds on our understanding from Chapter 2 to focus on how information is handled in the VSM. This chapter begins by introducing the literature on what information is present and shared within the VSM. Through a critical analysis of the current literature, an extended theoretical model is developed in this chapter that identifies what information is generated and shared in each element of the VSM. The analysis of the literature also highlights a number of areas where the literature does not provide us with understanding about information in organisations according to the VSM. Based upon these deficiencies in

the literature and the extended theoretical model, this chapter then presents the following five key research questions (the word ‘recursion’ in these questions is discussed as a concept in detail in Chapter 2 but essentially represents different structural levels in an organisation, e.g. departments, teams, individuals, etc.):

1. *What information is present within viable organisations at one level of recursion?*
2. *What information is shared within viable organisations at one level of recursion?*
3. *How does information sharing occur within viable organisations at one level of recursion?*
4. *What information is shared between different levels of recursion in viable organisations?*
5. *How does information sharing occur between different levels of recursion in viable organisations?*

Chapter 4 presents the methodology that was developed to research these five specific questions. The chapter begins by describing the qualitative approach taken in the research and the philosophy that underpins it. The chapter then details the four case studies (3 project teams and 1 company) used and discusses why they were selected. The chapter then describes how and what data was collected for each case study. The techniques used to analyse the data are then described with discussion given about the advantages and limitations of each technique.

Chapters 5-8 present the evidence for the findings made for each of the case studies. Each of these chapters begins by introducing one case study and describing it in terms of the VSM. This section examines the fit between the VSM and the case study to determine whether the VSM actually provides an adequate representation of it. Each chapter then moves on to explore each of the five research questions detailed above, using the extended theoretical model developed in Chapter 3 to guide the analysis. Each chapter then finishes by providing a summary of the main findings for the case study. Chapter 5 comes with a health warning – it provides a lot of low-level information that can, at times, make it quite heavy reading. The reader should be reassured that none of the other analysis chapters are written quite so in-depth. However, the reason for including such low-level detail in Chapter 5 is to provide the reader with a sense of the level of depth that was necessary to carry out the analysis for each case study. However, for the sake of brevity and to prevent the reader from becoming bogged down, subsequent analysis chapters concentrate on the

particular areas where the case studies differ from Project Team A, shielding the reader in other chapters from much of the low-level detail that is heavily present in Chapter 5.

In Chapter 9 the findings of the research are discussed. This chapter discusses the findings for each of the five research questions detailed above and the wider implications of the research. The chapter then concludes by highlighting the limitations of this study.

In Chapter 10 the conclusions of the research are presented. This chapter focuses on each of the contributions that the research makes and highlights their impact. The research aimed to increase our understanding of the role that information plays in organisational viability. This was found to be an area where there was limited literature available and presented a gap that this research contributes towards filling. As well as increasing this understanding, this chapter also highlights that the research identified certain deficiencies within the VSM and also developed and tested a framework that researchers can use to analyse information in organisations and develop more effective information systems. This chapter then concludes by highlighting some possible future directions that research in this area could take, including further empirical testing of the framework, further research on combining the approach with other tools and also reengineering the VSM and the framework to increase information security.

Chapter 2

Systems Thinking and the Viable Systems Model

2.0 Introduction

This chapter introduces the reader to the VSM. The chapter begins by introducing the research domain of systems thinking in which the VSM sits. The history of systems thinking is first described before introducing some of the key concepts within systems thinking. This section then moves on to describe the relationships between different systems thinking approaches and how VSM was selected for this research. The chapter then provides a detailed account of what the VSM is and the philosophy underpinning it. The chapter then examines the criticisms of the VSM before describing how the VSM has been applied in the literature.

2.1 Systems Thinking

2.1.1 Introduction

It was during the Renaissance period of the 14th to 17th centuries that marks the point when religious doctrines in Western Europe began to be questioned. The fundamental belief of having to accept an unquestionable reality designed by God shifted to a firm belief that a complete understanding of the universe would, one day, be achieved. People started to ignore the decree of the Church in the Middle Ages that curiosity was a sin and began to inquire about the nature of man and his surroundings (Ackoff, 1994). It was this newfound desire to understand the world that gave birth to, what is now known as, the Scientific Revolution and created the foundations upon which modern science was built.

René Descartes, acknowledged by many to be the first great modern philosopher, was a key figure in the Scientific Revolution. In the development of his philosophical framework for scientific enquiry, he argued that phenomena should be divided into their simplest

constituent parts and then analysed to gain an understanding of the more complex whole (Descartes, 1637/2008). This approach to inquiry is known as ‘reductionism’ and was based on the notion that the whole was equal to the sum of its parts. Reductionism became the standardised approach to scientific inquiry and can be seen to be applied in virtually every branch of science in the 18th and 19th centuries (Checkland, 1981).

However, the complex phenomena studied in biology did not lend themselves so well to reductionist thinking. Whilst biologists accepted that organisms could be broken down into a hierarchy of their constituent parts – molecules, cells, organs and organisms – by the early 20th century it was becoming clear that by analysing these alone, they were unable to explain the behaviour of complex organisms. As an example, in the 1920s, experiments were carried out that showed young tissue amputated from the tail of a newt and grafted onto a leg would grow into a leg on the newt but if older tissue was used it would grow into a tail (Koestler, 1945). As the young and old tissue were still made of the same cell types, the reductionist approach could not provide an answer to why this result occurred. Smuts (1926, pp. 98) reflected that “*every organism, every plant or animal, is a whole with a... synthesis or unity of parts, so close that it affects the activities and interactions of those parts*”. It was from this that the idea of ‘emergent properties’ arose, the suggestion that properties were present in complex phenomena that could not be explained from the characteristics of their isolated parts (von Bertalanffy, 1968). As stated by van Regenmortel (2004, pp. 1016) “*biological systems are extremely complex and have emergent properties that cannot be explained, or even predicted, by studying their individual parts*”. This realisation was based on the notion that the whole was greater than the sum of the parts.

It was in the late 1940s that the development of a different approach – systems thinking – began to take the form of a discipline in response to the inadequacy of reductionism in biology (Flood and Jackson, 1991). von Bertalanffy (1968; 1969), one of the founders of systems thinking, determined that each living organism consisted of interrelated and interdependent parts that interacted to maintain a ‘whole’. Rather than isolating the parts and studying them independently as in reductionism, systems thinking advocates ‘holism’ to concentrate on the whole and analyse the relationships between the parts to identify emergent properties (Jackson, 2000). This new approach aided the study of complex biological phenomena and it was not long before systems thinking was applied to studies of other types of phenomena, including organisations.

The belief that systems thinking could be taken from its biological sciences roots and applied to social situations was based on the “*intuitive similarity between the organization of the human body and the kinds of organizations men create*” (Back, 1971, pp. 660). However, the analogy between organisms and social situations is not without its criticisms. Back (1971, pp. 660) asserts that “*in the development of scientific sociology, grand developmental theories treating society like an organism have become extremely suspect*”. Katz and Kahn (1978) criticise this type of thinking, believing that essential differences are ignored between socially contrived social systems, which tend to be characterised by being highly variable and loosely articulated, and the physical structure of biological organisms. Due to this, Kast and Rosenzweig (1972) warn that it is probably best not to make the analogy between social systems and biology too literal, agreeing with Silverman (1971, pp. 31) who states that “*it may, therefore, be necessary to drop the analogy between an organisation and an organism: organisations may be systems but not necessarily **natural** systems*”. Nevertheless, systems thinking has been successfully applied in a huge range of social situations – some of which will be explored later in following sections.

The reason reductionism is not used in this research is that problems occur when the reductionist approach is applied to complex, real-world social situations (Checkland, 1981). Social situations involve a set of highly interdependent constituent parts and the relationships between these parts may be more important than the actual parts themselves (Jackson, 2000). An example of this is to think of an organisation divided into separate departments. Reductionist thinking would suggest that each department within this organisation could be independently optimised to achieve a certain goal. However, this reductionist approach has been found to be deficient, with organisations that had each of their parts optimised independently, failing to perform well as a whole (Flood and Jackson, 1991). Beer (1966) offers an example of the failure of the reductionist approach where the management of a large department store believed that, if they divided the profit of each section of the business by its floor area, they would identify the optimal use of floor space. The management believed that all they then needed to do was to use the practice of the section generating the most profit per square foot of floor space across the entire sales space. However, when they carried out the exercise the most profitable area per square foot of the business was calculated to be the toilets with their coin-slot operated cubicles – the organisation decided against becoming a large public convenience!

It is for these limitations of the reductionist approach that systems thinking is used in this research, to enable the investigation of the relationships between the parts of the social situations being studied.

2.1.2 Systems Thinking Concepts

Systems thinking requires that a 'system' is identified prior to analysis. A 'system' is defined as a set of interrelated elements (von Bertalanffy, 1968) that can be associated with the accomplishment of some purpose (Yolles, 1999). However, defining that purpose is not straightforward. Beer (1979) writes at length about defining systems and concludes that the purpose of any system will inevitably be imputed by its observer. It is therefore up to the analyst to determine the purpose of the system and the different elements that make up the system as a whole. These interrelated elements exist inside a boundary that make them distinct from elements that are less central to the system's functions (Flood and Jackson, 1991). The set of elements within the boundary is known as the 'system domain' and the set of elements outside of the boundary is called the 'environment' (Yolles, 1999). The system takes inputs from the environment and elements in the system domain apply processes to transform the inputs into outputs for the external environment. Inputs can be either physical or abstract in nature, such as raw materials, people, equipment, information or energy, and outputs can also be physical or abstract in nature, such as products or services (Yolles, 1999). Figure 1 shows a diagrammatic representation of a 'system':

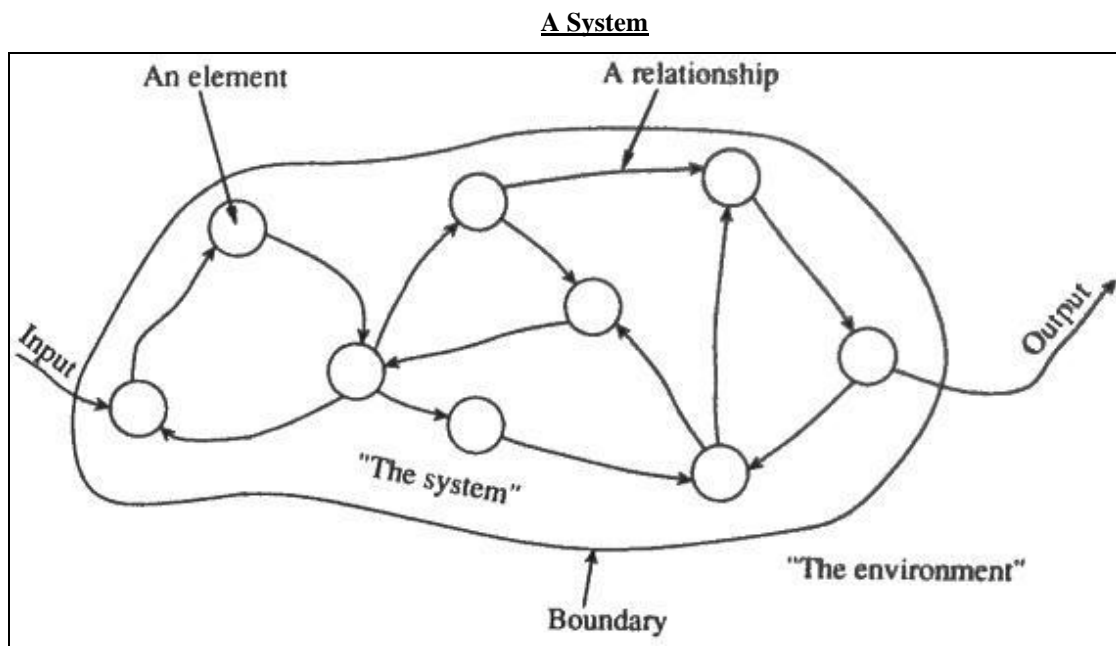


Figure 1 (Adapted from: Flood and Jackson, 1991, pp. 6)

2.1.3 Systems Thinking Classifications

Many different systems thinking approaches have developed over the years and have been categorised based upon certain criteria. Jackson and Keys (1984) began to develop a 'system of systems methodologies' which categorised systems thinking approaches according to the nature of the problem domain. The problem domain was categorised based upon two criteria – the complexity of the problem and the level of agreement between those involved about the nature of the problem. The complexity of the problem is categorised as either simple or complex. These authors defined a simple problem to consist of a small number of elements with few interactions between them, whilst complex problems composed of a large number of elements which are highly interrelated. The criterion used to distinguish between the levels of agreement between those involved about the nature of a problem are unitary, pluralist and coercive. These authors determine that a unitary problem situation occurs if a common set of goals are established, whilst a pluralist situation occurs in a situation where common agreement on goals cannot be made but there is a basic compatibility of interest. Coercive problem situations are characterised by completely incompatible goals amongst the people involved and heavy conflict is present (Flood and Jackson, 1991). Different systems thinking approaches were then classified in accordance with these categories and are presented below:

Classification of Systems Thinking Approaches

	Unitary	Pluralist	Coercive
Simple	<ul style="list-style-type: none"> • operational research • systems analysis • systems engineering • system dynamics 	<ul style="list-style-type: none"> • social systems design • strategic assumption surfacing and testing 	<ul style="list-style-type: none"> • critical systems heuristics
Complex	<ul style="list-style-type: none"> • viable system modelling • general system theory • socio-technical systems thinking • contingency theory 	<ul style="list-style-type: none"> • interactive planning • soft systems methodology 	<ul style="list-style-type: none"> • n/a

Table 1 (Adapted from: Flood and Jackson, 1991, pp. 42)

Jackson and Keys (1984, pp. 483) left out coercive-complex problems from their classification based on their belief that “*the drastic problems which exist in such contexts are unlikely to succumb to the remedies of problem-solving methodologies*”.

As Table 1 demonstrates, there are a variety of systems thinking approaches available. Whilst considering the approaches classified as ‘simple’ in Table 1, it became clear that these approaches would be unable to deal with the complexity of the task highlighted at the start of this research – examining organisation-wide information management. As was shown above, simple problems consist of a small number of elements with few interactions between them. However, Chapter 1 identified that organisational information management is characterised by a rich set of interacting phenomena, with technology (Arora, 2002; McCann and Buckner, 2004), trust (Preece, 2006), strategy (Sunasse and Sewry, 2002; Wiig, 1999) and organisational structure (Preece, 2006; McCann and Buckner, 2004) all being examples from Chapter 1 given of important aspects of organisational information management. Further important aspects of information management given in the literature include culture (Goh, 2002), leadership (Forcadell and Guadamillas, 2002; Karlsen and Gottshalk, 2004) and time (Hayduk, 1998; Goh, 2002). These different facets of organisational information management implied that the research would consist of more than a small number of elements with few interactions between them that characterise ‘simple’ situations.

When reviewing the systems thinking approaches classed as ‘simple’, it soon became evident that this was indeed the case. For example, operational research methods, with their focus on mathematical modelling (Jackson, 2000) were unsuitable for the research as it would be very difficult to try to model concepts such as organisational structure or leadership from the discussion above mathematically. Furthermore, systems dynamics (Forrester, 1961; 1969), is also criticised for its attempt to use “*mathematics in a loose*

fashion... the richness of social reality defeats SD [systems dynamics] modellers” (Flood and Jackson, 1991, pp. 81). These two approaches are classed very much in the ‘hard’ systems thinking approach discussed in Chapter 1. In contrast to looking at the more ‘hard’ aspects of situations, strategic assumption surfacing and testing (Mason and Mintroff, 1981) is more concerned with the ‘soft’ issues in situations. This approach looks at the more social aspects of the relationships between members of an organisation, highlighting the human and political aspects involved in situations. However, this approach is still classified as a ‘simple’ approach in Table 1 as Flood and Jackson (1991) highlight that, whilst this approach can handle some of the social aspects, issues such as organisational structure slide into the background.

Given the inability of the ‘simple’ systems thinking approaches to analyse the complexity of organisational information management, this category of approaches was discounted for this research. As a result, the focus turned to examining the ‘complex’ systems thinking approaches available for use with this research. Each of these ‘complex’ systems thinking approaches from Table 1 are described below:

- General Systems Theory (von Bertalanffy, 1968; 1969) is concerned with the laws that apply to systems in general. It uses mathematics and logic to develop general principles and models that can be transferred to, and used in, different fields to help aid conversations between different disciplines (Jackson, 2000). However, the overarching general theory that was originally envisaged is said to have failed to have emerged (Checkland, 1981). It is the generality of this approach that leads to the major criticism of general systems theory (GST). Boulding (1956) highlights that a trade-off occurs between generality and content and Checkland (1981, pp. 94) argues that “*the problem with GST is that it pays for its generality with lack of content*”. An approach using GST in this research could have involved using the theory and models to try to develop a more empirical information processing model for systems. This could have helped GST to overcome the criticism above of providing limited content, in terms of information processing. However, Jackson (2000) says that the impact of GST has been more on helping to develop other organisational and systems thinking theories, with the use of GST to actually test hypotheses or conduct research being uncommon. The abstract nature of GST led to it being rejected as a potential approach for this research, due to it failing to provide much in the way of support for analysing organisational information management.

- Socio-Technical Systems Thinking (Emery and Trist, 1960) is an approach based on the notion that the interaction of social and technical factors in a system determines performance. The social system is made up of structure and people and the technical system is made up of technology and tasks (Bostrom and Heinen, 1977). It has already been highlighted in Chapter 1 that information management should be seen as both a social and technological issue (Gao et al., 2002; Offsey, 1997; Sena and Shani, 1999). This made the socio-technical systems thinking approach a potentially useful approach for this research. The socio-technical systems thinking approach identifies that if either the social or technical factors are optimised independently, this can lead to detrimental effects on performance as unpredictable relationships between the two factors can result (Jenkins et al., 2009). This may explain why authors such as Scarborough and Swan (1999), described in Chapter 1, found that many information management implementations using a technology-driven approach have encountered problems. Therefore, the socio-technical systems thinking approach advocates joint optimisation of both the social and technical aspects in a system to successfully increase system performance (Rousseau, 1977). As this description of socio-technical systems thinking shows, there is a lot of congruence between this approach and the issues highlighted in Chapter 1. An approach using socio-technical systems thinking could have involved a deep analysis of the relationships between the information available and requirements of people within organisations and trying to develop a way to optimise that with the technical aspects that support information management in organisations. However, the socio-technical systems thinking approach is not without its critics. Alder and Docherty (1998) determine that the approach focuses on the internal workings of the organisation but pays limited attention to the external environment. However, this criticism has been responded to by some authors developing the methodology to include external environment issues (e.g. Taylor and Felten, 1993). A greater concern for this research, given its desire to undertake an *organisation-wide* view on information management, is highlighted by Alder and Docherty (1998, p. 320) in that the approach “*draws heavily on social psychology and thereby on small group theory... studies have often been restricted to individual functions or sites in a company*”. Another concern arises from Hirschhorn, Noble and Rankin (2001), who criticise the approach by saying that its use is often rooted in mass production and labour use and is, perhaps, not so well attuned to the current concerns of industry. Given that Chapter 1 highlighted the current prevalence of the service industry over the manufacturing industry, these criticisms

provided concern about the selection of the socio-technical systems thinking approach for this research.

- Contingency Theory (Burns and Stalker, 1961; Woodward, 1965; Lawrence and Lorsch, 1967) is an approach which assumes that there is not an optimal way to structure or manage a system, with the best way being contingent upon the internal and external situation of the system. This approach seeks to develop high performance in systems through examining, and then attempting to match, the characteristics of the environment and the characteristics of the system (Betts, 2003). An approach could have been taken using contingency theory in this research through undertaking a matching process of the information available and requirements in the environment to the information available and requirements of the organisations. With its focus on the organisation and the environment, contingency theory overcomes the limitation of the socio-technical systems thinking approach, where it was criticised by Alder and Docherty (1998) for not providing much focus on the external environment of the system. However, Donaldson (1996) highlights that contingency theory is criticised for viewing the system as having to respond to the environment, failing to appreciate that systems can also actively try to change the environment themselves rather than needing to change their own internal structure to respond to the environment. Furthermore, contingency theory has been heavily criticised, with the most important criticism being that the characteristics chosen in any given contingency theory based study tending to account for only a small amount of the actual variance in performance in the organisation (Weil and Olsen, 1989). Schoonhoven (1981) highlights several other problems with the theory – the most damning being that she believes that contingency theory is not a theory at all with a lack of clear substance. Given the heavy criticism of contingency theory, it was not selected as the approach for this research.

Whilst the limitations discussed above of general systems theory, socio-technical theory and contingency theory meant that they were not chosen for this research, the remaining three systems thinking approaches were all determined to be strong candidate approaches for working with in this research. These systems thinking approaches will be first introduced and then the reasons for their selection/non-selection will be discussed in greater depth once all of them have been introduced.

- Interactive Planning (Ackoff, 1974; 1978; 1981) is an approach that aims to include all relevant stakeholders to build consensus of an idealised system. The approach works backwards from where the members of the system want it to be to where it is currently. The idealised situation is compared to the current situation to identify where the gaps are and then planning is undertaken by the participants to work towards the more desirable system (Sinn, 1998). Flood and Jackson (1991) highlight that this approach makes an assumption that all stakeholders will be willing to engage in the process and to participate freely and openly, ignoring the possibility of conflict existing between stakeholders. However, Chesterton et al. (1975) see deep rooted conflict as widespread across organisations. Ackoff (1975) defends interactive planning from this criticism by suggesting that all conflict can be resolved through people contemplating a desirable future they share in common. However, Rosenhead (1976) shows that incompatible desires for the future are certainly not a rare phenomenon in organisations. Jackson (2000) also highlights that equal stakeholder participation is essential for interactive planning – as it provides justification for the impartiality of the results and because it produces creativity and commitment to implementation – and that this equal participation is taken for granted in interactive planning. However, a range of factors can impact on whether participants join the process in the first place, such as time and desire for change. Even if full stakeholder participation does occur, Jackson (2000) is sceptical that more powerful stakeholders will participate on an equal footing with less powerful stakeholders – creating a bias towards the more powerful members. Ackoff (1975) does acknowledge this power asymmetry is present in organisations but believes that organisational structural change can overcome it. Furthermore, Flood and Jackson (1991) highlight that if powerful stakeholders resist less powerful stakeholder involvement, there are other ways around this, such as introducing less powerful stakeholders into the process firstly as consultants and then slowly increasing their involvement.
- Soft Systems Methodology (Checkland, 1981; Checkland and Scholes, 1990) is an approach that encourages debate amongst stakeholders to help explore their perspectives of the current situation and idealised situations. Models are used to explore perspectives and provide structure for debate, with the aim of generating consensus amongst participants as to how to make the situation better and develop a shared commitment to “*desirable and feasible change*” (Checkland and Poulter, 2006, pp. 11). The development of soft systems methodology (SSM) was a significant step in

systems thinking with Flood and Jackson (1991) suggesting the management and systems sciences are indebted to Checkland for a profound observation that provides the foundation to SSM. Checkland (1981) shifts the notion of a ‘system’ from representing some *real world situation* to representing the *process of enquiry*. SSM is described as a learning system that leads to purposeful action in a continuous cycle (Flood and Jackson, 1991). Checkland (1981) articulates a seven stage model that analysts can go through in a non-prescriptive manner. Each stage provides modelling techniques or strategies to help users and participants learn about the situation to help generate mutual understanding and consensus amongst participants. As the discussion below will show, SSM is a highly regarded methodology which is used widely by researchers and practitioners. However, the approach does draw some criticisms. Flood and Jackson (1991) highlight that SSM sees social reality as the conscious creation of human participants and that problems occur when perceptions of different participants do not overlap. However, these authors suggest that this is a very limited view ignoring, for example, the design of communication and control structures in an organisation. This criticism seems based upon the more positivist view of an objective ‘reality’ existing, as discussed in Section 4.1, and so seems related to an incompatibility of paradigms issue rather than a deficiency of SSM from an interpretivist perspective. Related to this is the SSM ideology that participant perceptions will change in response to pressure from alternative perspectives – ignoring that they might be hard to change because of the wider social and political forces that shaped the underlying beliefs (Mingers, 1984). However, Mingers (2000) highlights that more recent developments in SSM have focused on the social and political dimensions. SSM also suffers from the same criticism discussed above for interactive planning in that it requires equal participation from the full range of stakeholders for the results to be legitimate and to secure support for implementation (Flood and Jackson, 1991). However, if this became an issue in an SSM approach, intuitively it would seem likely that this issue could be helped to be overcome using the same methods provided in the discussion above for interactive planning, such as introducing less powerful stakeholders into the process firstly as consultants and then slowly increasing their involvement.

- Viable System Modelling (Beer 1979; 1981; 1985) is an approach that provides a model for designing organisations and diagnosing problems within them. The model claims to provide all the necessary elements for a system to survive (Beer, 1979).

Analysts can use this idealised model to compare with the current situation to diagnose faults which can then be corrected through changing the situation to adhere to the model. However, Jackson (1988) and Sutton (1995) have both noted that social systems can still survive even when not adhering to logical structures such as those prescribed in viable systems modelling (VSM). As a result, some authors (e.g. Yolles, 2005) suggest the VSM is more about increasing effectiveness than maintaining survival. The concept of viability is discussed in much greater detail in Section 9.1, however both survival and efficiency are positive outcomes from a VSM intervention and this debate should not detract from that. The VSM is also criticised for being too simplistic for organisational study (Rivett, 1977; Checkland, 1980). However, there is significant disagreement with this, with authors arguing it is rigorous (Schwaninger, 2004) and possesses an enormous explanatory power (Jackson, 1988). Certainly the body of literature that shows successful interventions highlighted in Section 2.2.4 suggests that the VSM is not too simplistic to aid organisations. Whilst a very short account of the VSM is given here, Section 2.2 will provide much further discussion on the VSM.

Of these different systems thinking approaches, SSM has been by far the most popular approach taken by practitioners and researchers (Munro and Mingers, 2002; Mingers and Rosenhead, 2004). Given the predominance of SSM, it has provided the method an opportunity to strongly develop through its many practical applications and also through the considerable academic debate it has received in the literature (e.g. Jackson, 1982; Mingers, 1984; Rosenhead, 1984). In the context of this research, a variety of SSM practitioner applications have been undertaken in the area of information systems (Mingers and Taylor, 1992). The literature also provides a number of methods to use SSM to study information in organisations. Checkland and Howell (1998) provide extensive discussion and examples on applying SSM to the topic, Wilson (1990) extends SSM with techniques to establish information requirements to provide the basis for information system design and Multiview (Wood-Harper et al., 1985; Avison and Wood-Harper, 1990) combines SSM with the traditional DFD and ERD techniques described in Chapter 1 to understand information requirements.

Given the level of development of SSM and its predominance both in practice and the literature, the approach perhaps seemed the most natural choice for this research. Indeed, the initial planning of this research began with SSM in mind. The research was originally set to build upon the already existing well developed information research base in SSM

highlighted above and evolve it through combining its use with more recent ERD and DFD-style techniques such as Process-Oriented Holonic (PrOH) Modelling (Clegg, 2007; Clegg and Shaw, 2008). Had this been done, the research would have followed a more interpretivist approach to answering the research questions posed in Chapter 1 and would have required significant participation from the members of the organisations studied.

Whilst interactive planning does include some recommendations on designing appropriate information systems (Flood and Jackson, 1991) there is nowhere near as extensive interest in information in the approach compared to SSM. Nevertheless, interactive planning could still have been used in this research, following a similar approach to that described had SSM been used. Interactive planning could have been used to identify where an organisation wanted to be and where it was now. Then, a technique such as PrOH modelling could have been used to study how information processes needed to change in the organisation to support them in moving to their desired state. This could have developed interactive planning much further in to a tool to help organisations design their information management processes.

The decision as to which systems thinking approach to use in this research was difficult. Interactive planning was ultimately rejected as it has many similar traits to SSM, although the approaches are certainly not the same – see Sinn (1998) for an overview of the differences. However, as discussed above, interactive planning is much less developed in terms of information-related issues than SSM. As a result, whilst developing interactive planning through this research might have helped it move towards the level of development of SSM, there was a concern. This concern was that, without interactive planning being a dramatic step away from SSM, researchers/practitioners may just stick to what they know and keep going with the more established SSM approach to information-related issues. As a result, interactive planning was rejected to try to keep this research as relevant as possible.

In terms of SSM and VSM, as discussed above, this research began with SSM in mind. SSM certainly felt like the natural choice and provided the tools on which this research could have been built. However, it was the claim of VSM – that it provides the sufficient and necessary elements for the continued survival of a system – that sparked real intrigue when designing this research. This claim is by far the strongest of any of the systems thinking approaches available (Schwaninger, 2006). Furthermore, Schwaninger (2004)

states that the theory has never been falsified. We saw in Chapter 1 how the recent ‘credit crunch’ has put extra pressures on organisational survival, with a number of household-names failing to survive. This claim of VSM that it can maintain organisational survival made it the most interesting proposition out of all of the system thinking approaches discussed above. However, when considering the design for this research the question naturally arose that – if VSM really does provide everything that is needed for organisational survival, and it has never been falsified, why is there nowhere near as much interest in it as there is in SSM? There are a number of criticisms of the VSM that are addressed in Section 2.2.3 that may help to answer this question. However, perhaps the most significant one, especially for this research focusing on organisational information, is that Schwaninger and Ríos (2008) criticise the VSM for being unable to provide much help with detailed information and communication structures and call for new theories to be explored about the way people interact and what information they need in the VSM. Despite this criticism, the VSM does provide strong foundations to explore information in organisations – with the model defining a number of communication channels that organisations need to have in place in order to survive. Explicit communication channels providing detailed relationships between elements in organisations are not present in any of the other systems thinking approaches discussed above. The VSM therefore provided a solid foundation upon which to build an investigation about information sharing in organisations. Furthermore, Jackson (1988) concludes that the VSM has enormous explanatory power compared to other organisational analysis tools. This explanatory element is a key advantage for this research too, which seeks to provide *understanding* about the role that information plays in organisational survival. Given this, it was decided to change the approach of this research from SSM to try to extend the VSM – which has received relatively little interest recently. Through developing the information management element of the VSM further through this research it is hoped that it will renew relevance and interest in the model.

However, before we can explore the research questions in detail, we first need to describe what the VSM is and how it can be used. As a result, the VSM will now be detailed in the next section.

2.2 Viable Systems Model

2.2.1 Viable Systems Model Introduction

The viable systems model (VSM) is a modelling technique developed by Beer (1979; 1981; 1985) and is based upon established cybernetic theory. Cybernetics is a field of study about how information and control actions are used to steer systems towards meeting objectives, whilst counteracting various disturbances (Heylighen and Joslyn, 2001). Applied to the study of management systems, cybernetics in the VSM is defined as the “*science of effective organisation*” (Beer, 1974, pp. 13).

The fundamental principle taken from cybernetics underlying the VSM is the Law of Requisite Variety, which is based upon the assertion of Ashby (1956, pp. 207) that only “*variety can destroy variety*”. The term ‘variety’ is used in the VSM as a measure of complexity in a system and is defined as the number of possible states a system can take (Beer, 1974). Intuitively, it can be asserted that the management of an organisation has lower variety than the operations of an organisation – management cannot possibly know everything that happens within the operations of an organisation (Beer, 1985). Equally, the operations of an organisation will certainly have lower variety than that of its external environment. Work on the Law of Requisite Variety shows that responses from a system will not always be optimal when the variety in the stimuli is greater than the variety of responses available to that system (Gray, 2000). In order to achieve optimal responses, therefore, the variety of the stimuli and the variety of the system need to be balanced so that ‘requisite variety’ is achieved. To achieve requisite variety, systems need to absorb environmental variety by increasing (amplifying) their own variety, or by reducing (attenuating) the variety incoming from the external environment (Beer, 1974). This process is shown between the management, operations and external environment of an organisation in Figure 2:

System Variety

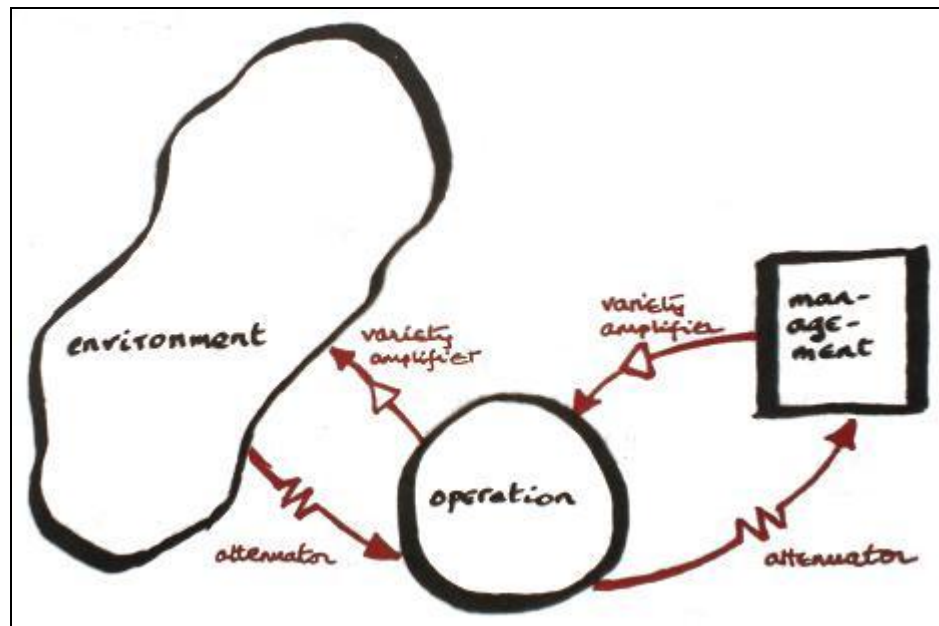


Figure 2 (Adapted from: Beer, 1985, pp. 27)

An example of attenuation between operations and management is management only examining totals and averages of production to check performance, rather than examining all the data available on production from each machine for each day, etc. An example of amplification between operations and management is management holding a meeting to discuss a production problem with production staff. An example between operations and the environment would be an organisation, facing changes through globalisation, amplifying its variety through accessing new resources and capabilities or attenuating its variety by persuading the Government to put trade barriers in place (Devine, 2005).

The Law of Requisite Variety leads to the construction of the VSM's First Principle of Organisation:

*“Managerial, operational and environmental varieties, diffusing through an institutional system, tend to equate; they should be **designed** to do so with minimal damage to people and cost”*

(Beer, 1979, pp. 97)

It is the emphasis on the word ‘design’ in this principle that leads Beer (1979) to define the practice of management as ‘variety engineering’. The VSM asserts that systems need to handle the variety in their environments in order to be ‘viable’. A viable system is described as one that is able to maintain a separate existence (Beer, 1979) that is “*capable*

of maintaining its identity independently of other such organisms within a shared environment” (Beer, 1984, pp. 14). This focus on identity is key to the viability of a system. The notion of autopoiesis (Varela et al., 1974) is drawn upon to describe how viable systems maintain this identity. Autopoiesis means “*self-production*” and an autopoietic organisation is “*realized as an autonomous and self-maintaining unity through an independent network of component-producing processes such that the components, through their interaction, generate recursively the same network of processes which produced them*” (Zeleny, 1977, pp. 13). So the autopoietic organisation utilises processes to produce itself: a cell will produce cell-forming molecules, an organism will renew its organs and a social group will ‘produce’ group-maintaining members (Zeleny, 1977). It is this idea that a viable system continuously “*produces itself*” that Beer (1979, pp. 405) uses to determine how a viable system “*goes on*” to retain its identity over time, regardless of the changes made within the system itself. Such changes in an organisational system can include staff coming and going or departments opening and closing, but an autopoietic system is able to maintain its identity despite these events occurring (Beer, 1979). An example would be a bank previously offering its services solely on the high street closing all of its branches and changing to offer its services through online banking, telephone banking and cash machines instead. Despite the complete change in structure, the organisation would still be identifiable as a bank, since it will still be providing financial services (Vidgen, 1998). This example highlights the importance of identity, the purpose of the system, as its defining characteristic. It is this characteristic that leads to the development of the first part of the viable system model.

It is the circle in Figure 2 that encloses all of the operations that ‘produce’ the viable system (Beer, 1985). These operational elements carry out the primary tasks of the viable system, each having their own localised management, and are known as System 1 (henceforth labelled S1) units in the VSM. An S1 unit is shown in Figure 3:

An S1 Unit

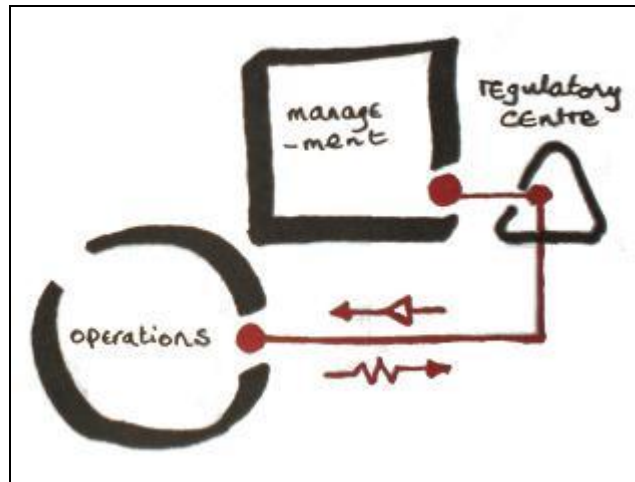


Figure 3 (Adapted from: Beer, 1985, pp. 43)

Figure 3 shows that attenuation and amplification occur between the localised management and the operations in the S1 unit through a regulatory centre. The plans, procedures and programmes imposed on the operations of S1 by the localised management are classed as 'regulation' and amplify managerial variety by elaborating on details sent from senior management and attenuate operational variety by imposing objectives to be carried out (Beer, 1985).

S1 units also interact with their environment, as shown in Figure 4:

S1-Environment Interaction



Figure 4 (Beer, 1985, pp. 43)

We have seen a diagram in Figure 2 that is very similar to Figure 4 already when we were discussing the Law of Requisite Variety and looked at how attenuation and amplification occurred. The four lines showing attenuation and amplification in these diagrams are called ‘channels’ and the channels shown here are collectively known as the ‘operational axis’. Channels do not transmit variety themselves but transmit information that is used to attenuate or amplify variety. This leads to the VSM’s Second Principle of Organisation:

“The four directional channels carrying information between the management unit, the operation and the environment must each have a higher capacity to transmit a given amount of information relevant to variety selection in a given time than the originating subsystem has to generate it in that time”

(Beer, 1979, pp. 99)

This principle states that each channel must have enough capacity to be able to transmit information about the number of states, or variety, in the time available to it. For example, if a problem develops on one of the production lines in the operations – the problem needs to be transmitted to management so they can address the situation. Two separate types of information need to be sent to management – which production line it is and the degree of seriousness of the problem (Beer, 1979). This information can be determined by the production worker. However, if the production worker then asks the person from school on two weeks’ work experience to send the message “production line 3 has critically broken down”, the school child (i.e. the channel) may not have the knowledge to determine that the production line number and the level of problem seriousness are states of the system that need to be conveyed. The child may get to the manager’s office and deliver the message “things are in a bit of a state on the factory floor”. This is an example of the channel not being of a high enough capacity to transmit the required information.

The information being transmitted across these channels gives rise to the VSM’s Third Principle of Organisation:

“Wherever the information carried on a channel capable of distinguishing a given variety crosses a boundary, it undergoes transduction; and the variety of the transducer must be at least equivalent to the variety of the channel”

(Beer, 1979, pp. 101)

Transduction is the process of translating information from a channel into the language the receiver understands. This is done through a process of coding and decoding information as shown in Figure 5:

Transduction



Figure 5 (Beer, 1985, pp. 47)

So, for example, the operations need to code information into a form that management will be able to decode, and therefore understand, when it receives it.

The three principles of the VSM detailed so far need to hold continuously, to enable the system to remain viable. This leads to the VSM's Fourth Principle of Organisation:

“The operation of the first three principles must be cyclically maintained through time, and without hiatus or lags”

(Beer, 1979, pp. 258)

Having considered a single operational element of a system in the diagrams above, attention is now turned to how different S1 units relate within a system. This is shown in Figure 6:

Relationship between S1 Units

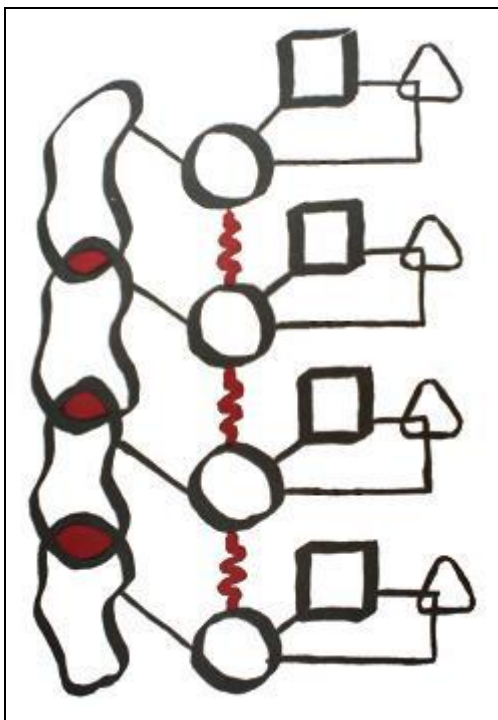


Figure 6 (Adapted from: Beer, 1985, pp. 57)

Figure 6 shows four S1 operational units connected together by a squiggly line. This connection may be strong or weak but in every viable system the connection will exist (Beer, 1979). At the very least, different S1 units will be competing against each other for resources and some S1 units may even take outputs from one S1 unit, process them and then send them to other S1 units. Each S1 unit, therefore, directly impacts upon every other S1 unit which can potentially cause S1 units to get in each other's way. As a consequence, each S1 unit continuously has to adjust to other S1 units. However, by adjusting itself, this directly impacts upon the other S1 units, who then adjust themselves, forcing the original S1 unit to need to adjust again, leading to continuous over-correction by each S1 unit. This is known as oscillation and leads to the requirement for an anti-oscillatory device in the VSM known as System 2 (henceforth labelled S2). S2 is shown in Figure 7:

S2

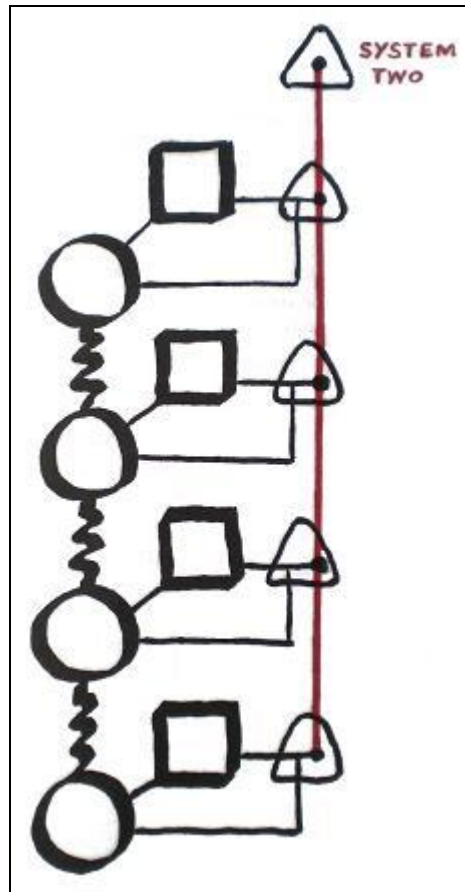


Figure 7 (Adapted from: Beer, 1985, pp. 67)

Each S1 unit is ignorant of the operations of other S1 units but, as can be seen from the diagram, S2 connects to all of the S1 units which enables it to understand how the S1 units relate to one another. S2 uses this understanding to co-ordinate the S1 units to prevent them from shaking the system to pieces through oscillation.

We have so far seen that S1 units carry out their operations in ignorance of other S1 units and that S2 co-ordinates these S1 units to stop them getting in each other's way. However, we have not yet considered how the S1 units know what it is they are supposed to be doing or how they receive the resources to do so. This is the role of System 3 (henceforth labelled S3) in the VSM. S3 is responsible for the day-to-day management of the internal and immediate functions in the VSM and carries out resource bargaining with the S1 units to allocate resources. This attenuates the variety of S1 by determining that, out of all of the activities that S1 could undertake, it is these particular activities that will be carried out (and not the other activities available), and the resources negotiated to carry out these activities will be provided (Beer, 1985). Due to the high volume of variety generated by each S1 unit, it is impossible for S3 to fully understand the intimate details of the activities

of each S1 unit, let alone all of the different S1 units in the VSM. This is an important point, as a problem issue in organisations is that senior management often assumes – and exercises – the power to poke around in the activities of its operations (Beer, 1985). However, given that it cannot fully understand S1 operations, S3 does not have requisite variety to do this poking around in S1 and therefore Beer (1979) argues that, once the resource bargain is complete, S1 should have full autonomy to carry out the agreed activities.

Sometimes, however, senior management may want to access information about S1 operations to carry out a check. For example, S3 may suspect that the production team of an S1 unit are deliberately performing slowly to reduce the level of work they have to do each day. For this reason, S3 has a special function available to it called System 3* (henceforth labelled S3*) in the VSM. S3* enables audits to be carried out to allow senior management to delve into, and ascertain specific information about, the operations of an S1 unit. Beer (1985) argues that senior management should not use this mechanism regularly, as it reduces the autonomy of S1, and so these audits should only be carried out sporadically.

Figure 8 shows the channels that link S1, S2 and S3 in the VSM:

S1-S3 Communication Channels



Figure 8 (Beer, 1985, pp. 83)

The communication channels in Figure 8 are labelled as:

- (i) corporate intervention
- (ii) resource bargain
- (iii) operational linkages
- (iv) environmental intersects
- (v) S2: anti-oscillation
- (vi) S3*: audit

Channels (ii), (iii), (v) and (vi) have already been discussed above. Channel (i) enables senior management to intervene directly if something in S1 is not performing the objectives set by S3. Channels (i) and (ii) are known collectively as the command axis and pass through each local management square so that senior management can connect to any

local management square in the VSM. Channel (iv) represents the relationships between the external environments of each S1 unit.

The law of requisite variety leads to the VSM's First Axiom of Management to be applied to channels (i)-(vi):

“The sum of horizontal variety disposed by [the number of] operational elements = the sum of vertical variety disposed on the six vertical components of corporate cohesion”

(Beer, 1979, pp. 217)

The focus of the VSM up until now has been dealing with inside the system. Whilst the S1 units have been shown to each interact with their own local environments, the VSM is embedded in an environment that is much wider than the sum of the S1 environments (Beer, 1979). This external environment is full of challenge and opportunity (Beer, 1979) and a VSM needs to be able to adapt itself, either incrementally (morphogenesis) or dramatically (metamorphosis), to manage the variety of the external environment (Yolles, 2000). This aspect of the VSM is handled by System 4 (henceforth labelled S4). S4 is responsible for interacting with the environment, identifying relevant environmental changes and making recommendations about how to best adapt to these environmental changes. This leads to tension naturally arising between S3 and S4, with S3 attempting to maintain internal stability and S4 pushing for adaptation to the environment (Jackson, 1988). This tension is problematic, as it causes S3 and S4 to not have requisite variety which needs to be achieved to meet with the VSM's Second Axiom of Management:

“The variety disposed by System Three, resulting from the operation of the First Axiom and the variety disposed by System Four, are equivalent”

(Beer, 1979, pp. 298)

To enable this axiom to be met, a homeostat is used to balance the variety between S3 and S4 as shown by the thick black arrows between S3 and S4 in Figure 9:

S3/4 Homeostat



Figure 9 (Beer, 1985, pp. 129)

If S3 and S4 are not balanced, the system may run into one of two difficulties. If S3 is 'stronger' than S4, the system may ignore relevant environmental developments that the system needs to adapt to and just continue with its current activities (Achterbergh and Vriens, 2002). Conversely, if S3 is 'weaker' than S4, the system may implement new innovations without having the necessary operational capabilities to carry them out successfully (Achterbergh and Vriens, 2002).

Figure 9 also shows System 5 (henceforth labelled S5), which sets the overall direction for the system and defines what purpose the S1 units should be achieving. It is S5 that monitors the S3/S4 homeostat, as shown in Figure 9 by the red lines linking S5 to the homeostat, and it is S5 that also makes the final decision about any adaptation to be made by the system, giving it the tag of 'boss' in Figure 9 above. S5 closes the logic of the VSM and, as a result, acts as a variety sponge mopping up any variety left over in the system that was not accounted for by S1-S4 (Beer, 1985). This leads to the VSM's Third Axiom of Management:

“The variety disposed by System Five is equivalent to the residual variety generated by the operation of the Second Axiom”

(Beer, 1979, pp. 298)

Due to all of the attenuation and transduction of information that takes place between S1 and S5, there is potential for S5 not to become aware of major problems developing in the system. For this reason, the VSM encompasses a special feature called algedonic signals that enable other functions in the VSM to alert S5 to potential danger. This is shown in red on Figure 10:

Algedonic Signal



Figure 10 (Beer, 1985, pp. 133)

This algedonic signal bypasses everything else in the VSM in order to reach S5 as quickly as possible to enable a rapid response.

We have now seen the different elements of the VSM and are now in a position to put it all together, without it appearing too overwhelming. The complete VSM is shown in Figure 11:

The VSM



Figure 11 (Beer, 1984, pp. 15)

To show the different roles S1-S5 play in the VSM, a short example of a school teaching system will be discussed. This school teaching system encompasses the teaching staff, the facilities and resources of the school, as well as the management of the teaching activities within the system. Students are classed as the customers of this system and the purpose of the system is to educate these students. This system will then contain the following S1-S5 components:

- S1 - contains student classes as operational elements, with each class being the responsibility of a teacher, with the intention (output) of learning maximisation for the students within the class
- S2 - many of the facilities of the school will be shared, e.g. there are only a certain number of laboratories and sports facilities that can only be used by a certain number of student classes at a time. S2 is therefore needed to co-ordinate the teaching activities in these facilities by providing a school timetable to ensure that only one lesson is taught in one room to a class at any single point in time
- S3 - S3 would set goals for student attainment by a certain period and use student examinations to monitor this attainment as a measure of the teaching staff performance. S3 would also engage with the teachers responsible for the classes in resource bargains for textbooks, educational software, etc.
- S3* - an assessor may be used to sit in during one of the lessons a teacher gives to their class to ensure teaching activities are being carried out in a correct manner. A sample of student exam papers may also be marked by a second examiner to ensure exams are being marked correctly
- S4 - gathers information from the external environment on new subjects that could be taught as well as information on updates for existing lesson syllabi
- S5 - decisions such as whether the school should take on a specialist status are made, e.g. becoming an art school. A decision to become an art school would give the system the values, purpose and the overall direction of teaching art subjects to its students

In the VSM diagram in Figure 11, it can be seen that each S1 unit is actually a VSM itself. This is based upon the Recursive System Theorem, which stipulates that each “*viable system contains, and is contained in, a viable system*” (Beer, 1979, pp. 118). Figure 12 shows different recursion levels for, as an example, an individual knowledge worker:

Recursion Levels for an Individual Knowledge Worker



Figure 12 (Leonard, 1999, para. 15)

Each bubble in Figure 12 is a system and, as you move inwards towards the centre, each system is embedded in the previous system in that group. Take, for example, the viable system of an individual knowledge worker in this diagram. Looking at the top left grouping, this worker is shown to be embedded in a work group, which is embedded in a department, which itself is embedded in a company, which in turn is embedded in an industry. Each of these embedding systems is said to be at a different level of recursion and are assigned numerical identifiers, with the system being analysed (known as the ‘system-in-focus’) being at recursion level 1. The system that the system-in-focus is embedded in is at recursion level 0 and the systems that are embedded within the system-in-focus are at recursion level 2. Each level of recursion makes up part of S1 in the next higher-level VSM it is embedded within.

As an example of the different recursion level identifiers, we will take the department in the diagram above and define it as the system-in-focus. The department is therefore at recursion level 1 in this example. This leads to the company the department is in being at recursion level 0 and the work groups that make up the department being at recursion level 2. Incrementally higher or lower levels of recursion are given incrementally higher or lower numerical identifiers. So in the example above, the industry the company is in is at recursion level -1 and the individual knowledge workers that make up the work groups are at recursion level 3.

As can be seen from Figure 12 above, systems can be embedded in a number of other systems, e.g. the individual knowledge worker in the diagram is embedded in the work group, committee, customers, family, membership in chapter and team systems. Some recursive relationships may also have fluctuating boundaries, for example a company may be embedded within a number of different industries (Leonard, 1999). Systems may also play different roles at different levels of recursion, for example the individual knowledge worker in Figure 12 may perform different tasks at the work group and divisional levels of recursion. The use of recursion in the VSM enables the system to be analysed in its context, giving the analyst an integrated understanding about the situation (Yolles, 1999).

2.2.2 Philosophical Underpinnings of the VSM

The VSM is a formalised cognitive model that sees a situation as a system and is intended to be used to identify and correct the faults within that system that prevent it from being viable (Yolles, 1999). This is based upon an objectivist epistemology – that an objective ‘real world’ system can be made viable through it adhering to the model. van Gigch (1989, pp. 30) highlights the objectivist epistemology of the VSM, suggesting that the VSM provides “*truth*” at each level within the system. However, Yolles (1999) argues that this ‘truth’ is a difficult concept to define and is belief-based according to an agreed set of ‘criteria’. He argues that this ‘criteria’ is subjective and that “*we can only use our own criteria to judge others*” (Yolles, 1999, pp. 359). Jackson (2000, pp. 156) also highlights that the VSM cannot be just seen as having a completely objectivist epistemology, stating that “*attention is given in organisation cybernetics to the role of the observer*” with Beer (1979) stating that the purpose of any system is subjectively imputed by its observer.

Given the epistemological assumptions of the VSM above, it therefore sits within the post-positivist paradigm according to the classification of Guba and Lincoln (1994). This classification is summarised in Table 2:



Table 2 (Guba and Lincoln, 1994, pp. 109)

As Table 2 shows, the ontological aspect of the postpositivism paradigm is known as critical realism and stipulates that an objective reality exists, although it is only imperfectly apprehensible. This ontological perspective can be seen as something of a middle ground between the two extremes of positivism and constructivism with Ryan (2006b) commenting that postpositivism accepts that the subjective is of equal validity as the objective. Epistemologically, as discussed in the context of the VSM above, postpositivism abandons the positivist stance that the researcher and the 'object' of study are independent entities, instead accepting that the researcher may influence the object of study, or the object of study may influence the researcher (Guba and Lincoln, 1994).

Whilst this section gives a brief introduction to the philosophical underpinnings of the VSM, we will return to this subject in Chapter 4 when discussing how the philosophical assumptions of the VSM informed the methodology adopted in this research.

2.2.3 Criticisms of VSM

Beer (1984) asserts that each of the five systems (S1-S5) described above are necessary for any system to be viable. Schwaninger (2006) further supports this by stating that the viability of a system will inevitably be prejudiced if this structure is not completely adhered to. However, Jackson (1988) and Sutton (1995) both note that social systems can still maintain a separate existence and, indeed, perform well when not adhering to logical structures, such as that prescribed by the VSM. This is an extremely important point to consider – if systems can still exist when not adhering to the structure of VSM, perhaps the model is wrong – or perhaps something more important to achieve viability is missing from the model. Yolles (2005) agrees with this, suggesting that the VSM structure actually leads to effectiveness and not necessarily existence, with non-viable organisations just suffering from crises that viable organisations do not suffer from. Sutton (1995, pp. 1038) believes that, for this reason, the VSM is better viewed as a tool to “*assess the manner in which viability is being maintained in an enterprise rather than for the presence of appropriate functions... [through appraising] the degree to which [the functions] are efficient, effective and empowering*”. Beer (1979, pp. 115) himself accepts that establishing what is sufficient for viability is difficult – suggesting that only empirical verification, by asking those in a system “*if anything necessary to viability has been left out*” of the VSM, can answer that question.

Beer (1979) suggests that a possible rigorous test to determine whether the components present in the VSM are really all that is needed for an organisation to be viable would be to build an organisation from scratch using only VSM principles. As shown in the next section on the applications of the VSM, this has been done – although any rigour in this method is lost through the people engaged in building the organisation pumping variety into the process – they can adhere to the VSM to the letter in building the organisation but they may also be unknowingly adding something else to the process at the same time (Beer, 1979). Given this, Beer (1979, pp. 115) accepts that, despite the VSM aiming to deliver “*a statement of conditions that are necessary and sufficient*”, the lack of rigour to determine whether the components are sufficient to ensure viability “*means [the VSM] shall fall short of the target – like any good manager*”. Indeed, as with any systems thinking approach, no two-dimensional diagrammatic representation of phenomena can ever fully capture the multidimensional complexity of reality (Brocklesby et al., 1995). Beer (1985, pp. 2) writes “*a model is neither true or false: it is more or less useful*” and it

is this ‘usefulness’ that has led to the use of the model in a range of applications. These applications are reviewed in the next section.

The VSM is often criticised for, what some authors believe has been left out, the attention given to culture within the VSM. Jackson (1988, pp. 566) confirms that there is little doubt that, for the VSM, “*the source of viability of an organisation [is] in its structural arrangements for handling complexity rather than its corporate culture*” possibly leading managers to “*neglect their fundamental role as engineers of an organization’s corporate culture... [leading to] direct dysfunctional consequences for an enterprise*”. Leonard (1999) and Schwaninger and Ríos (2008) do not agree with this, however, as they see S5 in the VSM as the part that handles the cultural aspects of an organisational system. Leonard (2000) sees culture as a significant part of the identity of a system and suggests that it is used as an important attenuator of variety, in order to enable the system to disregard ill-fitting future directions early on. Another criticism is that the VSM is too simplistic to study organisational systems (Rivett, 1977; Checkland, 1980) through it being based upon organismic analogy and therefore may miss the conscious and reflective elements which Dachler (1984) believes are present in all social systems. However, Jackson (1988) does not agree and argues that the VSM, through being underpinned by cybernetic science, has an enormous explanatory power compared to other organisational analysis tools.

However, whilst the VSM does attract the criticisms above, it is generally held in high regard by the management science community. As already stated, Jackson (1988) concludes that the VSM has enormous explanatory power compared to other organisational analysis tools. Indeed, Schwaninger (2004) strongly concurs with this, arguing that its rigour is undoubtedly a strength and claims that the theory has never been falsified. Another strength is the generalisability of the VSM – it is as much applicable to small firms as it is to national governments (Jackson, 2000). This has led to it being used in the wide range of applications detailed in the section below.

2.2.4 Applying the VSM

The VSM has been widely applied, in small/large companies from a range of sectors (Beer, 1979; Ben-Eli, 1989; Brocklesby and Cummings, 1996; Bruning and Lockshin, 1994; Espejo, 1989a; Holmberg, 1989; Warren, 2003; Bassett-Jones et al., 2007; Pollalis and

Dimitriou, 2008; Schwaninger, 2006), industries (Britton and McCallion, 1989; Shaw et al., 2004; Leonard, 1989; Devine, 2005) and governments (Beer, 1981). The application of the VSM in this literature occurs in two different ways. The more common application of the VSM, known as Mode I (Espejo, 1989b), is to use the VSM as a diagnostic tool to identify cybernetic weaknesses in a system that are causing it problems (Brocklesby et al., 1995). The other application, known as Mode II (Espejo, 1989b), is to use the VSM in a design capacity as a template to build a cybernetically-sound system (Brocklesby et al., 1995).

Most applications of the VSM are conducted in its Mode I capability. However, one situation where the VSM was used in Mode II is reported by Holmberg (1989). In this article, the VSM was turned to as the company began to severely struggle financially. The employees at the company were all educated in the VSM to change the culture within the system. Through the gradual acceptance and use of the principles of the VSM structure, it is reported that the company became profitable once more. Schwaninger (2006) also reports on a partial implementation of the VSM at one system (an insurance company) to enable a major re-invention of itself. The company fully re-structured their basic business units to match the structure given by S1 and S2 of the VSM. This has been classed as a major organisational success, enabling the company to build upon a solid foundation for the future.

However, Yolles (1999, pp. 374) points out, "*it is normally the VSM rather than the phases of inquiry of VSM methodology that is stressed in the literature*". This can indeed be seen from the original literature on the VSM. In Beer (1979) and Beer (1981) the VSM is constructed using cybernetic principles but these publications give very little guidance on actually how the model should be applied in order to study organisational viability. Even in Beer (1985), where it is claimed that it is a handbook or manager's guide on how to use the VSM, the book is more geared towards educating managers on what the VSM actually is through a number of exercises to base on their firm, rather than a particular methodology with which to analyse organisational viability.

As a result of this, a number of different methodologies have been developed by different authors to offer a more comprehensive guide to analysing social organisations. The two more common methodologies are Viable Systems Diagnosis (VSD) by Flood and Jackson (1991) and the VIPLAN method by Espejo (1989b) and Espejo et al. (1999). Of these two,

VSD is the more structured through it taking a detailed step-by-step approach for each of S1 through to S5. These steps are shown in Table 3:

The Viable System Diagnosis (VSD) Process

<p>System Identification:</p> <ul style="list-style-type: none"> • Identify/determine purpose(s) to be pursued • Determine the relevant system for achieving the purpose – this is called the “system-in-focus” • Specify the S1 units that are needed for the system-in-focus to accomplish its purpose • Specify the rest of the viable system as a whole <p>System Diagnosis of the System-in-Focus:</p> <ul style="list-style-type: none"> • Study S1: <ul style="list-style-type: none"> ○ for each S1 unit detail its environment, operations and localised management ○ study what constraints are imposed upon each S1 unit by higher management ○ ask how accountability is exercised for each S1 unit, and what indicators of performance are taken ○ model S1 according to the VSM diagram • Study S2: <ul style="list-style-type: none"> ○ list possible sources of oscillation or conflict between S1 units and their environments and identify the elements of the system that have a harmonising or damping effect on these ○ ask how S2 is perceived to identify whether it is threatening or facilitating • Study S3: <ul style="list-style-type: none"> ○ list the elements involved in control ○ ask how S3 exercises authority ○ ask how resource bargaining with S1 is carried out ○ determine where responsibility lies for the performance of S1 units ○ clarify what audit enquiries are conducted into S1 units ○ understand the relationship between S3 and S1 units (e.g. autocratic/democratic) and find out how much freedom S1 units possess • Study S4: <ul style="list-style-type: none"> ○ list all S4 activities ○ ask how far ahead these activities consider ○ question whether these activities guarantee adaptation to the future ○ determine if S4 is monitoring what is happening to the environment and assessing trends ○ assess in what ways, if any, S4 is open to novelty ○ find out if an environment for decision exists that brings together external and internal information ○ question if S4 has facilities to alert S5 to urgent developments • Study S5: <ul style="list-style-type: none"> ○ ask who is involved and how they act ○ assess whether S5 provides a suitable identity for the system-in-focus ○ ask how the ethos of S5 affects the perception of S4 ○ determine how the ethos of S5 affects the S3/4 homeostat ○ investigate whether S5 shares an identity with S1 or whether there are any differences • Check that all information channels, processes and controls are properly designed
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Table 3 (Adapted from: Flood and Jackson, 1991, pp. 94-95)

Through conducting these steps to carry out a VSM diagnosis, Flood and Jackson (1991) believe it will identify the faults present within an organisation. The most common faults these authors highlight are:

- different levels of recursion are defined incorrectly in the organisation
- the organisation fails to see the importance of certain primary activities and so does not treat them as S1 units with their own localised management
- additional irrelevant structures exist within the organisation that do not contribute to viability
- S2-5 try to become viable systems in their own right rather than supporting the S1 activities to achieve viability for the whole system
- S2 is not fully established
- S4 is too weak so recommendations for change are ignored, with S5 only listening to S3
- S3 interferes in the day-to-day running of S1 units
- S5 does not create a strong enough identity, leading to the organisation being unsure of its exact purpose
- the communication channels in the organisation do not correspond to those in the VSM diagram
- transmission of performance data in the organisation is not fast enough

Whilst following the same format as VSD in terms of carrying out steps to identify faults in organisations, the VIPLAN method has more generalised steps than those in VSD. These steps are (Espejo et al., 1999, pp. 661):

1. *establishing organisational identity*
2. *modelling structural activities*
3. *unfolding of complexity: modelling structural levels*
4. *modelling distribution of discretion*
5. *modelling the organisational structure: study, diagnosis and design of regulatory mechanisms (adaptation and cohesion)*

Despite both the VSD and VIPLAN methods having been said to have been successfully applied to organisations (Flood and Zambuni, 1990; Jackson, 2000; Espejo, 1989a), this research believes they are deficient in one specific area. Whilst, Espejo et al. (1999) state that it is necessary to pay attention to the interactions along the communication channels and Flood and Jackson (1991) state that these information channels need to be designed properly, nowhere in the original development of the VSM or in VSD/VIPLAN is

reference made to what information these channels should carry or how it should be carried. Through the development of the VSM, Beer describes *why* the communication channels are present, but he does not define exactly *what* actually flows through them and *how* this occurs. Obviously, taking the VSM as a general model for all systems precludes the precise specification of the information flowing through the VSM, as information flowing in a biological system, for example, will be different to that which flows in an organisational system. However, neither the VSD nor the VIPLAN methods, which are meant for use in analysing social organisations, offer any specific guidance on the role that information should play to sustain viability, other than to give the vague advice that communication channels need to be paid attention to and designed properly. But how can this be done without knowing what information should be present and how it should flow in the VSM? The next chapter looks at this issue in more detail.

2.3 Summary

In summary, the VSM is a modelling technique based on a systems thinking approach. The VSM asserts that viability – the ability to maintain a separate existence – can be achieved through organisations adhering to a specific structure involving five key elements. This chapter has described this structure in detail. The chapter has also explored the criticisms of the VSM by some authors for being too simplistic, putting too much emphasis on total adherence to the VSM structure and ignoring organisational culture. However, it was argued that, despite its limitations, the strong cybernetic foundations of the VSM make it a powerful explanatory tool that can be used to analyse and diagnose viable systems. The chapter then went on to show how the VSM has been applied to a range of different situations, demonstrating the versatility of the approach. The chapter concluded by identifying a limitation of VSM methodology is that it does not offer any specific guidance on the role that information should play to sustain viability. This issue is explored in more detail in the next chapter.

Chapter 3

Information in the Viable Systems Model

3.0 Introduction

This chapter builds on our understanding from Chapter 2 to focus on how information is handled in the VSM. This chapter begins by introducing the literature on what information is present and shared within the VSM. Through a critical analysis of the current literature, an extended theoretical model is then developed in this chapter to identify what information is generated and shared in each element of the VSM. Based upon this extended theoretical model, this chapter then presents five key questions that form the basis of this research.

3.1 Current Literature on Information in the VSM

The previous chapter concluded by identifying that nowhere in the original development of the VSM or in VSD/VIPLAN is reference made to what information VSM communication channels should carry or how it should be carried. The previous chapter identified that if we do not know what information should be present and how it should flow in the VSM, how can we conduct comprehensive diagnoses of communication issues when analysing organisations with the VSM? This is supported by Schwaninger and Ríos (2008) who criticise the VSM for being unable to provide much help with detailed information and communication structures and call for new theories to be explored about the way people interact and what information they need in the VSM. In order to look in detail at this issue, a review of the literature was undertaken.

This literature search showed that information in the VSM has received little attention from only a handful of authors. This is supported by Tsuchiya (2007) who states that research has only just started on this topic and by Paucar-Caceres and Pagano (2009) who, as part of their research on identifying the links between systems thinking tools and information management, identified that only 2 information management articles were

published that used or made reference to the VSM between 1995 and 2005. However, their literature search did only focus on 16 specific journals between 1995 and 2005. As a result of these limitations, a more extensive sweep of the literature was undertaken in this research. This sweep of the literature was conducted using EBSCO, Proquest and Science Direct, as well as edited books, to identify literature from any time period that included the terms (“*viable system* model**” OR “VSM”) AND (“*information*” OR “*knowledge*”) in their titles, abstracts or keywords. The articles found were then sifted through to identify those that made reference to the information that is present in the VSM or how it is shared in the VSM. The search was originally conducted on 7th July 2007 and resulted in 9 relevant articles being found. The search was then repeated on 27th February 2010 to identify any new research that had been published and resulted in one further relevant article being found.

In the articles identified, de Raadt (1990) focused on information transmission during the adaptation process of viable systems, Espejo (1979a) and Espejo (1979b) examined how computers could filter information in organisations for management, Warren (2003) looked at how the communication channels presented in the VSM diagram could be used to develop effective information flows in a small company, Clemens (2009) examined environmental scanning through S4 of the VSM and Bititci et al. (1997) focused on performance measurement information using the VSM. However, these six articles focus on information within a very specific area of the VSM. A more holistic view is taken in Leonard (1999) and Leonard (2000) which begin to look at how information management from the individual and organisational perspective can be modelled using the VSM, although these present more of a general discussion than a comprehensive account of all information present in the VSM. Yang and Yen (2007) look at input, process and output information in the VSM but this is done at a very high-level and provides very little guidance for diagnosis. For example, Yang and Yen (2007, pp. 646) highlight that S3 generates “*decision rules*” for the VSM but provide no details about what information makes up these decision rules, e.g. goals, performance indicators, etc. It has only been in Achterbergh and Vriens (2002) that a detailed attempt has been made to comprehensively identify the types of information necessary to achieve organisational viability using the VSM. Their findings are presented in Table 4:



Table 4 (Achterbergh and Vriens, 2002, pp. 236)

In Table 4, the authors use the notation F1-F5 to represent what is labelled as S1-S5 in the VSM. The letter “G” stands for where they believe the information is generated and the letter “A” stands for where they believe that information is applied.

We can use this model to help us to identify certain information within the VSM. S1 carries out the primary activities in the system and so needs to contain the knowledge required to perform each primary activity. Weick (1969) states that systems must possess a certain amount of knowledge at their inception in order to be viable. This knowledge is labelled ‘*modus operandi*’ in the table above and will reside within S1, either tacitly from the actors within it of knowledge of the processes used to carry out the primary activities, or explicitly as step-by-step procedure documents, copyrights, patents and trademarks, etc.

(Leonard, 2000). Through carrying out the primary activities, S1 will generate information on the '*performance*' of each primary activity detailing data such as outputs for a given time period, for example. Should S1 units fail to meet the '*goals*' set for them, information about the '*causes of goal and performance misalignment*' will reside within them which may enable them to identify '*actions to counter goal and performance misalignment by S1*'. It is important to stress that S1 units may be able to address small performance and goal misalignments themselves but S3 plays a much stronger role in the monitoring and control of S1 performance which is discussed below. Any information on '*problems and needs of the management of S1 activities*' will also arise in the S1 units.

The role of S2 is to co-ordinate S1 activities to achieve synergy. In order to investigate oscillation, S2 needs to understand the '*interdependencies between S1 activities*' and determine the level of '*actual oscillations*'. Once this has been worked out, S2 needs to establish the '*actual performance loss due to oscillations*' and the '*gap between norm for admitted and actual performance loss due to oscillations*' that is set by S3. If the actual performance loss exceeds the permitted loss, S2 needs to determine the '*causes of the gap between admitted and actual performance loss due to oscillations*'. Based upon this, '*experiences with anti-oscillatory measures*' will be used along with '*heuristics to implement counteractions*' in order to determine the '*anti-oscillatory measures*' to be undertaken by S2.

S3 monitors and controls the operational elements of the system. To do this, S3 sets '*expected performance of the primary activity (goals for S1 activity)*' and then utilises '*monitoring practices by S3*' to determine the '*goal and performance misalignment*' and the '*consequences of goal and performance misalignment*'. S3 also sets the '*norms for admitted performance loss due to oscillations (goals for S2)*' and decides on any '*control practices by S3*' in S1 it deems necessary. S3 also carries out '*reviews by S3 of proposals for innovation*' made by S4 by identifying the '*desired goals for S1 based on proposals for innovation*' and working out the '*gap between desired and current goals of S1*'. Having identified this, S3 compares the '*required capacity for reorganization of S1 activities*' with the '*actual capacity for reorganization of S1 activities*' to determine the '*gap between required and actual capacity for reorganization of S1 activities*'. Following this review, S3 will work with S4 to propose '*finalized plans for adaptation of organizational goals (a joint S3 and S4 product)*' to S5.

Organisations are adaptive systems which need to be able to change goals to maintain their viability (Achterbergh and Vriens, 2002). It is the role of S4 to look for '*developments in the relevant environment of the organization*', so that it can make '*proposals for innovation made by S4*' to suggest necessary changes. To do this, S4 carries out a number of activities, such as R&D, market research, attending conferences and reading literature (Leonard, 1999; 2000). Conversations between people within the system and those in the external environment are also important for S4 to sense emerging market needs and trends (Leonard, 1999). These innovations might be in the form of identifying new products that the system could produce, identifying training for employees or proposals to recruit staff (Leonard, 1999; 2000). Once the innovation proposals have been reviewed by S3, S4 works with S3 to generate '*finalized plans for adaptation of organizational goals (a joint S3 and S4 product)*'.

The role of S5 is to set the '*organizational goals*' that provide the system with an identity, which is important to provide a focus for the system to follow a direction (Leonard, 1999). A key function of S5 is that it pays particular attention to the tension that naturally arises between S3 and S4. This tension is due to the desire of S3 for stability and the desire of S4 for adaptation in a VSM (Jackson, 1988). S5 controls this tension through using the S3/4 homeostat, which maintains the balance between the present activities and activities that are oriented towards the future in the system (Leonard, 1999). S5 determines the level of '*actual imbalance between S3 and S4*' and, as this balance tends to fluctuate over time, Leonard (1999) stipulates that S5 should monitor this balance regularly. If an imbalance is present that is above the '*norms for balance between S3 and S4*', S5 needs to determine the '*causes of imbalance between S3 and S4*' and use its '*experiences with regulatory measures to counter the imbalance between S3 and S4*' to determine '*regulatory measures to counter the imbalance between S3 and S4*'. If S3 and S4 are not balanced by S5, the system may either ignore relevant environmental developments that the system needs to adapt to, or may implement new innovations without having the necessary operational capabilities to carry them out successfully (Achterbergh and Vriens, 2002).

Whilst the Achterbergh and Vriens (2002) model currently offers the most comprehensive insight into the information present within a VSM, through analysing it in comparison to the other literature identified in the search described above, it is argued here that their model does not capture all of the information inherent in the VSM. The next section will

highlight the areas where this research suggests the Achterbergh and Vriens (2002) model is deficient.

3.2 Development of the Extended Theoretical Model

Through examining the Achterbergh and Vriens (2002) model in comparison to the literature discussed above, and also other literature available on the VSM, seven omissions from the Achterbergh and Vriens (2002) model were identified in this research. This section will now discuss each omission in detail before presenting an extended theoretical model of the information generated and applied in the VSM.

The first omission this research identified in the Achterbergh and Vriens (2002) model is that it makes no reference to the interaction between S1 and the environment that is shown to occur in the VSM diagram in Figure 11 by the channels linking S1 to the environment. In the Second Principle of Organisation detailed in Chapter 2, Beer (1979) explicitly states that there are channels that carry information between the operation and the environment but the information carried along this channel is not detailed in the model by Achterbergh and Vriens (2002). Leonard (1999) believes that S1 units all engage in iterative information exchanges with their external environments, acquiring information about operations from suppliers, contractors, outside experts, competitors and from customers. She also believes that general information about the customers S1 units deal with, such as demographics, markets and preferences, and more specific information, such as which customer bought which products and how much for and what they liked or complained about, flow between the environment and S1. Further examples of information flow between the environment and S1 are when customers or suppliers help the organisation to design or produce particular products. Information from the external environment may also be used as an input to a process, or as an output of a process, in S1 units. An example of output information would be teachers in a school transferring educational information to their students in the external environment, in order for the S1 unit primary activity (teaching) to occur.

The second omission from the Achterbergh and Vriens (2002) model identified through synthesising the literature is that of operational information. Leonard (1999; 2000) believes that information, such as patent expiry dates, maintenance records, project reports and

personnel records of operational staff, resides within S2 of the VSM. The idea behind operational information being held at S2 is to provide centralisation of this information, so that it is quickly available and ready to disseminate to the S1 units when required. For example, if one of the S1 units needed a speaker of another language it could find out from the personnel records held in S2 which S1 unit had a speaker fluent in the required language, rather than have to ask all of the S1 units separately. Equally, if a project report was needed by a S1 unit, it is quicker to obtain it from S2 rather than first try to identify which other S1 unit carried out the project and then ask it for a copy of the report. S2 holding operational information reduces the opportunity for 'islands' of information to exist, where information becomes isolated in S1 units, preventing other S1 units from accessing the information.

The third omission from the Achterbergh and Vriens (2002) model is the information flowing between S3 and S1 concerning the resource bargaining that was described in Chapter 2. Whilst the Achterbergh and Vriens (2002) model describes S3 setting goals for S1 units and S1 units providing S3 with information about their needs, the model misses out the information used in the negotiation process that ensues. This resource bargaining is said by Leonard (1999) to often take place in real-time, with adjustments being constantly made to changing conditions. Whilst information such as management accounting and performance figures are often used in order to base decisions about resource allocation, knowledge also needs to be drawn upon of how people in the operations work together and of the work that they perform to help determine resource allocation (Leonard, 2000). S3 should aim to allocate resources in such a way as to gain the highest performance of the whole system (Leonard, 2000).

The fourth omission from the Achterbergh and Vriens (2002) model identified was that S4 can attempt to influence the external environment in order to manipulate it to benefit the system (Jackson, 1988). An example would be for S4 to try to change customer desires to that of products a system produces using advertisements. This manipulation can, however, sometimes be dangerous as it may lead to the damage of relationships that the system depends upon in the external environment (Morgan, 1982). For example, an organisation may accidentally upset a supplier if one of its advertising campaigns inadvertently manipulates customer demand away from another product that a supplier also produces.

The fifth omission from the Achterbergh and Vriens (2002) model arises from the model stating that S5 needs to determine overall organisational goals to steer the organisation. However, organisational goals do not emerge on their own – they are bound to the knowledge of the organisation’s past experiences, their level of development, their relationships and the social, business and economic environments in which they exist (Leonard, 1999). These aspects make up the culture of the organisation and knowledge of such is not present in the model of Achterbergh and Vriens (2002).

The sixth omission from the Achterbergh and Vriens (2002) model is that the model does not make any specific reference to S3* in the VSM. The sole purpose of S3* is to conduct audits for S3, which Beer (1985) believes should be made distinct from S3. S3* needs to determine the best way to conduct the audit and may choose from a range of investigative techniques, such as looking through documentation, observation, creating models/simulations, conducting interviews or carrying out some sort of measurement (Leonard, 2000). Whilst explicit information, such as patents, are relatively easy for S3* to identify and investigate, it is much harder to identify and investigate tacit information in the form of employee skills and capabilities. Due to this, S3* often tends to investigate processes rather than the actual information base if it is auditing intellectual capital (Leonard, 1999). Examples of such would include investigating whether the infrastructure of S1 supported adequate communication between different primary activities or whether there were systems in place to quickly locate employees with a specific skill set needed (Leonard, 1999). S3* will then conduct the audit in order to generate the results of the audit for S3.

The final omission from the Achterbergh and Vriens (2002) model is that it does not include the algedonic signal, which was described in Chapter 2 as enabling other functions in the VSM to alert S5 to potential danger.

Given these omissions from the model, it is argued here that the Achterbergh and Vriens (2002) model should be extended to encompass the following types of information:

- interaction between S1 and the environment
- operational information
- resource allocation
- manipulation of the external environment

- cultural knowledge
- S3* auditing
- algedonic signal

For this reason, a new theoretical model of the information generated and applied in the VSM has been created and is presented below in Table 5:

Extended Theoretical Model

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
1	External environment information	G, A	A				A	
2	Goals set by performance and modus operandi of the primary activities in S1		G, A	A	A	A	A	
3	Organisational goals		A		A		A	G, A
4	Expected performance of the primary activity (goals for S1 activity)		A		G, A			
5	Monitoring and control practices by S3		A		G, A			
6	Goal and performance misalignment		A		G, A			
7	Causes and consequences of goal and performance misalignment		G, A		G, A			
8	Actions to counter goal and performance misalignment by S1		G, A					
9	Heuristics to implement counteractions		G, A					
10	Operational information		A	G, A				
11	Anti-oscillatory measures		A	G, A				
12	Interdependencies between S1 activities			G, A				
13	Actual oscillations			G, A				
14	Actual performance loss due to oscillations			G, A				
15	Norms for admitted performance loss due to oscillations (goals for S2)			A	G, A			
16	Gap between norm for admitted and actual performance loss due to oscillations			A	G, A			
17	Causes of the gap between admitted and actual performance loss due to oscillations			G, A				
18	Experiences with anti-oscillatory measures			G, A				
19	Problems and needs of the management of S1 activities		G, A		G, A			
20	Resource allocation		A	G, A	G, A			
21	Manipulation of external environment	A					G, A	
22	Proposals for innovation made by S4				A		G, A	A
23	Desired goals for S1 based on proposals for innovation				G, A			
24	Gap between desired and current goals of S1				G, A			
25	Required capacity for reorganisation of S1 activities				G, A			
26	Actual capacity for reorganisation of S1 activities				G, A			
27	Gap between required and actual capacity for reorganisation of S1 activities				G, A			
28	Auditing				A	G, A		
29	Reviews by S3 of proposals for innovation				G, A		A	A
30	Finalised plans for adaptation of organisational goals (a joint S3 and S4 product)				G, A		G, A	A
31	Regulatory measures to counter the imbalance between S3 and S4				A		A	G, A
32	Developments in the relevant environment of the organisation						G, A	
33	Norms for balance between S3 and S4							G, A
34	Actual imbalance between S3 and S4							G, A
35	Causes of imbalance between S3 and S4							G, A
36	Experiences with regulatory measures to counter the imbalance between S3 and S4							G, A
37	Cultural knowledge	A	A	A	A	A	A	G, A
38	Algedonic signal	G, A	G, A	G, A	G, A	G, A	G, A	A

Table 5

Table 5 shows the extensions made to the theoretical model in red. There is, however, a further omission made in the Achterbergh and Vriens (2002) model that also presents itself in this extended theoretical model. This omission is that the model does not include the information flow between different S1 units, as represented by the fuzzy line between different S1 units in the VSM diagram in Figure 11. Beer (1985) makes this link explicit as communication channel (iii) in Figure 8 and Leonard (1999) supports this channel being present in the VSM by stating that different S1 units often have common processes, technology and customers, which enables them to learn from each other using this channel. Communities of practice between different S1 units are an example of the use of this communication channel. However, the Achterbergh and Vriens (2002) model does not

model this as it represents S1 as being one ‘system’, which makes the model more concise to use, rather than breaking S1 down into its constituent units. For example, if five S1 units were present in a VSM, the model would have to duplicate all of the S1 information domains for each of the S1 units, increasing the size and complexity of the model. Therefore, the approach of treating S1 as one ‘system’ has also been adopted in Table 5 as it makes its use as an analysis tool (described in Chapter 4) more concise through grouping information domains for all S1 units. However, it should be noted that by doing this, the information sharing across one of the communication channels is not represented in the model. Whilst the model itself does not represent this, the analyses in this research will consider this communication channel as shown in the next section where the research questions about how information is shared in the VSM are discussed.

3.3 Research Questions

This section uses the discussion from building the extended theoretical model in the previous section to identify specific research questions that the current literature does not answer about the role that information plays in sustaining organisational viability.

The previous section highlighted theoretical omissions from the Achterbergh and Vriens (2002) model and developed an extended theoretical model to include these. However, these additions to the model have been derived from the literature and have not been empirically tested. Achterbergh and Vriens (2002) also do not provide evidence of empirical testing on their model and, through using InterScience citation tracking (carried out originally on 7th July 2007 and then again on 27th February 2010 to include any new research), no other work detailed in the literature has been carried out using their model. This lack of empirical evidence casts potential doubt over whether the extended theoretical model is actually an accurate account of what information is present in an organisational VSM. The Achterbergh and Vriens (2002) model is also presented as being at the recursion level of the company, which may lead to different information being present at different levels of recursion in the extended theoretical model. For this reason, this research will empirically test the extended theoretical model presented in Table 5 through answering the following question:

1. *What information is present within viable organisations at one level of recursion?*

Through identifying where information is generated and then applied, the extended theoretical model in Table 5 also shows where information needs to be shared in the VSM. However, this again has not been empirically tested and leads to this research further empirically testing the extended theoretical model presented in Table 5 through answering the following question:

2. *What information is shared within viable organisations at one level of recursion?*

However, these questions still do not give us a complete overview of information sharing in the VSM and the Achterbergh and Vriens (2002) model makes no reference to how information sharing actually occurs in the VSM. It was identified in Chapter 2 that the VSM has a number of communication channels that this information is shared through. In order to understand how information sharing occurs in the VSM, the communication channels that each type of information is shared across need to be identified. To do this, each of the communication channels have been labelled A-M on a simplified VSM diagram in Figure 13:

VSM Communication Channels

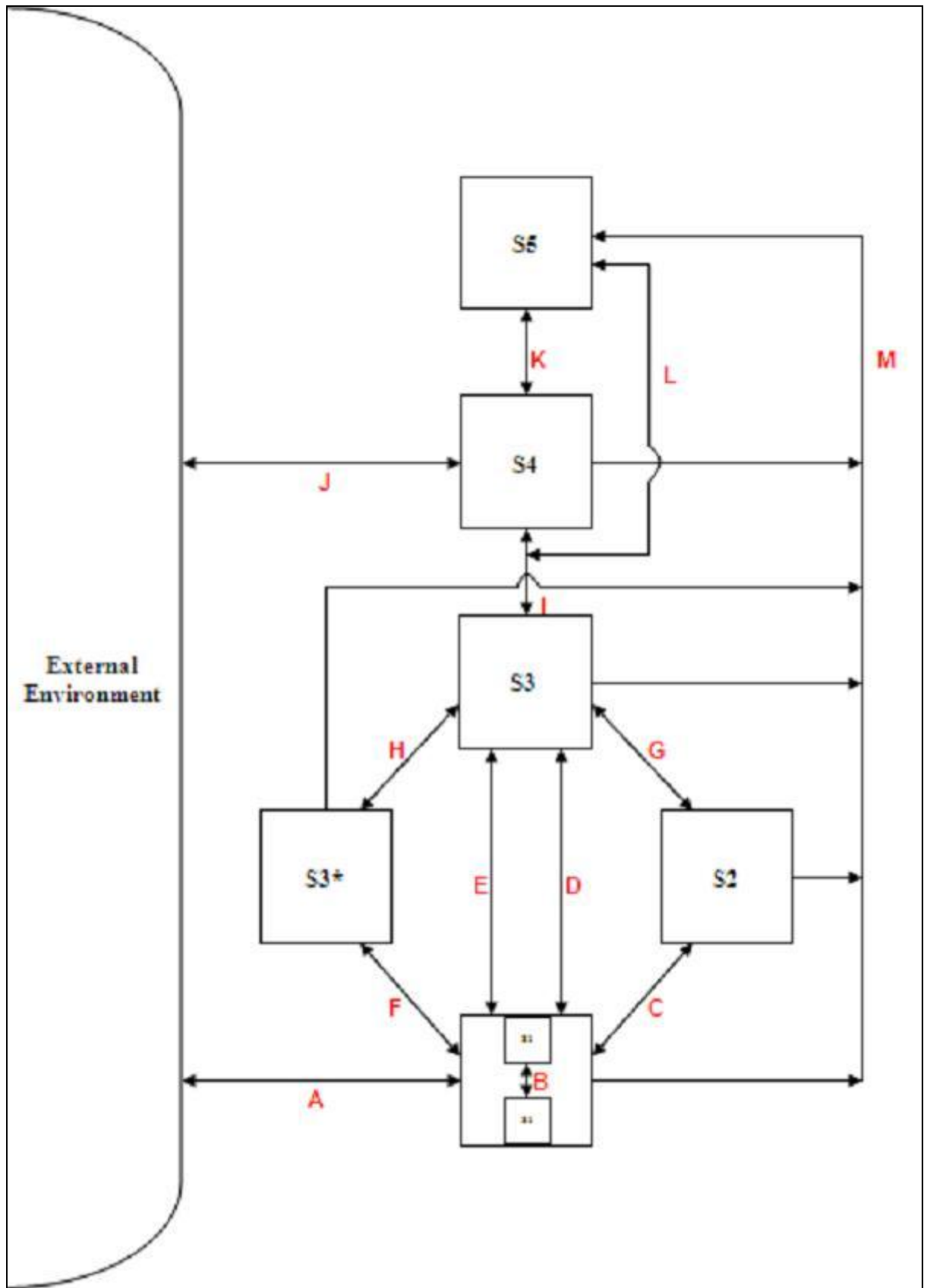


Figure 13

The traditional names from the VSM literature of the communication channels in the VSM have been used in the key for Figure 13 in Table 6. Where names have not previously been assigned to particular communication channels in the VSM literature, a name has been assigned in the key that describes the linkage between the different elements of the VSM either end of the communication channel:

VSM Communication Channels Key

Label	Communication Channel
A	S1-External Environment
B	operational linkages
C	anti-oscillation
D	corporate intervention
E	resource bargain
F	audit
G	S2-S3
H	S3-S3*
I	S3-S4
J	S4-External Environment
K	S4-S5
L	S3/4 homeostat
M	algedonic signal

Table 6

Using the extended theoretical model in conjunction with Figure 13, this research will then be able to explore the following research question:

3. *How does information sharing occur within viable organisations at one level of recursion?*

The research questions posed so far enable us to determine what information should be generated in an organisational VSM, where it should be generated, where it should be shared and through which communication channel it should be shared. However, the extended theoretical model in Table 5 does not show how the information at one level of recursion in the VSM relates to other levels of recursion. Espejo et al. (1999) argue that the interactions between two successive recursion levels are at the core of the VSM in order to achieve cohesion. For this reason, this research will also consider the following question:

4. *What information is shared between different levels of recursion in viable organisations?*

Leonard (1999) states that the recursion level directly above and directly below the system-in-focus should be studied when carrying out VSM investigations. For this reason, the research will look at the three recursion levels of 0, 1 and 2. It can also be seen from the VSM diagram in Figure 11 that there are communication channels present between the different recursion levels shown in the model, with S5 at the higher level of recursion linked to S5 of the lower recursion level, S4 at the higher level of recursion linked to S4 of the lower recursion level and so on until S1. However, the VSM literature is limited in describing how information at one level of recursion in the VSM is shared with other levels of recursion. For this reason, this research will also consider the following question:

5. *How does information sharing occur between different levels of recursion in viable organisations?*

These research questions drove the selection of the data collection and data analysis approaches for the research, as described in the next chapter.

3.4 Summary

In summary, this chapter analysed the literature to identify how information is handled in the VSM. The literature search conducted showed that information in the VSM has received little attention, from only a handful of authors, and that only Achterbergh and Vriens (2002) have made a detailed attempt to comprehensively identify the types of information necessary to achieve organisational viability using the VSM. However, through a critical analysis of the current literature, this chapter has argued that Achterbergh and Vriens (2002) omitted seven types of information that are also thought to be present in the VSM. As a result, an extended theoretical model was developed in this chapter to identify what information is generated and shared in each element of the VSM. Based upon this extended theoretical model, this chapter then presented the five key questions that form the basis of this research, specifically:

1. *What information is present within viable organisations at one level of recursion?*
2. *What information is shared within viable organisations at one level of recursion?*
3. *How does information sharing occur within viable organisations at one level of recursion?*

4. *What information is shared between different levels of recursion in viable organisations?*
5. *How does information sharing occur between different levels of recursion in viable organisations?*

The next chapter describes how these research questions were used to select the methodology used to carry out the research.

Chapter 4

Methodology

4.0 Introduction

This chapter uses the research questions developed in the previous chapter to guide the development of the methodology used in this research. This chapter describes how and what data was collected and looks at the limitations of this approach. The chapter then moves on to describe the techniques used to analyse the data collected and also discusses the limitations of these techniques.

4.1 Philosophical Underpinnings

Smith and Dainty (1991) claim that the assumptions of the research framework must be understood when undertaking a piece of research for it to be completed successfully and that an understanding of alternative perspectives is necessary so that a research approach is developed that is appropriate to the research questions being asked. It is in this section then that the assumptions of different research frameworks are examined to determine the most appropriate for this research. Healy and Perry (2000) state that scientific research paradigms are the overall conceptual frameworks within which researchers work. Deshpande (1983, pp. 101) expands on this, defining it as the “*set of linked assumptions about the world which is shared by a community of scientists investigating the world*”. As was shown in Table 2, Guba and Lincoln (1994) set out that there are four such paradigms: positivism, postpositivism, critical theory and constructivism, each characterised by three elements: ontology, epistemology and methodology. Healy and Perry (2000, pp. 119) describe each of these elements as “*ontology is the “reality” that researchers investigate, epistemology is the relationship between that reality and the researcher, and methodology is the technique used by the researcher to investigate that reality*”.

Each of the paradigms summarised in Table 2 will now be considered in turn to determine which perspective is the most appropriate for this research. Positivism is the paradigm

upon which the standard view of ‘science’ derives (Robson, 2002) and, as a result, predominates in the natural sciences (Healy and Perry, 2000). Guba and Lincoln (1994) state that, ontologically, the positivist paradigm stipulates that reality is ‘real’ and that people can apprehend it. Epistemologically, positivism assumes that research can be conducted in an objective way, without being affected by the values of the researcher (Bryman, 2001). Positivism further assumes that the researcher and item of study are independent, suggesting that the researcher can carry out the investigation without influencing it or being influenced by it (Guba and Lincoln, 1994). Methodologically, positivism advocates the application of methods used in the natural sciences to study social reality (Bryman and Bell, 2007) and assumes that independent variables can be measured (Healy and Perry, 2000).

As part of the history of positivism, sociology emerged in the early to mid-nineteenth centuries and early sociologists took the existing scientific approach that was being used in the natural sciences and applied it to the social world (Scott, 2002). Durkheim (1938, pp. xiv) highlights that “*the sociologist put himself in the same state of mind as the physicist, chemist, or physiologist when he probes into a still unexplored region of the scientific domain*”. As a result, society was deemed to run on sets of universal laws in the same way as the natural sciences adhere to and this positivist thinking remained the dominant sociological paradigm until at least the 1960s (Scott, 2002). However, in the 1960s other paradigms began to challenge positivism in sociology, with criticism of positivism including (Robson, 2002):

- social phenomena do not exist ‘out there’ but in the minds of people, with reality not being objective but subjective
- it is difficult for the researcher to not affect the phenomena being studied when conducting research
- the emphasis on quantitative methods in positivism cannot capture the meaning of social behaviour

This last criticism relates to the discussion on reductionism in Section 2.1.1. As noted by Hesse (1980), the positivist paradigm is reductionist. In Section 2.1.1 the limitations of reductionism were discussed at length and it was shown how the systems thinking movement evolved as an attempt to overcome these limitations. To quickly recap, reductionism involves the approach to scientific enquiry developed by Descartes

(1637/2008) of dividing phenomena into their simplest constituent parts and then analysing these to gain an understanding of the more complex whole. However, as shown in the discussion of Section 2.1.1, this approach breaks down when trying to explain the behaviour of certain complex phenomena. It was this that led to the idea of “emergent properties” being present in phenomena – properties that could not be explained from the characteristics of their isolated parts alone (von Bertalanffy, 1968). Section 2.1.1 went on to discuss why reductionism was not suitable for this research and presented the problems discussed in the literature about applying reductionism to complex, real-world social situations. Indeed, Section 2.1.1 noted that social situations involve a set of highly interdependent constituent parts and the relationships between these parts may be more important than the actual parts themselves (Jackson, 2000). As a result it was determined that systems thinking, advocating “holism” to concentrate on the whole and analyse the relationships between the parts to identify emergent properties (Jackson, 2000), would be used in this study. As a result, positivism was not considered further as a potential paradigm for this research.

Interpretivism is a term given to an orthodoxy that provides the completely contrasting epistemology to positivism (Bryman and Bell, 2007). Despite having its roots in the 19th century, interpretivism was relatively unsuccessful and unpopular until the 1960s when social scientists began to open their work up to approaches other than the positivistic scientific approach (Scott, 2002). Interpretivism views the subject matter of social science as being fundamentally different to that of natural sciences and so therefore requires a different logic of research procedure to positivism (Bryman, 2001). Scott (2002) highlights that the philosophical strand running through interpretivism is that the world is not something that exists in an objective sense, rather it exists through people’s perceptions of it. This author goes on to state that everything is perception in interpretivism and, as a result, we must explore those perceptions in order to explore the world. Interpretivism is said by a number of authors (e.g. Riccucci, 2010; Lum, 2002; Robson, 2002) to be synonymous with, or very similar to, constructivism – which is one of the paradigms classified in Table 2. Ontologically, constructivism sees reality as constructed through human intellect (Guba and Lincoln, 1994). Epistemologically, constructivism is subjectivist, with reality being constructed through interaction between researchers and participants (Robson, 2002). Another paradigm with a subjectivist epistemology is critical theory (Guba and Lincoln, 1994). Ontologically, critical theory sees reality being constructed over time through social, political, cultural, economic, ethnic and gender

values (Healy and Perry, 2000). In direct contrast to positivism, this focus on values in critical theory acknowledges that findings from research are influenced by researcher values (Miller and Brewer, 2003).

The subjectivist epistemology of constructivism and critical theory enables social researchers to explore experience and perception in order to explore the social world (Scott, 2002). However, Bhaskar (1998) highlights the argument against the totally subjective nature of reality, stating that objects, entities and structures must exist (although not necessarily be observable) to generate events that humans observe. The argument can be demonstrated by a major cornerstone of natural science – replication of findings – where experiments need to bring about particular outcomes repeatedly, regardless of who carries out the experiment, for findings to be regarded as secure (Robson, 2002). This suggests there must be some natural structures that exist, be they atoms, organisms, etc., that are independent of the experimentalist to bring about repeatable outcomes. However, this argument alone assumes that the natural world and social world are fundamentally the same – something which needs to be considered much more carefully. Bhaskar (1979) and Mingers (2000) accept that a number of differences exist between these two worlds:

1. natural laws are not affected by their own operation, whereas social structures can only exist as a result of social activity
2. natural laws are generally universal, whereas social structures are localised in terms of space and time
3. natural laws are independent of our conceptions of them, whereas social structures cannot exist independently of a conception of who they are and what they are doing and thus always require some degree of interpretation/understanding of the meaning of their actions
4. phenomena in the natural world are relatively easy to isolate and control in the laboratory, whereas social situations are inherently interactive and open and subject to a multitude of factors that are very difficult (perhaps impossible) to recreate in laboratory settings
5. phenomena in the natural world have characteristics that make them generally easy to measure and compare, however, intrinsically the phenomena in social situations are meaningful, which makes it much more difficult to measure or compare them

6. natural laws are static but social science is itself a social product shaped by social conditions and its practice produces social scientific knowledge that may affect and change the social world being studied

As a result of these differences between the natural and social world, it would be inappropriate to simply dismiss paradigms with a subjectivist epistemology as making incorrect assumptions. Indeed, difference number 3 above in particular gives rise to what Section 2.1.3 shows is the most commonly used systems thinking approach currently available – soft systems methodology. Rather than perceiving the social world as a system, SSM defines that “*‘the system’ is no longer some part of the world which is to be engineered or optimised, ‘the system’ is the process of enquiry itself*” (Checkland and Scholes, 1990, pp. 277). The constructivist premise of SSM is that nothing is intrinsically a ‘situation’ but it is the ‘perceptions’ of humans that create a situation, with each human having different perceptions of that situation based upon their different taken-for-granted assumptions about the world (Checkland and Poulter, 2006). A simple example of this are terrorist acts, which to other people are thought of as freedom fighting acts. SSM is used for bringing about change in problematic situations and works by examining different people’s perceptions of a situation to build understanding that can be used to identify changes that accommodate each person’s different view of the problematic situation (Checkland and Poulter, 2006). However, whilst the focus of SSM and other purely subjectivity based approaches is on changing social systems through changing people’s world views (Flood and Jackson, 1991), this is incompatible with the VSM’s objectivist approach – that an objective ‘real world’ system can be made viable through it adhering to the model. Given that the VSM is at the very heart of this research and the research questions are formed from the theoretical foundations of the VSM, critical theory and constructivism could not be considered further as potential paradigms for this research.

The preceding discussion has shown that, whilst there is validity in the assumptions made by other paradigms in Table 2, they are not fully compatible with this research. The discussion will now present how the research fits with the remaining paradigm in Table 2 – postpositivism.

The ontological aspect of the postpositivism paradigm is known as critical realism and stipulates that “*phenomena are produced by mechanisms that are real, but that are not directly accessible to observation and are discernable only through their effects*” (Bryman

and Bell, 2007, pp. 628). This implies that an objective reality exists, although it is only imperfectly apprehensible (Guba and Lincoln, 1994). Realism research studies perceptions of participants in order to “*provide a window on to a reality beyond those perceptions*” (Healy and Perry, 2000, pp. 120). This ontological perspective enables the objectivist ontology of positivism and the subjectivist ontology of critical theory/constructivism to co-exist (Robson, 2002), with Ryan (2006b) commenting that postpositivism accepts that the subjective is of equal validity as the objective. Epistemologically, postpositivism abandons the positivist stance that the researcher and the ‘object’ of study are independent entities, instead accepting that the theories, hypotheses, knowledge and values of the researcher may influence the object of study (Reichardt and Rallis, 1994), or the object of study may influence the researcher (Guba and Lincoln, 1994). On the face of it, postpositivism appears to immediately placate the problems with the other paradigms discussed above – it provides the objective reality the VSM needs to work, whilst not reducing the social world down to the isolated variables of reductionism. Drawing on the work of Mingers (2000) provides further insight into why postpositivism is a highly appropriate paradigm for research of this nature:

1. it enables an objective realist ontological stance whilst addressing the major criticisms of positivism for social science
2. it addresses the properties of both the natural and social sciences
3. it fits well with the use of systems thinking as an applied discipline

Given the appropriateness of the postpositivist paradigm for stipulating that a real world exists, as necessary for the VSM to operate, whilst being sensitive to acknowledging that humans have the ability to think, form opinions and comprehend their own behaviour differently in the social world (Shaw, 1999) – postpositivism was selected to be the paradigm for this research. Whilst using the postpositivist approach in this research it is recognised that the other paradigms give rise to contradictions to the use of postpositivism. As Ryan (2006b) states, whilst we can examine the contradictions and the tensions these different paradigms engender, we have to recognise that we are unable to control or resolve them definitively – something which this research (and indeed all research) has to live with. As Bhaskar (1979, pp. 170) suggests, postpositivist epistemology “*is fallible, as corrigible as the outcome of any other piece of human argument. I... regard it as merely the best account (at present) available*”. Having argued that postpositivism is the most

appropriate paradigm, the discussion will now turn to explore the methodological approaches available for this research.

4.2 Data Collection

Ryan (2006a) states that the choice of data collection methods are guided by the nature of the research questions and Chapter 3 determined that the following questions would be analysed in this research:

1. *What information is present within viable organisations at one level of recursion?*
2. *What information is shared within viable organisations at one level of recursion?*
3. *How does information sharing occur within viable organisations at one level of recursion?*
4. *What information is shared between different levels of recursion in viable organisations?*
5. *How does information sharing occur between different levels of recursion in viable organisations?*

As can be seen from these questions, the research focuses specifically on the generation and sharing of information in viable organisations. We have already considered the notion of viability in Chapter 2 – the ability to maintain a separate existence – but what do we mean by ‘organisation’? An organisation, according to Robbins (2005, pp. 4) “*is a consciously co-ordinated social unit, composed of two or more people, that functions on a relatively continuous basis to achieve a common goal or set of goals*”. This definition implies that manufacturing companies, service companies, schools, hospitals, etc. are organisations, as are other levels of recursion, as discussed in Chapter 2, such as company divisions and project teams. As a result, the first methodological decision to be made was to determine the type(s) of organisation this research should study in order to answer the research questions.

Given that the Achterbergh and Vriens (2002) model is developed for the company-recursion level, companies were chosen as one of the types of organisation for which data would be collected. This was chosen so that the comprehensiveness of the extended theoretical model could be tested by using it in its original context, to avoid criticism that

any omissions found in the extended theoretical model simply arose because the research examined an entity for which the model was not originally built. However, as discussed in Section 3.3, due to the model being originally developed for the company-level of recursion, different types of information may be present at different levels of recursion that are not included in the extended theoretical model. As a result, project teams were also selected to be studied to provide a comparison between recursion levels. The choice of project teams over the higher recursion levels, such as industry, was resource led – to examine an entire industry in the depth required would have taken far more time than was available to conduct this research. Project teams were chosen over other lower recursion levels, such as departments, to provide the greatest relevance of this research to current and future working practices, as many companies are becoming increasingly more dependent upon project teams to accomplish their tasks (Rubery et al., 2002; Huang and Newell, 2003; Drucker, 1998; Gareis, 1996).

One approach available to conduct research with are classic scientific laboratory experiments, which examine phenomena in a controlled setting (e.g. a laboratory) and has been extremely successful for research in the natural sciences (Adi, Amaeshi and Tokunaga, 2005). Scientific laboratory experiments are based upon the ‘scientific method’, which is an approach that undertakes “*systematic, controlled observation or experiment whose results lead to hypotheses which are found valid or invalid through further work, leading to theories that are reliable*” (Baur, 1992, pp. 19). Finley and Pocoví (2000) further highlight that unbiased observations are used to justify scientific conclusions. This emphasis on observation focuses scientific method on the material and physical world, which “*does not account for the full nature of human beings as... beings endowed with the mental and spiritual capabilities to project beyond the observable spatio-temporal dimensions of reality*” (Adi et al., 2005, pp. 14). It was shown in Section 4.1 that positivism assumes that phenomena must be observable and that the researcher is independent of the ‘object’ of study and therefore will not influence it. As a result, the scientific method is positivist (Robson, 2002), which in Section 4.1 was shown to be a poor fit with this research due to the reductionist nature of the paradigm. As a result, scientific laboratory experiments were rejected as an approach for undertaking this research.

Another approach based on the positivist paradigm are quantitative approaches. For example, financial data can be sourced from secondary sources of data such as financial databases and various statistical techniques can be applied. We have already seen in

Section 2.1.3 that operational research methods, with their focus on mathematical modelling (Jackson, 2000), were unsuitable for this research as it would be very difficult to model the more social elements of this research highlighted in Chapter 1 mathematically. Evered and Louis (1991) suggest that quantitative approaches overlook human behaviour and Shaw (1999) believes that the social world should not be reduced to the isolated variables that quantitative research methods dictate. As a result, a quantitative research approach was determined to not be able to capture the more social element of information management and so was rejected as an approach.

One approach that has a high quantitative element to it, but can also encompass the more social dimension of research are social surveys (Miller and Brewer, 2003). Survey research collects standardised data from a sample of people in order “*to define or describe variables, or to study relationships between variables*” (Malhotra and Grover, 1998). The word ‘variables’ in this description suggests that the data should be quantifiable. Whilst this is often the case (Malhotra and Grover, 1998), surveys can also encompass open ended questions to provide exploration of some area (Robson, 2002). Miller and Brewer (2003) highlight there are three main types of survey:

- the postal survey – where the participant fills out a standardised questionnaire by themselves and sends it back to the researcher
- the telephone survey – where the standardised questions are asked over the phone to a participant with the researcher writing down the responses
- face-to-face survey – where a questionnaire is either filled out by the participant with the researcher on hand to clarify any questions or the standardised questions are asked face-to-face to the participant with the researcher writing down the responses

Survey research is one of the most widely used research approaches and enables data to be collected from a large number of people (Miller and Brewer, 2003). However, Pinsonneault and Kraemer (1993) highlight that surveys are limited if trying to gain a detailed understanding of context. Shaw (1999) believes that when studying the social world it is important to capture the *real-life context* of the phenomena being studied. Given this, it was important to carry out a detailed study of what was going on *inside* organisations to understand the human activity and social processes that provide the real-

life context of information generation and sharing. As survey research struggles with this requirement, it was rejected as an approach for this research.

Focusing on this requirement for a methodological approach that would enable the research to be conducted *inside* the organisation, Braa and Vidgen (1995) identify that there are three methodological approaches that can enable study within an organisation: field experiment, action research and case study. Field experiments are an extension of the classic scientific laboratory experiment described above in this section. However, whilst scientific laboratory experiments are conducted in an artificial and controlled setting, field experiments are conducted within an organisational setting, providing a more realistic environment than is possible in a laboratory (Braa and Vidgen, 1995). Robson (2002) highlights that this makes it much easier to generalise results to the real-world, given that the research was already conducted within the real-world. Action research is an approach that enables learning through change (Letwin, 1946). It involves researchers and practitioners working together in an iterative process involving problem diagnosis, action intervention, and reflective learning (Avison et al., 1999). This reflective learning enables action research to build and test theory within the context of practice itself (Braa and Vidgen, 1995). Bryman and Bell (2007) highlight a key strength of action research is that it bridges the gap between researchers and practitioners, creating output from action research that is more readable and relevant to both practitioners and academics. A case study is a methodological approach that focuses on a single ‘case’ or multiple ‘cases’ to develop intensive, detailed knowledge about them (Robson, 2002). A ‘case’ is an object of interest – for example a situation, an organisation, a location, a person or an event – and the researcher aims to provide a detailed elucidation of it (Bryman and Bell, 2007). Case studies enable researchers to use multiple sources of data (Yin, 1981), enabling the researcher to study phenomena in great detail.

To help in choosing which of these methodological approaches best serves the research, it is important to consider the underlying positions of these different approaches. Braa and Vidgen (1995) help us to do this through developing a framework to examine the methodological positions of these in-organisation methodological approaches. This framework helps us to focus on what the desired outcomes of the research are, in terms of either prediction, understanding or change. These outcomes are shown as points on a triangle in Figure 14:

Research Outcomes Framework for In-Organisation
Methodological Approaches



Figure 14 (Braa and Vidgen, 1999, pp. 28)

Braa and Vidgen (1995) state that the prediction outcome of their framework involves the more reductionist approaches described in Section 4.1 and takes the more positivist view of the world involving connected variables that can be controlled and predicted. These authors therefore argue that field experiments are a research approach that sit firmly within this prediction category. In terms of change, research that seeks this outcome involves intervening in a situation to try to bring about improvements. These authors therefore argue that action research sits within the change category. In terms of understanding, research seeking this outcome will increase the level of understanding about the phenomena being researched. When categorising research approaches that fit in to the understanding category, Braa and Vidgen (1995) make a distinction between two different types of case study. One type, which they name as hard case studies, involves the more classic case study approach proposed by Yin (2003). This type of case study can be used as an explanatory, descriptive or exploratory tool to analyse the interaction of factors and events in a real-life context. Braa and Vidgen (1999, pp. 29) describe hard case studies as “*positivist-informed*” due to its attempts to capture “*reality*” in detail. The other type of case study, which Braa and Vidgen (1995) call soft case studies, moves away from the more positivist position of hard case studies. This soft type looks more at the underlying social relation processes inherent in a case study to gain greater understanding of social totality beyond each case study (see Walsham, 1993 for an overview). Braa and Vidgen (1999) highlight that soft case studies can be based on ethnography. Ethnography involves the immersion of the researcher in a case study to capture, interpret and explain how the people involved in it make sense of their lives and their world (Robson, 2002). This involves the researcher blending in to the case study through, for example, taking on a

working role within an organisational case study (Bryman and Bell, 2007). Data collection in ethnography is typically prolonged over time to provide a comprehensive understanding of the significance of behaviours, events, etc. involved in the social world being studied (Robson, 2002). It is this soft case study approach that Braa and Vidgen (1995) categorise as being in the understanding category. These authors argue that hard case studies, with its more positivist view, fits between the understanding and prediction categories of their framework.

Braa and Vidgen (1995) see the points on the triangle as the theoretical ideals of the different research outcomes. However, in practice, research approaches fall on a continuum between each point (represented by the dotted lines in Figure 14). As already shown by the placement of hard case studies between the prediction and understanding categories, it is possible for research approaches to incorporate different aspects of the three ideals in the framework. The authors highlight another two approaches that fit inbetween the theoretical ideals of their framework. The first of these are quasi-field experiments, which follows an experimental approach in terms of design but is unable to preserve the ideals of experimentation, such as randomised selection/control groups (Robson, 2002) due to the constraints of the research setting (Braa and Vidgen, 1995). As a result, quasi-field experiments move away from the prediction idealist category in the framework. The other approach that fits inbetween the theoretical ideals of the framework is an approach that Braa and Vidgen (1995) call action case studies. This is a hybrid approach of balancing the trade-offs between making interpretations of theory and creating change in practice (Yen, Woolley and Hsieh, 2002). As a result, the action case study approach straddles the understanding and change categories in the framework.

The framework categorising the positions of these different methodological approaches is shown in Figure 15:

Positioning of In-Organisation

Methodological Approaches

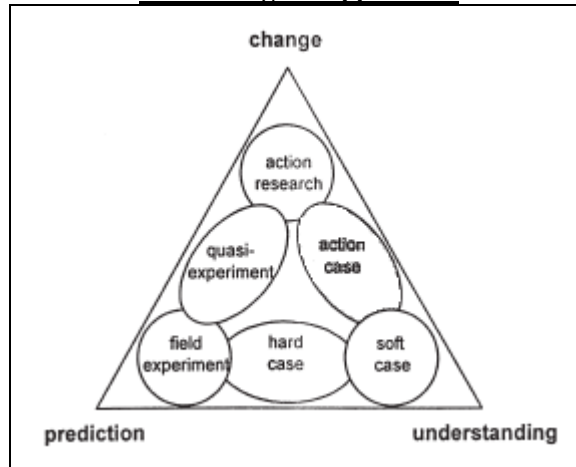


Figure 15 (Adapted from: Braa and Vidgen, 1999, pp. 32)

Using this framework we are able to examine how these different methodological approaches can be used to answer the research questions highlighted in Chapter 3. We earlier saw how scientific laboratory experiments had been rejected due to their positivist nature (Robson, 2002). Whilst an advantage of field and quasi-experiments is that they can move experimentation away from the artificial setting of the scientific laboratory into the organisation, these approaches still derive from the scientific laboratory experiment principles of reducing phenomena down into variables (Braa and Vidgen, 1995). As a result, these approaches would have struggled to capture and explore the richness of the social aspects of the research, in the same way the scientific laboratory experiment struggles as described above in this section. The use of field and quasi-experiments in organisations are also hindered by the reactive effects from awareness of an experiment occurring (Robson, 2002). An example of such an effect is from a set of experiments conducted at the Hawthorne works of the Western Electric Company in the USA (Roethlisberger and Dickson, 1939), where workers increased their productivity because of the conditions that the experiment produced – e.g. positive attention from researchers, etc. (Bryman and Bell, 2007). Furthermore, a difficulty with these experiment approaches is that few real-life organisations are willing to be experimented on (Braa and Vidgen, 1995). As a result, field and quasi-experiment approaches were rejected as suitable approaches for this research.

We saw earlier in this section that Avison et al., (1999) state action research is an iterative process involving (1) problem diagnosis, (2) action intervention, and (3) reflective learning. An action research approach could have been taken in this research. For (1)

problem diagnosis, the VSM could have been used to diagnose faults within organisations. It was shown in Section 2.2.4 that the VSM has diagnostic capabilities in its Mode I (Espejo, 1989b) application. This diagnostic approach could have been undertaken through following the steps of the VSD process shown in Section 2.2.4. Information management diagnosis could then have taken the form of comparing the current organisational information generation and sharing practices to how and where information is shown it should be generated and shared in Table 5. For (2) action intervention, this diagnosis could inform the action that would then be taken to change the organisation to adhere to the VSM model and to how and where Table 5 suggests information generation and sharing should be carried out. This approach would have enabled (3) reflective learning to occur through looking at how organisations reacted to a VSM intervention using Table 5 as a practical tool. However, by carrying out the research this way, there is a strong possibility that the organisations would have been constrained by VSM thinking early on and the research would have just focused on the application of Table 5, rather than seeking to identify if any other types of information promote viability. As action research is fundamentally about change, it requires the group or organisation being researched to be willing to be subjected to the implementation of action (Coughlan and Coughlan, 2002). This narrows the potential organisations that this research could have analysed, given that organisations would have to have been found that were willing to participate in change. The reasons for selecting the specific organisations for analysing in this research are discussed in detail in Section 4.2.1. The section shows that one organisation, the company, was looking for ways to operate more effectively and efficiently and so action research could have been appropriate there. However, this section earlier highlighted that the research also wanted to analyse project teams as they presented a gap in the VSM information literature. Section 4.2.1 highlights the reasons for selecting the project teams used in this research but none of these project teams showed a desire to be changed. Indeed, even if they had have done, Fullan (2001) highlights that effective change takes time and, given that Project Team A were only working on their project for a period of 3 months, this meant very limited time was available to undertake action and for it to make a difference. Furthermore, participation and involvement from both the researcher and participants are central to action research (Robson, 2002). The level of participation and involvement required for an action research approach to this study would have proved significantly difficult with the project teams selected in Section 4.2.1 because, as is shown in Chapters 5-7, many of their members were exceptionally busy. As a result, it would have been very hard to have increased the level of participation from these members beyond that which was ultimately provided in

this research. Whilst an action research approach could be a useful future direction for this research to take, for the reasons given above it was not chosen to be the approach used for this research.

Having rejected the aforementioned methodological approaches to the research, this left the three case study approaches. In rejecting the action research approach, it was shown that this research was more about *understanding* how Table 5 related to organisational information management rather than trying to use it for change. The research sought to examine the fit between the extended theoretical model and real-life organisational settings to build confidence that the model was representative of the real world. As a result, the ideological placement of this research was in the understanding category of the framework. Given the importance of ensuring the model was appropriate for organisations before using it to advise change, action case studies with their focus on change (Braa and Vidgen, 1995) were not the type of case study used for this research. However, it should be noted that in undertaking research, there is always a possibility of change occurring due to researcher effects – such as in the Hawthorne works study by Roethlisberger and Dickson (1939) discussed above. As shown in Section 4.1, postpositivism recognises that through the researcher being present in a situation conducting research, they may create changes in the phenomena being studied (Guba and Lincoln, 1994). As a result, it was accepted that there is an element of change that may occur through conducting this research but, in contrast to the action case study approach, this research did not actively seek to create change.

However, the placement of the research at the ideological position of understanding misses out an important aspect of the research. A key concern of the research is to examine whether the extended theoretical model is actually a tool that can be used to predict organisational information problems. Given there is a level of prediction to the research, the positioning of it must be moved from the ideological far right of the framework to a degree towards the prediction category on the left. However, this move leftwards cannot be too far as we have already shown that information creation and sharing is a human activity and that it is important to capture this more human, softer, side of information in the research. As a result, the case study approach that appears most appropriate falls inbetween the hard and soft case study approach in the framework as shown by the cross in Figure 16:

**Positioning of this Research in Relation to
In-Organisation Methodological Approaches**

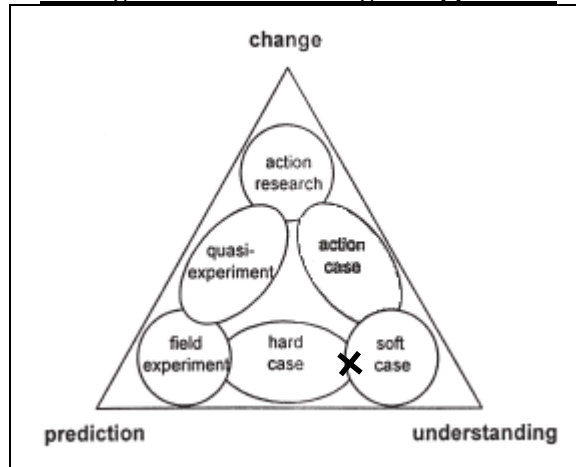


Figure 16 (Adapted from: Braa and Vidgen, 1999, pp. 32)

Whilst the placement of the cross creates a non-ideological placement of the methodological approach, Braa and Vidgen (1995) highlight that it is often difficult to remain faithful to an ideological position within the framework due to the messiness of conducting research within an organisation. The placement of the research between the hard and soft case study approaches also further supports the postpositivist position of this research. As highlighted in Section 4.1, postpositivism stipulates that an objective reality exists, although it is only imperfectly apprehensible (Guba and Lincoln, 1994) and that postpositivist studies need to study perceptions of participants in order to “*provide a window on to a reality beyond those perceptions*” (Healy and Perry, 2000, pp. 120). As a result of this, the case study approach was considered the most appropriate approach for this research.

Ryan (2006a, pp. 71) further suggests that postpositivist research, as this research is as described in Section 4.1, tends to use case studies as they enable levels of complexity, such as “*what kinds of things are happening, how and why they are happening and what they mean to the people involved*”, to be examined that are otherwise difficult to reveal by other research approaches.

The use of case studies provides an approach to handle the postpositivist ontological position of reality being imperfectly apprehended by humans, as well as the systems thinking ideal of holistic analysis, as case studies provide a “*holistic approach...that will allow for the maximum number of contexts of each case to be taken into account*” (Miller and Brewer, 2003, pp. 22). Whilst case studies provide an approach that enables the

maximum number of contexts to be considered, Ryan (2006c) notes that the epistemological stance of postpositivism accepts that it is impossible to ever fully know what is going on in a situation. This is a criticism that positivists can level at this research in that, if we do not know what is fully going on, how do we know it is right? Ryan (2006c) states that postpositivist research can illuminate what is happening but she warns that, if one thinks they understand the situation perfectly, they probably misunderstand completely. A postpositivist stance recognises the complexity of social situations and means that this research cannot simply aggregate the data collected to determine an overall 'truth' (Ryan, 2006b), but through using case studies it does provide a rich description of the phenomenon, through which explanation can be formed (Hamel et al., 1993). This explanatory element is crucial to this research because, as highlighted in Chapter 1, its main aspiration is to provide explanation on how the information generation and sharing practices in organisations can support their viability. The next section describes the rationale behind selecting the most appropriate case(s) to use to meet this objective.

4.2.1 Case Selection

In order to understand the way information is used in organisations, this research needed to investigate organisations in their entirety. The ontological aspect of postpositivism concerning the need to study participant perceptions implies that the research needed to study as many participant perceptions in each case as possible to gain the best possible understanding of the reality beyond individual perceptions. The more perspectives that could be considered in each case would also enable a more comprehensive view of the differing approaches that individuals took to information generation and sharing within each case study. An SME was therefore chosen to be studied in this research as, given its size, it enabled the realistic possibility for the researcher to talk to all the employees and to gain a strong understanding of how the whole company worked that would simply not have been possible in a larger company. The company selected, labelled Company A in this research, was a design and printing company, employing 35 staff, offering a complete range of print services including graphic design, production, storage and delivery. At the end of 2007, the company found itself competing in a saturated market where they were experiencing pressure on their prices and, as a result, their profit margin. Due to this, the company was looking for ways to operate more effectively and efficiently. To support this, the researcher was invited to work closely with the senior managers, employees and

customers of the company to redesign critical customer service processes. The requirement of the business to increase its efficiency through redesigning the way they shared information within the company and with customers in the external environment made this case study highly relevant to this research, as it enabled both within system and outside system boundary information generation and sharing at the company to be researched.

In terms of the number of cases, Lee (1989) states that each case study features unique and non-replicable events, opening up studies with a small number of cases to criticism that their findings may not be applicable to other settings. However, as discussed above, the research sought to provide the most in-depth study possible of the phenomenon and increasing the number of companies researched would have led to the level of depth in which the phenomenon could have been studied being diluted. As a result, a single organisation at the company level of recursion was selected for this research.

As highlighted in the previous section, this research sought to examine different recursion levels and so small project teams, consisting of three members each, were chosen for this purpose as again, given their small size, they enabled the realistic possibility for the researcher to talk to all the members and to gain a strong understanding of how each whole project team worked. The researcher worked as part of one of the project team case studies, which enabled an even more in-depth study of this case study to take place. However, in order to ensure that the findings made were not biased through the participation of the researcher in the case study, a further two project teams which the researcher was not a team member in were selected to study for comparison. In order to reduce the chances of findings made from comparisons between them emerging only because the project teams were completely different to each other, all three project teams were selected due to them each being a similar size and operating in similar settings.

The first of these project teams, henceforth labelled Project Team A, worked together on a research project from November 2008-January 2009 which had been commissioned by a city council. The council were seeking support to prepare a bid to obtain money from the Government to increase local respite provision for disabled children and their carers. After a series of meetings between the council and a local university, a project team consisting of 3 members from the business school at the university was set up to assist the council. The research undertaken by the project team was an investigation into how two specific types of local service providers could be enhanced to increase respite provision for disabled

children and their carers. There were three primary sources that Project Team A collected data from: the carers of disabled children, managers of local service providers and staff at local service providers. The researcher was invited to work as a Research Assistant on this project to conduct the bulk of data collection and analysis for the project. The opportunity to work inside this project team made this case study extremely interesting and relevant to this research. It enabled the researcher to experience and understand the situation much better by being a part of the project team and seeing first hand how information creation and sharing occurred within the project team.

The second of these project teams, henceforth labelled Project Team B, consisted of 3 members who worked together on a research project from October 2006-July 2009 which was being carried out by staff in a university. The research undertaken by the project team was an action research approach to inform the production of a computer system holding a repository of advice and guidance for scientists carrying out public engagement activities. Project Team B's research consisted of collecting data from a range of scientists conducting public engagement activities to identify how these activities were currently conducted and the issues involved in doing so. They collected data using focus groups and through the collection of various relevant literature. They then analysed this data to identify the requirements that scientists had for the computer system and the findings from this led to the design and production of a prototype computer system. User testing by scientists carrying out public engagement activities was then carried out using the prototype with data being collected on the suitability of the prototype for these users. The researcher met this project team during a workshop he was assisting in. The researcher then sent a proposal to the project team proposing to carry out research on this project team so they could learn more about how they worked together. This case study was relevant to this research as the researcher was not part of this project team and so it provided a case study that could be compared to Project Team A to ensure that the findings made were not biased through the participation of the researcher in Project Team A.

The final project team in this research, henceforth labelled Project Team C, consisted of 3 members initially, subsequently reducing to 2, who worked together on a research project from October 2006-July 2009 which was being carried out by staff in a university. The research undertaken by the project team investigated how culture could be changed in universities to increase the level of engagement between scientists and the general public. They conducted their research in two stages, with the first stage consisting of them

interviewing key staff at universities to understand the issues involved in science engagement with the public. The second stage they carried out was action research through them working with universities to support them in increasing their science engagement activities. The researcher met this project team during a workshop he was assisting in. The researcher then sent a proposal to the project team proposing to carry out research on this project team so they could learn more about how they worked together. This case study was relevant to this research as the researcher was not part of the project team and so it provided another case study that could be compared to Project Team A to ensure that the findings made were not biased through the participation of the researcher in Project Team A. Project Team C was also selected in addition to Project Team B as their members differed substantially in terms of member proximity compared to Project Team B, which enabled the research to contrast how member proximity affected the findings from the research questions.

As information sharing occurs over time, the study was conducted over periods of time that followed the project teams from when they were first formed through to the completion of their projects. The approach taken was repeated cross sectional (Miller and Brewer, 2003), with data being collected at various points as per the case specific details provided in Sections 4.2.3-4.2.5. The case specific details provided in Section 4.2.6 also shows that data was collected from the company at points over several months for the same reason. The use of this approach allowed for operational links to be traced over a period of time (Yin, 2003), to help establish any causation.

The selection of the case studies enabled a comprehensive study of the research questions. Using company and project team case studies, it enabled two recursion levels to be studied in depth, to identify any different types of information being present at different levels of recursion that were not included in the extended theoretical model. All case studies were also selected as they were of a size that enabled the realistic possibility for the researcher to talk to all the members of them, to gain as strong an understanding as possible of how information was created and shared in the whole case study. This would not have been practical in larger case studies or if the number of case studies had been increased. The selection of only one company does mean there is no direct cross-case comparison at the company level, however, through increasing the number of companies studied it would have reduced the level of depth the information creation and sharing practices of the company could have been studied in. Given that it was important to thoroughly analyse the

information generated and shared in this case study to determine if the information domains in Table 5 were a comprehensive representation of the reality, a single company case study was determined the best approach to take. Through selecting small project teams, this enabled the number of cases to be studied at this level of recursion to be increased. The choice of Project Team A was made as it enabled the researcher to view the information creation and sharing practices of the project team from *inside* the project team. This provided valuable insight that would have not been possible through just selecting project teams that the researcher was less involved in. However, as discussed above, through the researcher being a member of Project Team A, this could have caused the research to have been biased or to potentially miss something because the researcher was so involved. To minimise the effect this may have had on the results of the research, Project Teams B and C, which the researcher was not involved in, were selected to enable comparison between them and Project Team A. The decision to select two other project teams in Project Teams B and C, was made due to the contrasting proximities of where members of each project team worked. Project Team B members all worked in very close proximity to one another at the same university site. Contrastingly, Project Team C members worked from different locations and sites and were also often working in different cities and countries to one another. The selection of case studies with two such differing approaches to member proximity enabled the research to also analyse any differences that member proximity had on the findings from the research questions. The project team case studies were selected due to them all working on research projects, which reduced the chances of findings being made from comparisons between them emerging only because the project teams were engaged in completely different activities.

As discussed in Chapter 1, the overarching question posed in this research is what are the roles that information plays in sustaining viability in organisations? This question implies that the research needed to study viable organisations to understand how their information was helping to sustain their viability. In Chapter 2, it was shown that viability is defined as the ability of a system to maintain a separate existence and survive on its own (Beer, 1979). During the course of this research, this definition of viability has been found to be quite narrow and, as a result, leads to an interesting discussion in Chapter 9. However, it is argued here that the case studies selected were appropriate as they all met the definition of viability given above. Company A was formed in 1998, and had therefore maintained its existence for 10 years prior to data being collected – indeed, 2 years on from that data collection period, the company remains a viable entity. During the data collection period,

Company A was also not merely surviving, it was in a phase of turning around its performance substantially from making a loss in 2006 to making a predicted profit of around £160,000 by the end of 2008. Project Team A were viable through maintaining their existence from the beginning of the project in November 2008 to the end of the project in January 2009. Further, Project Team A delivered their project early, with the council reporting back to the project team that they were pleased with how the project had gone and signing it off as a success. Project Team B were also viable through maintaining their existence from the beginning of the project in October 2006 to the end of the project in July 2009. As with Project Team A, Project Team B delivered against its originally proposed outcomes and project team members commented on how smoothly the project had run overall. Project Team C were also viable through maintaining their existence from the beginning of the project in October 2006 to the end of the project in July 2009. However, unlike Project Teams A and B, Project Team C experienced significant internal structural changes, delays and also did not manage to deliver all of its originally proposed outcomes.

As a result, given the definition of viability by Beer (1979), all of these case studies were indeed viable and it is argued that their selection for this research was appropriate. Additionally, through selecting Project Team C, which was viable but suffered a number of issues, it enabled the research to compare the information within viable organisations that suffer from instability compared to the more stable viable organisations of the other case studies.

4.2.2 Data Collection Methods

Having rejected quantitative methods in Section 4.2, the data collected was determined to need to be qualitative in nature. Ryan (2006a) states that the way data is collected is illustrative of the beliefs about knowledge and human experience taken by the research and data collection methods are not simply neutral procedures but, instead, carry assumptions inextricably linked to the ontological and epistemological stance of the research. The discussion in Section 4.2.1 highlighted that postpositivist studies look at the different perceptions of people to help understand the reality beyond individual perceptions. It was therefore important that the perceptions of participants in this study were explored and King (2004) states that interviews allow the researcher to investigate such participant

perceptions. Interviews provided the most in-depth way to study these perceptions, allowing the researcher to probe for more detail from responses and obtain clarification (Miller and Brewer, 2003) if required, which would not have been possible with surveys. Interviews were also important for this research, as information existing in an individual's mind would not have been possible to study without talking to the individuals who held it.

As discussed in Section 4.2.1, in order to gain the most comprehensive understanding of the approaches taken to the generation and sharing of information within each case study, it was aimed to analyse each case study in their entirety. This meant that interviews were aimed to be conducted with all members of each case study, to get the greatest level of insight possible. The convention used to determine which potential participants were selected was based on the systems thinking approach discussed in Section 2.2, where elements within the system boundary are central to the system's activity. As was highlighted in Section 2.2, this is based upon the interpretation of the situation by the analyst. For Company A, members were defined as those who were directly employed and paid by the company, as people employed by the company are those that are conducting activities so central to the way the company is run that it chooses for these functions to be performed in-house rather than through out-sourcing. For the project teams, the members were defined as those who worked on the project throughout its entire duration and, without whose contribution, the project could not have been completed successfully. In the case of Project Team C, whose members changed during the project (as discussed in Section 4.2.5), the same definition applied in terms of contribution levels, but with exemptions from the duration requirement – the initial members were originally in place to work for the entire duration of the project and the new member worked for the remainder of the project after the changes.

Semi-structured interviews were conducted, as this approach gives a degree of flexibility to allow participants to digress and raise other interesting points, potentially relevant to the research (Miller and Brewer, 2003). This approach was taken as having a fully-structured interview could have restricted new points being raised by participants and fully-unstructured interviews may have led to interviews not covering the research topic. The questions used in the interviews were focussed on what information was being created by each participant in the company/project team; what information they were sharing with other participants in the company/project team and with people in the external environment; and how they were sharing this information. For the project teams, the

questions asked remained very similar at each data collection stage (with additional questions, such as, ‘what has happened in the project since last time we met?’ being added to the initial set of questions for subsequent interviews) to enable a comparison between the information used and shared by each participant at different stages in the project. The questions asked in these semi-structured interviews were open-ended to provide participants with as much of an opportunity as possible to give answers rich with information. Wherever possible, interviews were conducted on a one-to-one basis between the researcher and each participant to enable the researcher to explore issues with each participant in the greatest depth possible. Wherever possible, interviews were conducted face-to-face at the place of work of each participant, providing the researcher with the opportunity to see participants in their natural setting – which is one of the key aspects of case study research (Benbasat et al., 1987). Wherever possible, interviews were audibly recorded using a digital audio recorder as it enabled a complete account of what was said to be obtained, which could then be reviewed and analysed in its totality several times after the interview had taken place (Gillham, 2000). Following each interview, field notes were made as soon as possible to record the personal views and impressions of the researcher about the interview and any issues surrounding it. These notes helped the researcher in remembering the context of each interview when it was later analysed.

Semi-structured interviews are not without limitations as a data collection method. Miller and Brewer (2003) highlight a number of disadvantages of using semi-structured interviews. Whilst some of the disadvantages highlighted are practical, such as travel costs incurred and time taken to analyse them, there are four key limitations that are important to consider: reliability, lack of comparability, interruptions and interviewer effects. Miller and Brewer (2003) state their concern about the reliability of semi-structured interviews being based upon the data collected through them may not be reproducible if the study was to be conducted again. This criticism stems from the positivist paradigm and, as Watling (1995, pp. 5) states “*reliability and validity are tools of an essentially positivist epistemology. While they may have undoubtedly proved useful in providing checks and balances for quantitative methods, they sit uncomfortably in research of this kind*”. There is much debate in the literature about the applicability of reliability for qualitative research. Some authors, such as Patton (2002), argue that qualitative researchers should be concerned about reliability, but Armstrong et al. (1997) point out it is more common for qualitative researchers to reject reliability as necessary but do allow the concept to creep into their research. From a postpositivist perspective, it is accepted that the data would not be exactly

the same each time the interview was conducted but, as Stebanka (2001, pp. 552) highlights, precise “*repetitive correctness has value only in research settings dominated by the deductive demand for unconditional intersubjectivity*”. As this postpositivist research is concerned with generating understanding about how each participant views reality, reliable qualitative research does not need to produce the exact same data each time but it does need to help the researcher to “*understand a situation that would otherwise be enigmatic or confusing*” (Eisner, 1991, p. 58). As Ryan (2006b, pp. 20) states, “*in postpositivist research, truth is constructed through a dialogue; valid knowledge claims emerge as conflicting interpretations and action possibilities are discussed and negotiated among the members of a community. Researchers don’t ask themselves ‘is this the truth?’ Rather, we talk about the issues raised during the interviews, the participants’ reactions, and our interpretations of these interwoven ideas*”. In terms of lack of comparability, Miller and Brewer (2003) are concerned that, since the researcher may phrase questions differently or ask them in different orders, this can make it difficult for comparisons of the answers to take place. In order to address this criticism microanalysis was used to analyse the data. Microanalysis identifies common themes within the data wherever they occur and so the order and precise wording of questions was not important as this technique enabled comparison through the themes. This analytical method is further described in Section 4.3.1. In terms of interruptions, Miller and Brewer (2003) contend that it can be difficult to conduct interviews that are not interrupted, which can affect the quality of participant answers. Wherever possible, interviews were conducted in a private setting to minimise the chances of interruption. This was not always possible, especially when conducting interviews in Company A with factory workers who were conducting their job at the same time as being interviewed (see Section 4.2.6 for further details). In an effort to try to minimise the effect of interruptions, whenever the participant was interrupted the researcher would restate the question and what the participant was saying just prior to that interruption to remind the participant what was being discussed. In terms of interviewer effects, Miller and Brewer (2003) state that there exists a possibility that the interview can become biased with the researcher inclining the participant to a particular response. They state that researchers may have general expectations about what a participant knows or feels about situations and this may make researchers accidentally push participant answers towards a particular response. To respond to this criticism, the researcher mitigated the potential to bias interviews through asking open and non-leading questions. However, it was recognised that even this may not always prevent accidental bias and so the interviews

were listened to again by the researcher after they had been conducted to identify any source of bias and to ensure any such bias was not included in the subsequent analysis.

Another disadvantage of using semi-structured interviews is that there can sometimes be a difference between what people say they do and what they actually do. One example of this can occur when participants deliberately try to avoid looking bad through not disclosing information about what their real actions were in front of the interviewer (Bertrand and Mullainathan, 2001). Observation was therefore used to help negate the effects of any occurrence of this by allowing the researcher to directly study participant actions in terms of what information they created and shared and how they did so, providing further information about the phenomenon and its context (Yin, 2003). Observation took place during meetings of the members from the company or project teams and, when practical, meetings were recorded using either a digital video recorder or audio recordings were made. When meetings were not recorded in this way, the researcher would observe and take notes. As with the interviews discussed above, recordings of the meetings allowed for repeat observation of them in their entirety (Flick, 2006). Field notes were also made of meetings as soon as possible afterwards to help the researcher in remembering the context of each meeting when it was later analysed.

Whilst observation mitigated the problem identified above of there sometimes being a difference between what people say they do and what they actually do, Miller and Brewer (2003) note that observation has two key limitations that are important to consider: the reactive effect and the heavy reliance upon researcher interpretation. The reactive effect occurs because of the researcher's presence in the situation being observed, which can influence what is observed. This criticism is founded on the positivist belief that the researcher and the 'object' of study should be independent. However, postpositivism abandons this stance and accepts that the researcher may influence the object of study, or the object of study may influence the researcher (Guba and Lincoln, 1994). As a result, the researcher kept in mind that "*all research is contaminated and socially situated by the people involved and the methods used*" (Miller and Brewer, 2003, pp. 216) when using evidence from observation. The other criticism of the heavy reliance upon researcher interpretation in observation stems from the fact that a lot of data from observation comes in the form of field notes made by the researcher. These field notes are made solely by the researcher and are therefore a highly personalised view from the perspective of that researcher. This leaves these field notes potentially being open to criticism from positivists

that they were not objective. However, as already stated, postpositivism accepts researcher interpretation being part of the research. To mitigate the effects of this criticism, however, meetings were recorded whenever possible using a digital video or audio recorder to provide evidence that was not solely based upon the researcher's interpretation. However, this was not always possible and it is accepted that some observation evidence used in this research is based upon the personal judgement of the researcher. Nevertheless, as Miller and Brewer (2003) concede, sometimes a researcher's view is better than no view at all and can be used providing observation is not used as a sole method for collecting data. As a result of this, observation data was triangulated with other data when being analysed, as discussed later in Section 4.3.1.

Documentation including reports, minutes of meetings and budgets were also collected to corroborate and augment the data acquired from the other sources (Yin, 2003). These documents explicitly showed the types of information that was being created and shared within each case study. However, whilst this documentation was able provide an excellent account of historical data, Miller and Brewer (2003) highlight that there can be bias present within this type of data. They state that documents tell us only what the author of them want us to know, which is not necessarily what the researcher needs to know. It is therefore acknowledged that the documentation collected was almost always created for a specific audience and purpose other than for this research, which may have led to such documents not being wholly literal recordings of events (Yin, 2003). However, as much documentation as possible was always collected in an effort to try to reduce this bias by using triangulation as discussed later in Section 4.3.1.

It is argued here that the combination of interviews, observation and documentation was the best approach for conducting this research, based upon the advantages of each method discussed above. However, there is one other commonly used qualitative research method that was determined inappropriate for this particular research. Focus groups are a research method where individuals sit together and are facilitated by the researcher to discuss the topic under research. The advantage of focus groups is that views and experiences can be shared between participants leading to a discussion taking place where different viewpoints can be considered by participants. However, the use of focus groups would not have enabled the same depth of exploration of the issues to be achieved as the use of interviews does, as well as also having the disadvantage of not being confidential (Patton, 2002). Confidentiality was particularly pertinent to this research, as it explored information

sharing and any associated problems with it. If information sharing problems were caused by members of the project teams or the company, these problems may have not been discussed in a focus group, as participants may not wish to openly criticise or offend colleagues. However, by using one-to-one interviews, the participants were able to be guaranteed confidentiality by the researcher, which enabled participants to be more open with their views on any problems encountered.

The precise nature of the data collected for each case study will now be detailed in the following sections.

4.2.3 Project Team A Data Collected

Data was collected from the project team during November 2008-January 2009 and 9 interviews in total were held with the 3 members over this period at three distinct stages. These stages of data collection were at the start of the project, at the mid-way stage of the project and at the end of the project to collect data on how the project team worked throughout the lifetime of the project. Observations of 23 meetings the researcher had with other project team members and observations from 4 meetings that the project team had with the council were also conducted. The interviews and observations are detailed in Table 7:

Project Team A Data Collected

Dates	Interview/Observation Type
<i>29th October 2008</i>	Project Team Meeting
<i>30th October 2008</i>	Project Team Meeting
<i>6th November 2008</i>	Project Team Meeting
<i>12th November 2008</i>	Project Team Meeting
<i>17th November 2008</i>	Project Team Meeting and Council Meeting
<i>1st-9th December 2008</i>	1 x Project Manager Interview 1 x Research Supervisor Interview 1 x Research Assistant Interview
<i>1st December 2008</i>	2 x Project Team Meetings
<i>3rd December 2008</i>	2 x Project Team Meetings
<i>5th December 2008</i>	Project Team Meeting
<i>8th December 2008</i>	Project Team Meeting
<i>10th December 2008</i>	Project Team Meeting and Council Meeting
<i>11th December 2008</i>	2 x Project Team Meetings
<i>12th December 2008</i>	Project Team Meeting
<i>15th December 2008</i>	Project Team Meeting
<i>17th December 2008</i>	2 x Project Team Meetings
<i>19th December 2008</i>	2 x Project Team Meetings and Council Meeting
<i>22nd December 2008</i>	1 x Project Manager Interview 1 x Research Supervisor Interview 1 x Research Assistant Interview
<i>22nd December 2008</i>	Project Team Meeting
<i>5th January 2009</i>	Project Team Meeting
<i>14th January 2009</i>	Project Team Meeting and Council Meeting
<i>21st-23rd January 2009</i>	1 x Project Manager Interview 1 x Research Supervisor Interview 1 x Research Assistant Interview

Table 7

All interviews with the Project Manager and the Research Supervisor in this case study were recorded onto a digital audio recorder with the participants' permission. However, the researcher was the Research Assistant in this case study and so these interviews were not audibly conducted. Instead, the researcher gave written responses to the same questions that were asked to the Project Manager and Research Supervisor for each interview. As the researcher was a participant in this case study, the use of the data triangulation process described in Section 4.3.1 was particularly important during the analysis stages to check that the other members of the project team corroborated what the researcher said in the interviews to ensure there was no bias present in the data collected from the researcher.

Due to many of the meetings being impromptu and sometimes being held in locations with a high-level of background noise, these meetings were not recorded onto a digital audio recorder. However, field notes were made of all observations as soon as possible.

Documentation generated and used by Project Team A was also collected.

4.2.4 Project Team B Data Collected

Data was collected from the project team during October 2006-July 2009 and 8 interviews in total were held with 2 of the members over this period at four distinct stages. These stages of data collection were at the start of the project, two mid-way through the project and at the end of the project to collect data on how the project team worked throughout the lifetime of the project. Observations of 2 meetings the project team members had were also conducted. The interviews and observations are detailed in Table 8:

Project Team B Data Collected

Dates	Interview/Observation Type
<i>1st November 2006</i>	Project Team Meeting
<i>9th November 2006</i>	Project Team Meeting
<i>5th December 2006</i>	1 x Principal Investigator Interview 1 x Co-Investigator Interview
<i>13th August 2007</i>	1 x Principal Investigator Interview 1 x Co-Investigator Interview
<i>25th March 2008</i>	1 x Principal Investigator Interview 1 x Co-Investigator Interview
<i>20th July 2009</i>	1 x Principal Investigator Interview 1 x Co-Investigator Interview

Table 8

The Research Fellow chose not to participate in the interviews and, as a result, none were conducted with them. It is recognised that this led to the research not capturing the complete views of all of the project team members involved and it is accepted that this is a limitation of the analysis conducted on the project team. Nevertheless, evidence from the two other project team members in this case study does still provide insight into the information generation and sharing within the project team. As a result, the case study was still included in this research, albeit with an acknowledgement that the full range of perspectives were not included in the analysis. All interviews conducted in this case study were recorded onto a digital audio recorder with the participants' permission.

Both of the project team meetings were recorded onto a digital video recorder with the participants' permission. Field notes were also made of all observations as soon as possible.

Documentation generated and used by Project Team B was also collected.

4.2.5 Project Team C Data Collection

Data was collected from the project team during October 2006-July 2009 and 7 interviews in total were held with all members over this period at four distinct stages. These stages of data collection were at the start of the project, two mid-way through the project and at the end of the project to collect data on how the project team worked throughout the lifetime of the project. Observations of 4 meetings the project team members had were also conducted. The interviews and observations are detailed in Table 9:

Project Team C Data Collected

Dates	Interview/Observation Type
<i>1st November 2006</i>	Project Team Meeting
<i>9th November 2006</i>	Project Team Meeting
<i>20th-21st November 2006</i>	1 x Principal Investigator Interview 1 x Co-Investigator Interview 1 x Research Fellow Interview
<i>20th November 2006</i>	Project Team Meeting
<i>21st November 2006</i>	Project Team Meeting
<i>7th September 2007</i>	1 x Principal Investigator Interview 1 x New Co-Investigator Interview
<i>23rd May 2008</i>	1 x Principal Investigator and New Co-Investigator Interview
<i>15th July 2009</i>	1 x Principal Investigator and New Co-Investigator Interview

Table 9

As discussed in Chapter 7, this project team restructured themselves by removing the Research Fellow role and replacing the Co-Investigator with a new one. This led to second, third and fourth stage interviews only being held with the Principal Investigator and New Co-Investigator in this project team. Due to time pressures for the participants, group interviews were held with the Principal Investigator and New Co-Investigator on 23rd May 2008 and 15th July 2009. The reasons for choosing to conduct one-to-one interviews in this research were set out earlier in Section 4.2.2. However, the participants in this case study were exceptionally busy people and wanted to save as much time as possible by being interviewed at the same time so they could also use the interview as a way of catching up with where each other was in the project. Whilst it is accepted that conducting group interviews lost some of the advantages discussed earlier in this chapter of using one-to-one interviews, given the practical difficulties with the participants' availability and their desire to be interviewed together, a pragmatic approach was taken to conduct group interviews on the two dates. It is therefore accepted that the depth of exploration of the issues in these two interviews was limited compared to one-one interviews and that the participants may

not have discussed problems with information sharing if it was likely to involve the criticism of, or cause offence to, colleagues. As a result, the two group interviews were included for analysis in this research, albeit with an acknowledgement that they may not have been as insightful as if one-to-one interviews had been possible.

All of the project team meetings were recorded with the participants' permission, except for the one held on 20th November 2006 where permission was not given. The 1st November 2006 and 9th November 2006 meetings were recorded onto a digital video recorder and the 21st November 2006 meeting was recorded onto a digital audio recorder. Field notes were also made of all observations as soon as possible.

Documentation generated and used by Project Team C was also collected.

4.2.6 Company A Data Collection

Data was collected from the company during November 2007-May 2008 and 21 interviews in total were held with staff members over this period. Observations from this company were conducted when the researcher was invited to observe or take part in 6 company director meetings and spend 4 half-day periods shadowing 4 External Salespeople, visiting customers with them and observing how they engaged with customers. Observing this engagement with customers provided the research with insight into how the company shared information with the external environment. The interviews and observations are detailed in Table 10:

Company A Data Collected

Dates	Interview/Observation Type
<i>7th November 2007</i>	Company Director Meeting
<i>28th November 2007</i>	Company Director Meeting
<i>14th January 2008-13th March 2008</i>	4 x Internal Salespeople Interviews 5 x External Salespeople Interviews 1 x Production Co-ordinator Interview 2 x Artwork Designer Interviews 3 x Reprographics Designer Interviews 1 x Design Studio Director Interview 1 x Accountant Interview 1 x Production Manager Interview 1 x Print Operative Interview 1 x Finishing Operative Interview 1 x Distribution Manager Interview
<i>14th January 2008</i>	2 x External Salespeople Shadowing
<i>15th January 2008</i>	Company Director Meeting
<i>16th January 2008</i>	External Salespeople Shadowing
<i>18th January 2008</i>	Company Director Meeting
<i>21st January 2008</i>	Company Director Meeting
<i>26th February 2008</i>	External Salespeople Shadowing
<i>12th May 2008</i>	Company Director Meeting

Table 10

12 factory staff members were not interviewed as part of this research as their work was solely mechanical in operating the printing machines. A further member of staff, an Artwork Designer, was unable to be interviewed due to their prior work commitments. Due to time commitments, the Managing Director was not interviewed in a one-off formal interview setting, with questions instead being put to them in a number of discussions throughout the data collection period, for example during/after Company Director Meetings. This led to 21 of the 35 staff members being interviewed. All interviews in this case study were recorded onto a digital audio recorder with the participants' permission with the exception of five interviews. One of the Reprographics Designers gave permission to being interviewed but did not want to have their interview recorded onto the digital audio recorder. The company would also only allow interviews with the Production Manager, Print Operative, Finishing Operative and Distribution Manager to be conducted whilst these participants carried out their job, as removing these participants from their duties would have impacted upon production. As these jobs were being performed on the factory floor, these interviews were not recorded onto a digital audio recorder due to them being held in a location with a high-level of background noise. As a result, notes were made about the content of each interview as soon as possible afterwards.

The researcher was unable to carry out a half-day shadowing of one External Salesperson due to prior work commitments of the participant. 3 of the Company Director Meetings

were recorded onto a digital audio recorder with the participants' permission, although the ones held on 7th November 2007, 28th November 2007 and 18th January 2008, were not recorded due to permission not being given. Field notes were also made of all observations as soon as possible.

Documentation used in the processes of Company A, as well as a range of other documentation supplied by the company, was also collected.

4.3 Data Analysis

Ryan (2006c) notes that whilst postpositivist researchers agree that they need to analyse their data and then theorise from the subsequent findings, there is no prescribed analytic method in postpositivist approaches. For this research, there were two distinct stages for analysing the data. The first stage was to conduct microanalysis which is described in Section 4.3.1. Microanalysis was performed to identify the information generated and shared, as well as the processes by which these activities were performed, in the project teams and the company before moving on to the VSM analysis. It was important to conduct the microanalysis open coding before using the VSM, as this research needed to investigate any areas where the VSM was unable to provide an adequate representation of the project teams or the company. If VSM analysis had taken place prior to this, it may have constrained the thinking of the researcher to just looking for codes that fitted the VSM. The VSM analysis that took place following the microanalysis is described in Section 4.3.2, which took the form of using the Viable System Diagnosis process detailed in Table 3 and incorporating it with the use of the extended theoretical model presented in Table 5.

4.3.1 Microanalysis

The data analysis was conducted through the use of coding, with the researcher going through each interview/meeting, generating common categories within the data and identifying the relationships amongst them (Strauss and Corbin, 1998). This enabled the investigation of the processes and issues involved in generating and sharing information in the company/project teams. In order to carry out this coding, the audio/video recordings

were transcribed. Verbatim transcription, with an external organisation transcribing recordings in their entirety, was used for the interviews ensuring that all possible significant aspects of the interview data could be analysed (Miller and Brewer, 2003). Selective transcription, with the researcher deciding on which parts of the data were relevant for the research and transcribing them (Miller and Brewer, 2003), was undertaken to the recordings of meetings due to the vast quantity of data that these entailed, some of which was not necessarily useful to this research.

There are two different ways in which coding can be done. One approach is to use a top-down approach, where a structure is *placed upon* the data. Content analysis takes this approach where codes are identified prior to analysis and form a coding schedule (Bryman and Bell, 2007). This coding schedule is then used to analyse the data, with data that fits into the codes being assigned to the relevant codes (Bryman, 2000). The other approach is to use a bottom-up approach, where codes are generated *from* the data. Microanalysis, based upon grounded theory, takes this approach, which has at its core theory generation in research being “*grounded in data and built up from the bottom*” (Miller and Brewer, 2003, pp. 132). As a result, analysis of the data enables codes to emerge from the data (Strauss and Corbin, 1998).

As described in Chapter 3, given that one aspect of this research was to empirically test the model in Table 5, one approach to coding could have been to use the information domains in Table 5 to create a coding schedule, similar to that used in content analysis. However, this research wanted to determine if there were any information domains that were missing from Table 5 that were present within the project teams and company being studied. If Table 5 had been used to structure the analysis initially it may have constrained the researcher to just looking for those information domains within the analysis. As a result, a truly top-down coding approach could not be used.

Therefore, the more bottom-up approach to coding of microanalysis was needed to identify any information domains that Table 5 did not capture. However, microanalysis is about building theory from the data (Strauss and Corbin, 1998), where the data is traditionally used to build a theoretical framework. In this research, however, rather than use the data to build new models, it wanted to empirically test a pre-existing model – the extended theoretical model in Table 5. Strauss and Corbin (1998) do highlight that, in some instances, the use of theoretical frameworks in the coding process can be useful. These

authors stress that, if a theoretical framework is used in coding, the research must “*remain open to new ideas and concepts and be willing to let go if he or she discovers that certain “imported” concepts do not fit the data*” (Strauss and Corbin, 1998, pp. 40). However, these authors do not provide an explicit strategy on how to test theoretical frameworks using microanalysis. As a result, this research had to use microanalysis in a modified way, as described below.

Traditionally, microanalysis involves three stages (Strauss and Corbin, 1998):

- *open coding* – where data is gone through line-by-line to identify concepts and properties within the data
- *axial coding* – where categories identified in the first stage are related to higher-level categories
- *selective coding* – where all of the levels of categories are integrated and refined

The first stage of microanalysis, open coding, was conducted in the traditional way, with the researcher going through the data line-by-line and identifying concepts and properties that were relevant to this research, i.e. primarily those about information but also those about how the organisation was being run, for example the responsibilities, structure and processes within the business. This first stage of the microanalysis was therefore conducted in a bottom-up way with the concepts and properties found emerging directly from the raw data, enabling the research not to be constrained by the information domains within Table 5.

However, it was at the second stage, axial coding, that this research departed from the traditional use of microanalysis. These stages were not completed until the VSM process described in Section 4.3.2 but are described in detail here as they form part of the microanalysis approach. Traditionally in axial coding, the categories developed at the open coding stage would be gone through to identify higher-level categories that cluster related categories together (Strauss and Corbin, 1998). This is traditionally a bottom-up process with the researcher identifying commonalities between categories to develop the higher-level categories. This approach enables the building of theory and models through the development of the categories. However, in this research, rather than use the data to build models, this research was concerned with empirically testing the extended theoretical model in Table 5. As a result, rather than using a bottom-up approach for axial coding, this

research took a top-down approach to the axial coding stage through the different information domains in Table 5 becoming the higher-level categories. In doing so, the categories developed in the open coding phase were then assigned to the relevant information domains that described that type of information (according to the description of each information domain given in Chapter 3).

Selective coding is the final stage of microanalysis to refine and integrate all of the categories and to remove any duplication (Strauss and Corbin, 1998). This stage continued with the top-down approach used in axial coding through using Table 5 to structure this refinement process.

As can be seen from this description of the way microanalysis was used in this research, it was applied in a bottom-up way in the first stage before imposing a top-down structure in the latter two stages, rather than the traditional bottom-up way throughout with the data driving the coding structure. The reason for doing this was that the approach taken enabled the empirical testing of the extended theoretical model developed at the beginning of the research. This bottom-up approach to the first stage of microanalysis enabled the researcher to be free from an imposed structure to enable all relevant data to be coded. This meant that once the top-down structure was imposed in the analysis, it was possible to identify any data that had previously been coded in the open coding stage of the microanalysis that did not fit under one of the information domains in Table 5. This process therefore allowed the extended theoretical model to be checked for omissions and extended through any additional information domains identified in the data. This process is highlighted further in Section 4.3.2.

Through modifying the traditional Strauss and Corbin (1998) approach to microanalysis, there was a risk that this standard approach could be being used in an inappropriate way. However, as shown above, Strauss and Corbin (1998) highlight that theoretical frameworks can be used in microanalysis – the literature just does not say how. The approach this research took only changed the axial and selective coding elements of microanalysis and this change did not actually change the goals of these stages – it just used the theoretical framework rather than the data to structure the codes developed in the open coding stage. However, there is one limitation to this modified microanalysis approach. This limitation is that, through using a top-down structure to refine the codes at the axial and selective coding stages, there is the potential to miss the naturally forming

relationships between the open codes that the Strauss and Corbin (1998) approach enables. However, this research did not set out to understand the relationships between the information domains themselves, and so this was identified to not be a limitation to this research.

NVivo 8.0 was used for this research because software applications are able to provide a very efficient way to manage data for qualitative analysis. Dey (1993, pp. 57) highlights the importance of managing data efficiently in that “*given the sheer volume and complexity of qualitative data, failure to manage the data efficiently means failure to analyse the data effectively*”. The NVivo 8.0 software application was chosen as this family of software applications is well suited to data analysis in projects, such as this research, which have a number of varied data types from data collected over a long period of time (Barry, 1998). However, it is noted that a concern about NVivo software is that the way it structures analysis could lead to users imposing fixed hierarchical conceptualisations on the data, which may not necessarily be the most appropriate way of structuring the analysis (Crowley et al., 2002). Whilst the NVivo 8.0 software application was used in this research because of its data management efficiency, due to this criticism the researcher read through all of the transcripts again after coding had taken place to check if anything had been missed out through this hierarchical structuring process.

Bryman (2001) states that coding involves taking small fragments of text from the data, which may lead to contextual information from the data being lost. Due to this, the researcher played the audio/video at the same time the coding took place to ensure the context and any further information provided by the tone of voice was available at the time of coding. To further ensure the contextual information was retained, the researcher was the sole person to conduct the coding as other analysts could not have had the same level of understanding about the context surrounding the data, potentially leading them to misinterpret it. The coding was carried out through the researcher going through each transcript and audio line-by-line to identify concepts and properties within the data which were then segmented into common categories within the NVivo 8.0 software application. The categories developed were then used in the VSM analysis, as detailed in Section 4.3.2.

Whilst coding is an often used method for analysing qualitative data, it is not without its limitations, especially as there are no methodical procedures for assessing the validity of the analysis (Eysenck, 2004). Thomas (2006) highlights this through stating that different

researchers may produce non-identical findings, with non-overlapping categories, when analysing the same set of data. Given that there are no methodical procedures available to assess validity, it can therefore not be determined in this case which researcher has produced the more valid interpretation of the data (Eysenck, 2004). It is therefore recognised that the interpretations in the coding that led to the findings in this research are, to a certain extent, shaped by the assumptions and experiences of the researcher (Thomas, 2006). Rather than being seen as a limitation, however, Ryan (2006c) notes that this is just a feature of postpositivism in that all of the data is filtered through the researcher and the researcher has to decide how to use it. As discussed in Section 4.2.2, this research takes the postpositivist epistemological stance that the researcher and ‘object’ of study are intertwined. It is therefore argued that it was actually an advantage that the researcher used their combination of experience, reading of the literature and theoretical knowledge to provide a deep level of insight that the research would not have achieved if a positivist approach had been taken to try to keep the researcher and ‘object’ of study independent.

The multiple methods taken to collect data described in Section 4.2.2 enabled triangulation to be applied to the data collected. Triangulation allowed the confidence in the findings to be enhanced by developing “*converging lines of enquiry*” through finding corroboration amongst different data sources (Yin, 2003, pp. 98). There were two types of triangulation defined by Denzin (1970) that were applied during this research. Methodological triangulation was one type, which was used to determine corroboration between the different research methods of interviewing, observation and documentation. This was achieved by the researcher looking for corroboration between what was said in interviews and what was actually happening in observations. Corroboration was also sought between what the documentation collected stated and what was said in interviews and was happening in observations. Data triangulation was the other type of triangulation used in this research, which triangulated the different sources of data collected using each research method. This was achieved by the researcher looking for corroboration between what each participant said in each of their interviews compared to what they had said in the previous interviews they had given and this was also compared to what other participants had said in their interviews. Corroboration was also looked for between what occurred in each of the observations and then also between what was stated in each document collected. When conflict in the data arose, more evidence was collected to identify the reasons for that conflict. Details of such conflicts are presented in the analysis sections in Chapters 5-8. There exists another type of triangulation, called investigator triangulation, where data is

interpreted by more than one researcher and then triangulated (Bryman, 2004). The benefits of using this type of triangulation is subject to much debate in the literature. Whilst some authors, such as Mayes and Pope (1995, pp. 110) claim that “*the analysis of qualitative data can be enhanced by organising an independent assessment of transcripts by additional skilled qualitative researchers and comparing agreement between the raters*”, Armstrong et al. (1997) argue that the literature shows there are many more qualitative researchers who reject such a notion. Indeed, Morse (1994, pp. 231) argues that “*no-one takes a second reader to the library to check that indeed he or she is interpreting the original sources correctly, so why does anyone need a reliability checker for his or her data?*”. In agreement with the majority of this literature, this research did not use investigator triangulation. This type of triangulation was also deemed inappropriate due to the heavy involvement of the researcher in working with the company and project teams to collect the data. This meant that a different researcher would not have been able to reproduce the contextual background necessary to be able to analyse the data effectively.

4.3.2 VSM Analysis

Once the open coding had been completed, the stages of the Viable System Diagnosis (VSD) process by Flood and Jackson (1991) were carried out for each company/project team. The VSD process was chosen over the other VSM application approaches detailed in Section 2.2.4 due to it being the most structured and comprehensive approach available, through taking a detailed step-by-step approach for each of S1 through to S5. The VSD was initially used to build the VSM models by following the step-by-step process to firstly identify each system, establish its purpose and determine its wider context. The VSD process was then used to analyse each system in terms of S1 to S5 of the VSM by following each of the steps detailed in Table 3. This analysis was compared to the open coding to identify any processes described in the data that the VSM failed to model.

As described in Section 4.3.1, the extended theoretical model presented in Table 5 was then used to identify whether the information it states should be generated was actually present in each company/project team at level 1 recursion. The model was compared with information found to be present through the open coding for each company/project team. This enabled the research to determine whether the extended theoretical model actually provided an adequate representation of the information present in each company/project

team at this level of recursion in order to address the first research question posed in Chapter 3: *What information is present within viable organisations at one level of recursion?*

As described in Section 4.3.1, the extended theoretical model presented in Table 5 was used to identify whether the information it states should be shared was actually shared in each company/project team at level 1 recursion. The model was compared with information found to be shared through the open coding for each company/project team. This enabled the research to determine whether the extended theoretical model actually provided an adequate representation of the information shared in each company/project team at this level of recursion in order to address the second research question posed in Chapter 3: *What information is shared within viable organisations at one level of recursion?*

The findings from the open coding on how information was shared were then compared to how the communication channels in the VSM are defined to operate at level 1 recursion as detailed in Figure 13. This enabled the research to determine whether the VSM actually provided an adequate representation of how information is shared in each company/project team at this level of recursion in order to address the third research question posed in Chapter 3: *How does information sharing occur within viable organisations at one level of recursion?*

The analysis then looked at each of the other recursion levels in turn for each company/project team. Leonard (1999) suggests that the recursion level directly above and directly below the system-in-focus should be studied when carrying out VSM investigations in order to analyse the system-in-focus in context. As described in Section 4.3.1, the findings from the open coding were used to identify the information that was shared between the relevant recursion levels directly above each company/project team (recursion level 0) and the relevant recursion levels directly below each company/project team (recursion level 2) in order to address the fourth research question posed in Chapter 3: *What information is shared between different levels of recursion in viable organisations?* The open coding findings were then also used to determine how this information was shared between each recursion level for each company/project team in order to address the fifth and final research question posed in Chapter 3: *How does information sharing occur between different levels of recursion in viable organisations?*

It is acknowledged that the analytical approach described above is quite abstract in nature. As a result, practical examples of the analytical approach are given in Appendix 1 to provide more detailed insight into the analytical processes described above.

4.4 Summary

In summary, a case study approach was taken in this research to gain in-depth insight of information generation and sharing in organisations. The case studies selected were at the company and project team recursion levels to enable comparisons to be made in the research between recursion levels. One company was selected to provide as in-depth study as possible of its information generation and sharing. One project team was selected to enable the researcher to work inside it to provide a very in-depth view of the information generated and shared by the project team. However, to mitigate any bias working inside the project team may have created for the research findings, a further two project teams, in which the researcher did not work, were also selected to study for comparison. Cases were selected as they were each of a size that enabled the research to gain a holistic view of each case study.

Qualitative data was collected from the case studies through interviews, observation and documentation, providing a comprehensive data set that was triangulated to increase confidence in the findings. A modified version of microanalysis was then used to analyse this data before studying the case studies in terms of the VSM and the extended theoretical model in Table 5. This approach enabled a thorough analysis to be conducted to answer the research questions posed in Chapter 3.

Chapter 5

Project Team A Analysis

5.0 Introduction

This chapter presents the findings from analysing Project Team A. Before commencing this chapter, I would like to provide the reader with a warning – this chapter provides a lot of low-level information that can, at times, make it quite heavy reading. I would like to reassure the reader that none of the other analysis chapters are written quite so in-depth (or, indeed, as turgidly!). However, the reason for including such a low-level of detail in this chapter is to provide the reader with a sense of the level of depth that was necessary to carry out the analysis for all of the case studies. However, for the sake of brevity and to prevent the reader from becoming bogged down, subsequent analysis chapters focus more on the findings where deviation was found to occur compared to Project Team A.

As stated in Chapter 4, interviews were conducted with each member of Project Team A at three different stages – at the beginning of the project, mid-way through the project and at the end of the project. Observations were also recorded about meetings between project team members and a range of documentation was collected. By convention, when presenting evidence in this and subsequent analysis chapters, the source will be provided immediately after a quote or observation as an endnote.

The chapter begins by introducing Project Team A to the reader and describing the project team in terms of the VSM. This section examines the fit between the VSM and the project team to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

The chapter will then move on to explore the first question posed in this research as to what information exists at the first level of recursion. This section will make a comparison between the information found to exist at this level of recursion and the extended theoretical model in Table 5. This will enable an exploration of whether the extended

theoretical model actually provides an adequate representation of the information present in this project team at this level of recursion.

The next section will then look at the second question posed in this research and identify what information found in the section above is shared within the project team. This section will make a comparison between the information found to be shared at this level of recursion and the extended theoretical model in Table 5. This will enable an exploration of whether the extended theoretical model actually provides an adequate representation of the information shared in this project team at this level of recursion. The section will also examine how this information is shared within this project team at this level of recursion, in accordance with the third question posed in this research.

The following sections will then look at each of the other recursion levels in turn. As described in Chapter 4, the recursion level directly above and directly below the system-in-focus should be studied when carrying out VSM investigations in order to analyse the system-in-focus in context. Therefore, the relevant recursion levels directly above the project team (recursion level 0) are described and then the relevant recursion levels directly below the project team (recursion level 2) are described. Each section for these recursion levels will begin by introducing the recursion level to the reader and describe it in terms of the VSM. Each section will then explore the fourth question posed in this research to identify the information that is shared between each level of recursion and the project team. Each section will also examine how this information is shared between the recursion level and the project team, in accordance with the fifth and final question posed in this research.

This chapter will finish by providing a summary of the main findings for Project Team A from the analysis presented in this chapter.

5.1 Project Team A and the VSM

This section begins by providing a short background introduction to Project Team A before describing the project team in terms of the VSM. This section will then examine the fit between the VSM and the project team to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

5.1.1 Background Introduction

Project Team A worked together on a research project from November 2008 to January 2009 which had been commissioned by a city council. The council were seeking support to prepare a bid to obtain money from the Government to increase local respite provision for disabled children and their carers. After a series of meetings between the council and a local university, a project team consisting of three members from the business school at the university was set up to assist the council. The project team members have each been assigned the following labels in this research to aid the reader identify them: a Project Manager, a Research Supervisor and a Research Assistant. The Project Manager was a senior-level academic working in the field of psychology with a background in Government policy. It was through the Project Manager that the project came about, with the council contacting her because she had worked with the council on previous projects. The Research Supervisor had worked together previously on projects with the Project Manager and had shown an interest in becoming involved when the Project Manager was putting together a team. The Research Supervisor was a professor in their field with a strong research emphasis on decision making. It was through the Research Supervisor that I (the Research Assistant) became involved to complete the make-up of the team. As a PhD student I was working with the Research Supervisor on a couple of different projects and he invited me to join the project team. I had never worked with the Project Manager before, although I had met her a couple of times previously. From this point further in the text of this chapter, I will describe my role in the project in the third-person (using the label Research Assistant) to ensure that there is no confusion between the role I played in the project and the analytical thoughts I present in this chapter.

At the very start of the project, the roles of the different members of the project team were defined. The Project Manager was defined as the person who “*will be ultimately responsible for submitting all deliverables to [the council] as well as being first point of contact for the project. [They] will participate in the collection of data and analysis*”³. The Research Supervisor was defined as the person who “*will supervise, and participate in, the data collection and analysis as well as ensure the project meets quality levels of [the] Business School*”³. The Research Assistant was defined as the person who “*will conduct the bulk of the data collection and analyses phases of the project*”³.

The project team and the council initially struggled to define an exact scope for the project. The council found it hard to identify clear objectives and the project went through a process of scope creep (the process of defining the project scope is discussed in much more detail in Section 5.3.2). Eventually, the research undertaken by the project team was determined to take the form of an investigation into how two specific types of local service providers could be enhanced to increase respite provision for disabled children and their carers. There were three primary sources that data was collected from by the project team: the carers of disabled children, managers of local service providers and staff at local service providers. They collected data from the carers to identify the hopes and requirements that disabled children and their carers had for respite provision. They collected data from the managers of the local service providers and also some of the front-line staff that provided the service to identify the current respite provision and the potential capacity to increase it at the local service providers.

They collected data using a variety of methods, including face-to-face interviews, telephone interviews, focus groups, site visits and the collection of various relevant documentation. In total, 30 people were consulted through one-to-one interviews, 22 people through 3 focus groups and 9 site visits were conducted by the project team. All members of the project team were involved in data collection for the project but the majority of interviews were undertaken by the Research Assistant, whilst the Research Supervisor facilitated each of the 3 focus groups. The data collection process was intense, with data being collected by the project team almost every day over a three week period.

Each member of the project team analysed the data they had collected. This analysis was then discussed by the whole project team in a series of meetings held to identify where the gaps were between the current local service respite provision and the hopes and requirements that disabled children and their carers had for respite provision. Using suggestions from the local service providers and disabled children carers, the project team then identified potential ways that these gaps may be overcome.

The findings from their research were fed back by the project team to the council through a presentation of the emerging findings and then through the completion of a detailed report explaining the final findings. The project ran smoothly without any major problems and the project team were able to complete the project a week before the deadline. The council

reported back to the project team that they were pleased with how the project had gone and signed it off as a success.

This section provides only a short description of Project Team A to provide the reader with enough detail about what the case study is about. Much more detailed description about this case study will be presented in the following sections as the research questions are fully explored. The next section will begin to describe Project Team A in greater detail as it is described in terms of the VSM.

5.1.2 VSM Level 1

This section will present Project Team A in terms of the VSM before moving on to a discussion to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

As described in Chapter 4, the VSD process was used to generate the VSM for Project Team A. During the system identification phase of the VSD process the system was identified as:

- a system to **carry out research** into how local services could be enhanced to increase respite provision for disabled children and their carers to help the council understand the issues they would face in increasing supply side activities.

The system to achieve the purpose of carrying out research was the project team and, as a result, the project team system is the system-in-focus for this case study. The remaining steps of the VSD process were then undertaken for this level of recursion, generating the components of the VSM which will now be described.

- S1 units are the activities that the project team must carry out to achieve its purpose. The Project Manager stated that the project team “*need to complete the fieldwork first, we need to complete the analysis, we need to write the report and we need to submit the report – those are like the core things*”¹³. The Research Assistant supported this by stating that the critical components over the first month of the project were to complete “*data collection, analysis and first draft of report*”²⁴ before turning the draft report in

to a final report for the council. Mid-way through the project, the project team also generated a presentation which was used in a meeting “*to brief [the council] on emerging findings*”³. Therefore, in order for the project team system to achieve its purpose of carrying out research, it needed to undertake three main activities: data collection, data analysis and dissemination of findings and it is these activities that make up the S1 units of the Level 1 VSM.

- S2 dampens oscillations between the S1 units and co-ordinates them to achieve synergy. The data showed that there was a high level of dependency between the different S1 units, with the Data Collection S1 unit providing data for the Data Analysis S1 unit. The level of dependency between the project team members carrying out the S1 activities was also highlighted with the Project Manager commenting that “*to some extent we’re dependant on each other’s reliability*”¹³ and the Research Supervisor adding that “*we’re depending on each other to deliver... [for example] if you don’t do what you say you’ll do over the weekend, then I can’t do what I’ll say I’ll do on Monday*”¹⁴. Due to the high level of dependency between S1 activities, it was important that S2 was able to perform its anti-oscillatory function. The Research Supervisor was also mindful that the Data Collection and Data Analysis S1 activities should be carried out at the same time, “*so that we don’t end up with a big batch of data*”⁴ at the end of the data collection period without enough time to analyse it. S2 therefore had an important role in co-ordinating the three S1 activities to ensure that relevant information was passed between them and to ensure that too much time by project team members was not being spent on each activity, as discussed in more detail in Section 5.2.1.
- S3 is responsible for monitoring and controlling the S1 units. The scope of work provided in the project specification provided S3 with the basis for monitoring and control activities. The Research Supervisor confirmed this by stating that “*we have a scope of work that we will work to and we will need to revisit that scope of work periodically to make sure that we’re not missing anything*”⁴. The monitoring and control process is described in much greater detail in Section 5.2.1. Allocating the resources was also an activity that S3 needed to perform and, at the beginning of the project in the fifth project team meeting, the project team were observed to discuss how many days each member would work on the project¹⁸. As stated by the Research Assistant, “*we were working to a very tight deadline and so had to ensure the project*

didn't slip"⁸. However, it was not just the tight deadline that was an issue S3 needed to overcome, each project member also had other tasks outside of the project to perform. The Project Manager was particularly worried about another project they were working on, *"my bigger worry is [another project] at the moment because I've got one huge bid that's gone out on the outline proposal and the minute [the funder for it] say can you transfer this across to the main proposal that's going to put me under incredible pressure"*¹³. The Research Supervisor stated that *"I had so many other things on at the same time... while doing this project I also had another two projects that I was simultaneously working on that had deadlines – continuous deadlines throughout December and January – that's life"*¹⁰. However, the Research Assistant was able to support this resource allocation by providing much more flexibility in terms of time, stating that *"as I had less work on, I was able to make myself pretty much available all the time during the project so that we could be flexible when we needed to arrange meetings or contact one another"*⁸.

- S3* conducts audits for S3. S3* activities in the project team particularly focused on the occasional checking that none of the project team members went over the number of days that they were scheduled to work on the project. This check was undertaken by the Research Supervisor who sent two emails during the project to ask how many days each project team member had worked. The Research Assistant explained that the Research Supervisor *"asked me to keep a timesheet to record the hours I did"*¹ which enabled them to produce an accurate figure for this check. The Research Supervisor also kept a log of their time spent working on the project and confirmed at the end of the project that they had worked one day over their allocation of time on the project. The Project Manager and Research Assistant both stated that they stayed within their allocation of time for the project. Another audit was conducted to check the quality of the final report produced, with the Research Assistant conducting a *"proof read"*² of the final draft of the document.
- S4 is responsible for seeking out potential future directions for the system. S4 was involved with S3 in determining the scope of the project and was a joint process undertaken by the project team with the council, as described in detail in Section 5.3.2. S4 also had to ensure that the project team was aware of where the future of the project was going and the next steps that were needed to be done. The Research Supervisor played a particular role in this and commented *"when I look forward then I just see the*

*things that have got to be done – I just see the gaps*¹⁴. The Research Assistant also reflected on how the project team determined when to meet in response to S4 stimuli *“the [project team] meetings tend to be very reactive – we only have them when something happens that we need to respond to”*²⁴. Towards the end of the project, S4 also began looking to the future for the project team. The Research Supervisor stated that *“we need to identify what the next project is either with [the council] or beyond [the council]”*¹⁴. At the end of the project, the project team sent two proposal documents via email for extending the work with the council. One project was to work with another group of participants to fill a gap identified by the project team in the original scope of work. The other proposal was for the project team to generate a short summary report that was written to communicate the findings from the research to the general public. The council took the project team up on the second proposal²².

- S5 carried out the overall decision making processes of the project team. The Project Manager was seen to have the final say in any decisions. An example of this authority came from a decision needing to be taken arising from the S4 future looking activities. The Research Supervisor described it as *“[the council] at the moment has £8,000 or £7,500 sitting in an account somewhere earmarked for [either the project team/Business School] and I’d probably try and get it tied down more... I’d have it earmarked for [us] against a particular project so that it doesn’t get spun off”*¹⁴. The Project Manager saw a much lesser need to have this money tied down as they were confident that the money was already earmarked for the project team and so the council would not allocate it anywhere else. Although the Research Supervisor did not agree with this, they deferred to it saying *“that’s how [the Project Manager] wants to play it so that’s the way we’ll play it”*¹⁴. The Research Supervisor commented that this authority stemmed from the fact that the Project Manager *“knows [the council] better than I do and ultimately she brought the project to us so it wouldn’t be appropriate for us to take a heavy hand”*¹⁴.

5.1.3 VSM Level 1 – Model Suitability

As described above, the project team undertook three main activities – data collection, data analysis and findings dissemination. It co-ordinated these activities in the manner described by S2 and carried out monitoring and controlling on the three main activities as

described in S3. The S4 activity of defining project scope has not fully been explained by the VSM at this level of recursion but this is because it has been found to be a multi-level recursion process that is described further when the interaction between the council and the project team is explored in Section 5.3.2. S5 described the Project Manager's role in handling necessary decisions for the project team. There were no other processes described in the data that the VSM failed to model for this level of recursion.

5.2 Information within Project Team A

This section will explore the first question posed in this research as to what information exists at recursion level 1. This section will make a comparison between the information found to exist at this level of recursion and the extended theoretical model presented in Table 5. This will enable an exploration of whether the extended theoretical model actually provides an adequate representation of the information present in this project team at this level of recursion. This section will then look at the second question posed in this research and identify what information is shared within the project team. This section will make a comparison between the information found to be shared at this level of recursion and the extended theoretical model. This will enable an exploration of whether the extended theoretical model actually provides an adequate representation of the information shared in this project team at this level of recursion. The section will also examine how this information is shared within this project team at this level of recursion, in accordance with the third question posed in this research.

5.2.1 Information Present/Not Present at Level 1

This section presents the evidence for information present in the project team VSM at level 1 recursion in accordance with the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information present in the project team at this level of recursion that does not fit into the extended theoretical model.

As described in Section 5.1.2, the project team undertook three main activities: data collection, data analysis and dissemination of findings and it is these activities that make up the S1 units of the Level 1 VSM. In order to collect the data "*the bulk of the data for*

*this project will arise from meetings with key personnel from the suppliers of [the two local] services*³ types that were being studied in the research. These key personnel were divided further into management personnel to “*provide understanding of the management issues associated with increasing service provision*”³ and front-line workforce staff to “*provide insight from the perspective of the workforce on issues associated with increasing service provision*”³. Data was also being collected in this project from carers/parents of disabled children to obtain an “*understanding of the parental issues associated with service provision*”³. As these perceptions were taken from outside the project team itself through data collection, these disability stakeholder perceptions existed in the external environment of the project team (ID1 in Table 5).

The goals (ID2) were set for these various S1 activities in the project specification. For data collection, “*three focus group meetings of half day each, involving a total of 27 people. Twenty-four one-to-one interviews of 1 hour each. Three site visits of half a day each when we will informally interview 4 people at each visit, involving a total of 12 people. This approach will allow us to involve around 63 people in the consultation*”³ were to be completed by “*19th December 2008*”³. For data analysis, the goal was to use the data to find out “*how current supply of services from the [local service providers] can be scaled up and [to] identify critical issues associated with this*”³. For findings, the goal was to conduct “*meetings to brief [the council] on emerging findings*”³ and then “*submit [a] report to [the council] detailing the findings from the project*”³.

In terms of performance indicators (ID2) for data collection, the number of participants being spoken to was one as the project team had to ensure that they were “*not putting in too many*”⁴ because they “*could increase this number but effectively processing the data from 60 people is a very time consuming task and one that we do not underestimate*”³. It was also important to ensure the project team were “*not missing out too many*”⁴ participants as this could impact upon the reliability of the results. Another performance indicator for data collection was informal feedback from participants. An example of this occurred at the end of one of the focus groups when lunch was provided with the intention of gaining feedback as explained by the Research Assistant in an email to the council “*we sometimes find that lunch provides us with a bit of extra time to talk informally with the participants*”⁵. The Research Supervisor stated that identifying that participants in the focus groups “*were relatively comfortable and that they were able to do it*”⁴ was a useful performance indicator and the lunches at the end of the focus groups were useful to do this.

In interviews conducted by the Research Assistant, time was given after the digital voice recorder had been switched off to informally talk to participants too for the same reason. Other performance indicators about data collection included feedback from the council. The Research Assistant described one such feedback occasion where there *“was an impromptu meeting, held as one of my interview participants was running late, so I met with [the council project manager] to discuss how the project was going. She had received positive feedback from the parents at the parent focus group and seemed impressed with the cognitive [group] maps that we had sent to her from that focus group”*⁶. In terms of the data analysis, achieving project team agreement on the analysis was one performance indicator. For example, the project report stated that *“each recorded interview was analysed by at least two of the project team – by the original interviewer and by one of the team who was not at the interview”*⁷ which the Research Supervisor said provided an indicator *“to check whether [the analysis] is a reasonable view of the world”*⁴. The other performance indicator for data analysis was achieving project team agreement that the emerging findings were suitable given the research objectives. The Research Assistant gave an example of this where *“there were a couple of points where [the Research Supervisor] and I felt a bit uneasy that we weren’t concentrating enough on the actual workforce issues that the project required”*⁸ which prompted further discussion amongst the project team members and the council. The performance indicator for findings was feedback from the council on the presentation and the report. The Research Assistant stated that the council *“seemed impressed with our findings”*⁹ in the presentation and the Research Supervisor stated that *“in response to the presentation some emails [from the council] were very positive”*¹⁰. Following the submission of the report, the project team held *“a meeting to discuss the final report”*¹¹ with the council to obtain their feedback, where the Research Supervisor stated that the council members *“were very complimentary again”*¹⁰ about the report and the Project Manager supported this perception stating *“the client appreciated it... they’re very pleased with it”*¹².

In terms of modus operandi (ID2) of the different S1 activities that the project team undertook, this was driven by accepted research methodology and previous research experience that the project team members had gained from working on other projects. For example, data collection and data analysis activities were guided by a *“methodology called Journey Making: Joint Understanding, Reflection and Negotiation of Strategy. This is a methodology which uses group mapping as a technique to structure a group’s exploration of the issues through discussion. Maps are built real-time on a computer in front of*

*participants who subsequently use the map to inform their thinking about an issue*⁷. The Project Manager talked about how she was “*a researcher with a qualitative background*”¹³ and drew on her previous research experience of running focus groups when commenting on how she would set it up, “*normally if I was doing a focus group I’d have a facilitator and a co-facilitator*”¹³. Whilst the Project Manager had previous experience of running focus groups, she did defer to the Research Supervisor’s decisions for this data collection activity as the Research Supervisor had substantial previous experience of carrying out focus group workshops. The Project Manager commented that “*I’ve spoken to [the Research Supervisor] and asked him what he wanted me to do*” and that “*I’m basically going to follow [the Research Supervisor] because he does a different style of focus groups*”¹³. The Research Supervisor also commented that “*I’ve also taken over the role of workshop person, which is probably natural*”¹⁴ given his previous experience and the Research Assistant further commented that “*I usually deferred to [the Research Supervisor]’s judgement as he had extensive experience of working with these maps*”¹⁵ from the focus groups.

The organisational goals (ID3) for the project team were set in the project specification to determine “*how current supply of services from the [local service providers] can be scaled up and it will identify critical issues associated with this*”³ and that it was completed by the deadline given in the project specification. The expected performance (ID4) for the S1 activities of data collection, data analysis and findings were stated in the project specification and were the same as those already discussed above in the goals for the S1 units and their associated performance indicators. S3 was responsible for monitoring (ID5) these expected performance goals using the performance indicators identified. To monitor that the project was meeting the goals, the Research Supervisor stated that “*we will need to revisit [the] scope of work periodically to make sure that we’re not missing anything*”⁴. There were certain other checks that were carried out described by the Project Manager “*we need to check the confidentiality, we need to check that we’ve not broken any ethical considerations*”¹³. Confidentiality and ethical knowledge was a product of previous research experience and accepted research methodology, with the Project Manager commenting that the project members have “*that same theoretical background in terms of analysis, in terms of understanding ethics, confidentiality*”¹³. The Project Manager also stated that “*we need to check that we’re all happy with the content*”¹³, which an example for has been discussed above by the Research Supervisor stating that project team

members were checking interview analysis conducted by other members “*to check whether [the analysis] is a reasonable view of the world*”⁴.

In terms of goal and performance misalignment (ID6), one came from the number of participants consulted as part of the data collection activity. The goal, as discussed above, was to involve “*63 people in the consultation*”³. However, the project report states that “*in total, 52 representatives of carers, staff and managers were formally consulted as part of the research*”⁷. The cause of this misalignment (ID7) was explained by the Research Assistant who stated that “*I think because of the very tight timeframe for data collection, the [council] team have only a short time to get participants for each day*”¹⁶. The project report reinforces this by stating “*the short timeframe means that the research could only involve individuals who were available at very short notice*”⁷ and that the consequence of having a reduced number of participants led to obtaining “*a limited number of views from actual front-line staff who deliver the service. As a result, the research has limited first-hand information concerning how actual front-line staff feel about an increase to service provision for [disabled children]*”⁷. Due to the time pressures the project team had, they were unable to increase the number of participants and instead they decided to take the action (ID8 and ID9) simply to reduce the goal for the number of participants. The Research Assistant commented on this, “*in terms of overcoming these issues, there has been nothing we could really do, we just had to accept it and get on with the project*”¹⁶.

In terms of operational information (ID10), the Research Supervisor had knowledge of the skill-set of each project member. This was based upon the previous experience the Research Supervisor had with working with the two project members on different projects. The Research Supervisor stated that the project team “*less talked about what our skills are largely because I know what [the Research Assistant can] do and I know what [the Project Manager] does... so we haven't needed to go through [talking about] that*”⁴. This operational information supported personnel co-ordination, with the Project Manager, for example, being assigned to work on the Government policy aspect of the report as she had previously worked extensively in the social policy area.

As anti-oscillatory measures (ID11), the Research Supervisor played a significant role in ensuring the co-ordination of information between activities, supported by their statement that “*I probably perceived myself to be in the middle and for [the Research Assistant] to be at one side and [the Project Manager] to be at the other, and for [the Research Assistant] to*

*be sending me things and then I was sending them to [the Project Manager], and [the Project Manager] sending them to me and then I was sending them to [the Research Assistant]*¹⁰. The schedule of activity in the project specification also helped to coordinate the tasks by providing a date that each S1 activity should be completed by. As already discussed in Section 5.1.2 there was a high level of dependency (ID12) between the three S1 activities. The data provided no evidence to support any oscillation (ID13-14 and ID16-18) taking place within this level of recursion but the norms for admitted performance loss due to oscillation (ID15) were minimal, as the Research Assistant stated *“we were working to a very tight deadline and so had to ensure the project didn’t slip”*⁸ and because of the heavy interdependence between the S1 units for information to flow effectively between them as discussed in Section 5.1.2.

The S1 activities needed two key resources (ID19). One of these resources was personnel and this was sourced for the project team from the higher recursion level of the University Business School Research Academy as discussed in Section 5.3.3. The other key resource that the S1 activities required was time. The initial email from the Research Supervisor inviting the Research Assistant to join the project team set the expectation of the time he would need to personally allocate as being *“(very approximately) that this would be 20 days effort”*¹⁷. However, it was only in the fifth project team meeting, almost 3 weeks later, that the project team formally allocated (ID20) the amount of time each member would provide on the project when the team discussed *“the dates we were each available to collect data and we also discussed the level of pay we would each receive”*¹⁸ based upon a daily rate that was set. Shortly after this meeting, whilst the project proposal was being considered by the council, the Research Supervisor suggested that *“I’m going to propose that we each do another 20% to take it to over 50 days - 25, 14, 12 [days respectively] for [Research Assistant], [Project Manager], [Research Supervisor]”*¹⁹ to complete the analysis after Christmas. The other project team members accepted this proposal. These allocated figures were then audited (ID28) by the Research Supervisor, as already discussed in Section 5.1.2.

In terms of proposals for innovation made by S4 (ID22), many came from the project scope definition process. The Research Assistant described that during the scope definition process a proposal came to *“widen the scope of the project to include aspects like quantitative data”*²⁰. This set a desired goal (ID23 and ID35) for the Data Collection S1 unit to include quantitative data which the project team felt increased the gap between the

proposed scope of the project and the desired scope (ID24 and ID34) enormously – captured by the Research Supervisor’s simple email to the other project team members of “?”²¹ in response to the proposal to include quantitative data. The reason this gap was perceived to be so large was because to undertake the extra work would have required much more time capacity (ID25) than was actually available (ID26 and ID27). As the Research Supervisor commented, the project team, when reviewing such proposals (ID29), found that they “*don’t have enough time, the amount of time that is available is incredibly limited*”⁴. As a result there was no capacity for S1 activities to be increased due to time being so limited, so the only way it could be implemented was for the project team to “*either do a lot in not much detail or we can do a thinner one in more detail*”⁴. As a result, it was decided (ID30) that the S1 activities would “*go for the latter*”⁴ of being more detailed and retaining the original proposed scope goals. Therefore, it was the “*timeframe available*”⁸ that was used by the project team to determine (ID31) that the S4 innovations “*to increase the scope of the work... was infeasible*”⁸. The Research Supervisor showed that previous research experience helped counter the imbalance between S3 and S4 (ID33 and ID36) through understanding that the process of “*thin down the scope, expand the scope, thin the scope, expand the scope, thin the scope*”⁴ as “*going through exactly the normal thing you would normally do*”⁴.

There were a couple of future project opportunities arising in the relevant environment (ID32) of the project team. The Research Supervisor stated that “*you’re always looking to where’s the next project coming from*”¹⁴ and, as discussed in Section 5.1.2, the council accepted a proposal from the project team to generate a short summary report that was written to communicate the findings from the research to the general public²².

The culture (ID37) in the project team was similar in many ways to the culture of the University Business School Research Academy with the Project Manager noting that the culture in the project team was partly driven by the previous research experience of the project team members. Much of the previous research that members of the project team had been involved with had been highly applied research. Whilst the Project Manager stated that the Research Supervisor and the Research Assistant came from a research background that “*is obviously much more into systems than I am*”¹³, they noted that “*in a sense there’s still that same theoretical background*”¹³ in terms of previous research experience, such as the types of analysis undertaken, and that “*there’s still a similarity there and I think in that sense we can be compatible*”¹³. The Project Manager and Research

Supervisor both made a number of references to members of the project team being chosen on the basis that they were perceived to be able “*to deliver against very tight timescales to [a high] level of quality*”⁴ and that they were careful who they selected because of the urgency of the project. All of this lent itself to a culture within the project team of being no-nonsense, very fast paced and proactive and manifested itself in the very quick speed generally that emails were responded to between project team members and the frustration the project team members experienced at how slow the council were at times in making decisions or responding to requests for information and their overall general lack of organisation.

***Finding:* the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of oscillation at this level of recursion. This meant that in terms of the comparison between Table 5 and the information present at this level of recursion, there was no evidence to support information being present about the gap between admitted and actual performance loss due to oscillations and its causes (ID16-17) or any evidence that could support the use of experiences with anti-oscillatory measures (ID18) from the project team. There was also no evidence of manipulation of external environment (ID21) or any evidence to support the algedonic signal (ID38) at this level of recursion. There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.**

5.2.2 Information Shared/Not Shared at Level 1

This section presents the evidence for information shared within the project team VSM at level 1 recursion in relation to the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information shared within the project team at this level of recursion that does not fit into the extended theoretical model.

The communication channels discussed in Chapter 3 that supported information sharing at this level of recursion are provided in Figure 17 of the Project Team A VSM, which has been adapted from the generic VSM diagram of communication channels presented in

Figure 13. The greyed out communication channels are not explored at this level of recursion as they represent communication channels at a lower level of recursion which are examined in Section 5.4.

Project Team A VSM and Communication Channels

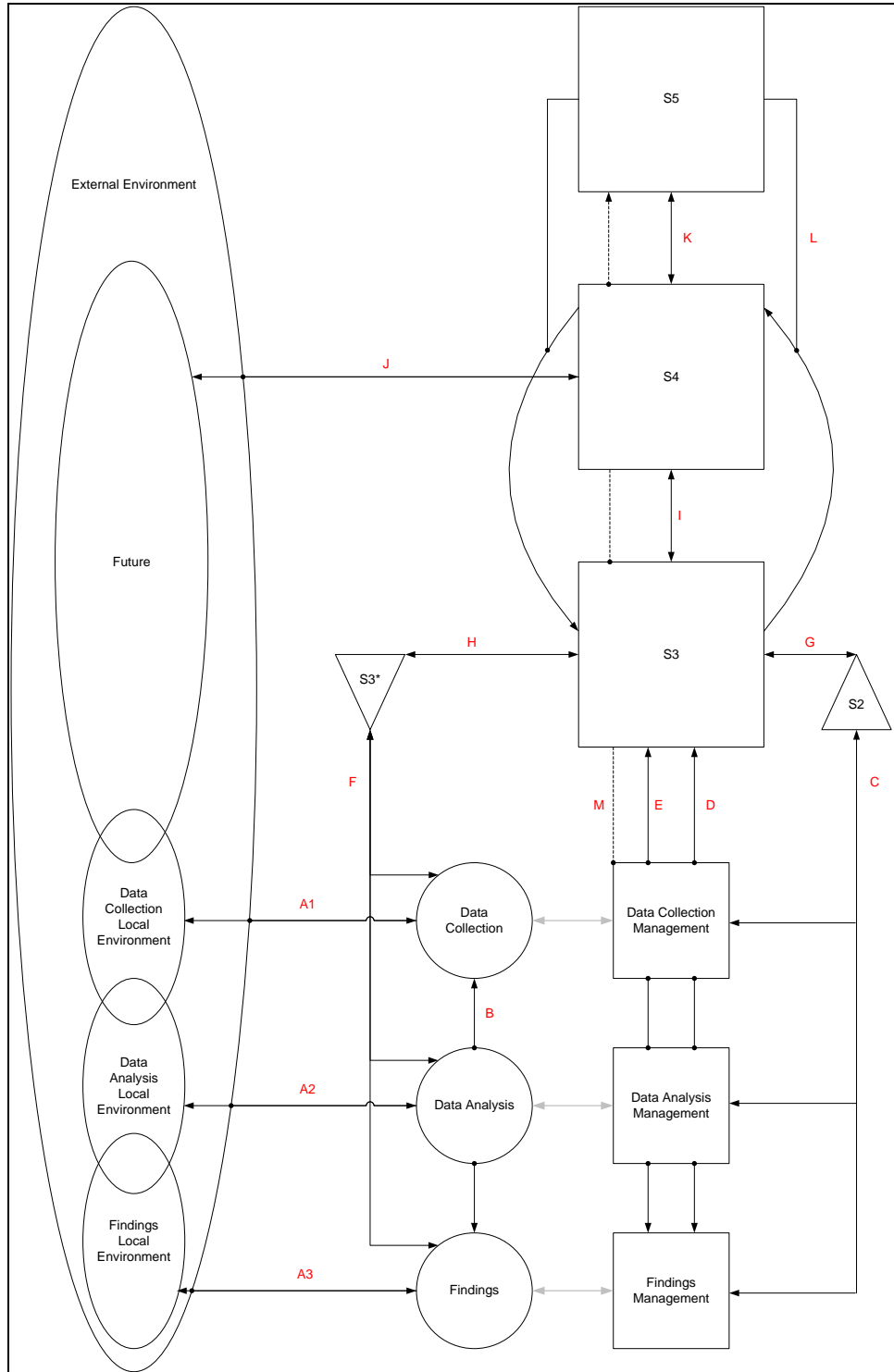


Figure 17

The data for the project was collected from participants in the external environment, demonstrating a one-way sharing of information across communication channel A1 between the external environment and the Data Collection S1 unit (ID1). The mode of information sharing here was “*through a series of focus groups and personal interviews as well as nine site visits*”⁷ and through the collection of documentation. However, information also flowed in the opposite direction across communication channel A1 to the participants as the project team members would discuss what the project was about and answer any questions the participants had on the research. Examples of this information sharing was present at the start of focus groups, where the Research Supervisor would begin the session by welcoming the participants, formally introducing the research project and discussing its aims. There was also an informal opportunity for the participants to ask about the research in more detail when lunch was provided as described above in Section 5.2.1. This mode of face-to-face sharing of information was also carried out in the interviews and site visits, with the Research Assistant always beginning the interview/site visit by explaining the research project and formally providing an opportunity for questions from the participants both at the start of each interview/site visit and at the end. When interviews were conducted over the phone, the same format was also used. In terms of S1 unit to S1 unit information sharing, the interdependences between the three S1 units have already been considered in detail in Section 5.1.2. In order to carry out analysis, the Data Analysis S1 unit needed the data collected from the Data Collection S1 unit across communication channel B. The email records show that interview audio, site visit notes, focus group maps and documentation were emailed between project team members so that whoever was carrying out the analysis had the data available. The Data Analysis S1 unit also had to provide the analysis to the Findings S1 unit so that the findings could be produced and disseminated. The email records show information sharing occurring between these two S1 units in the form of interview analysis notes, analysis write ups and analysis group maps, the latter being maps that were described in the project report as “*following each subsequent interview we updated the maps to reflect every new piece of learning, new issue and new perspective. This involved the project team revising the maps to broaden issues, add new themes and reshape the emerging results. The maps rapidly became a comprehensive representation of the perspectives of the range of participants involved in the study*”⁷.

The goals set by, performance and modus operandi of the primary activities in S1 (ID2) were shared between the S1 units and S2 across communication channel C which enabled

S2 to ensure the schedule of activity was being followed and determine if there was any oscillation. This process was handled by the Research Supervisor receiving information, through meetings, telephone calls and emails from the other two project team members. As discussed in Section 5.2.1, the Research Supervisor perceived themselves to be acting as a central co-ordination point for sharing information between team members, “*as long as somebody’s got their finger on the pulse and knows what other people are doing and what is not being done then you can cope*”¹⁰. An example of this information being shared between the Data Collection S1 unit and S2 was when a participant failed to turn up for an interview with the Research Assistant. Whilst the Research Assistant handled the rescheduling of the participant, he also notified the Research Supervisor via email of the rescheduling²³. The goals set by, performance and modus operandi of the primary activities in S1 were shared between the S1 units and S3 across communication channel D which enabled S3 to carry out the monitoring of performance. Information on what the S1 activities were undertaking and how it was going was necessary to use when revisiting the “*scope of work periodically to make sure that we’re not missing anything*”⁴. Information on the level of confidentiality, ethical standards, etc. that was used in the other checks discussed in Section 5.2.1 was also shared. The sharing of this information was never really explicit as all project team members were involved in the S1 activities so were able to carry out the S3 checks themselves. The monitoring and control practices by S3 (ID5) were summed up by the Project Manager as “*I don’t think they will be formalised processes but they will take place at different stages as different things emerge really*”¹³. This reactionary approach was supported by the Research Assistant who commented that “*there are no formal plans in place but I’m sure [the other two project team members] and I will communicate throughout the project to discuss progress and resolve any issues that arise*”²⁴. This occurred at one stage when the project team identified a goal and performance misalignment between the expected performance (ID4) in the scope of work set out in S3 and the performance of the Data Analysis S1 unit. The Research Assistant stated that the project team were “*uneasy that we weren’t concentrating enough on [one of the particular sets of] issues that the project required*”⁸. The misalignment was initially identified by the Research Assistant prior to the fifteenth project team meeting when the previous day the Research Supervisor had asked the Research Assistant to “*take a copy of the [focus group] maps away with me and go through them to see if we had missed anything*”²⁵. The Research Assistant then shared this misalignment issue (ID6) across communication channel D at the project meeting when feeding back “*some of the issues I had identified from going through the maps in the morning*”²⁶ to the other project team

members. The causes of this misalignment (ID7) was that much more broad and relevant data was elicited during the consultation, which the project team felt would be of benefit to the council.

In terms of sharing the goals set by, performance and modus operandi of the primary activities in S1 with S4, this was also not done explicitly but this information was used to inform decisions by the project team members about innovation proposals, as discussed in Section 5.2.1.

Organisational goals (ID3) were explicated in the project proposal document which was shared with S4 where they were used to inform if innovation proposals were relevant – such as identifying another group of participants needing to be worked with to fill a gap identified by the project team in the original scope of work as discussed in Section 5.1.2. The goals in the project specification were also shared with S3 and used at the start of the project to determine the lower level goals for the S1 units. These expected performance of the primary activity (goals for S1 activity) (ID4) were then shared using communication channel E to inform the S1 activities what they should be doing. For example, the most appropriate and number of data collection methods to use to achieve the research objective were discussed over email for the Data Collection S1 unit and then shared in the final version of the project proposal document.

The operational information (ID10) that the Research Supervisor had of the skill set of each project team member, as discussed in Section 5.2.1, supported personnel coordination and was shared across communication channel C. For example, the Research Supervisor asked the Project Manager to work on the Government policy aspect of the report as she had previously worked extensively in the social policy area.

Due to the time constraints of the project, oscillation needed to be kept to a minimum (ID15). Each project team member talked about the constant awareness of the need to work to a very tight deadline and to ensure the project did not slip in their interviews^{4,13,24}. This informed the goals set by the S1 units. Whilst there was no set formal process for identifying the level of oscillation, it was possible to identify any duplication, for example, with each project team member emailing their analysis to each other each time they had done some work on it. As discussed in Section 5.2.1, the Research Supervisor and the scheduling were used to reduce the possibility of oscillation occurring (ID11).

The S1 activities needed two key resources (ID19) – personnel (discussed in Section 5.3.3) and time (as identified in Section 5.2.1). The amount of time required was driven by the need for meeting the overall project team objectives. The needs of S1 informed the resource allocation (ID20) process across communication channel E. As discussed in Section 5.2.1, the initial email from the Research Supervisor inviting the Research Assistant to work on the project set the expectation that 20 days effort would approximately need to be given by the Research Assistant, which was then subsequently increased to ensure the analysis could be completed on time. As further discussed in Section 5.1.2, these allocated figures were audited (ID28) by the Research Supervisor who asked for them over email across communication channel F. As the Research Assistant explained, the Research Supervisor “*asked me to keep a timesheet to record the hours I did*”¹ which enabled them to email back an accurate figure.

The proposals for innovation made by S4 (ID22), reviews by S3 of proposals for innovation (ID29), finalised plans for adaptation of organisational goals (ID30) and regulatory measures to counter the imbalance between S3 and S4 (ID31) were found not to be shared at one single recursion level. To provide a richer description, this information sharing is described as a multi-recursion level process in Section 5.3.2.

Cultural knowledge (ID37) was found to be present within each of S1-S5. As described in Section 5.2.1, the culture within the project team was no-nonsense, very fast paced and proactive. For example, at S1 the Findings S1 unit was completed “*5 days early*”¹⁰ and “*every project team member pulled their weight*”⁸. At S2, no oscillation occurred through the proactive information sharing and co-ordination from the Research Supervisor discussed above. At S3, the project team members got frustrated at how the council were unable to “*make decisions quickly*”¹³. At S4, the project team actively searched for new projects that they could carry out, with the Research Supervisor commenting that “*you’re always looking to where’s the next project coming from*”¹⁴. This cultural knowledge was shared across the entire VSM model for Project Team A through each project team member working together across S1-S5.

Finding: the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is shared in viable systems at one level of recursion. However, there was no evidence of the algedonic

signal (ID38) on communication channel M or information being shared across communication channel J to manipulate the external environment (ID21). As stated in Section 5.2.1, there was also no evidence that supported the presence of oscillation at this level of recursion and, therefore, the sharing of information on oscillation (ID16) was not able to be observed. There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

Finding: Table 11 shows how the extended theoretical model relates to the final version of the coding scheme developed for level 1 recursion in Project Team A. Table 11 shows in black where the information domains from the extended theoretical model matched those found through coding the data and the information domains that did not match the coding of the data are shown in grey. There was no evidence of any other failure of the extended theoretical model to match the data coding for this level of recursion:

Coding Scheme for Project Team A Recursion Level 1

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
1	External environment information	G, A	A				A	
2	Goals set by, performance and modus operandi of the primary activities in S1		G, A	A	A	A	A	
3	Organisational goals		A		A		A	G, A
4	Expected performance of the primary activity (goals for S1 activity)		A		G, A			
5	Monitoring and control practices by S3		A		G, A			
6	Goal and performance misalignment		A		G, A			
7	Causes and consequences of goal and performance misalignment		G, A		G, A			
8	Actions to counter goal and performance misalignment by S1		G, A					
9	Heuristics to implement counteractions		G, A					
10	Operational information		A	G, A				
11	Anti-oscillatory measures		A	G, A				
12	Interdependencies between S1 activities			G, A				
13	Actual oscillations			G, A				
14	Actual performance loss due to oscillations			G, A				
15	Norms for admitted performance loss due to oscillations (goals for S2)			A	G, A			
16	Gap between norm for admitted and actual performance loss due to oscillations			A	G, A			
17	Causes of the gap between admitted and actual performance loss due to oscillations			G, A				
18	Experiences with anti-oscillatory measures			G, A				
19	Problems and needs of the management of S1 activities		G, A		G, A			
20	Resource allocation		A	G, A	G, A			
21	Manipulation of external environment	A					G, A	
22	Proposals for innovation made by S4				A		G, A	A
23	Desired goals for S1 based on proposals for innovation				G, A			
24	Gap between desired and current goals of S1				G, A			
25	Required capacity for reorganisation of S1 activities				G, A			
26	Actual capacity for reorganisation of S1 activities				G, A			
27	Gap between required and actual capacity for reorganisation of S1 activities				G, A			
28	Auditing				A	G, A		
29	Reviews by S3 of proposals for innovation				G, A		A	A
30	Finalised plans for adaptation of organisational goals (a joint S3 and S4 product)				G, A		G, A	A
31	Regulatory measures to counter the imbalance between S3 and S4				A		A	G, A
32	Developments in the relevant environment of the organisation						G, A	
33	Norms for balance between S3 and S4							G, A
34	Actual imbalance between S3 and S4							G, A
35	Causes of imbalance between S3 and S4							G, A
36	Experiences with regulatory measures to counter the imbalance between S3 and S4							G, A
37	Cultural knowledge	A	A	A	A	A	A	G, A
38	Algedonic signal	G, A	G, A	G, A	G, A	G, A	G, A	A

Table 11

5.3 Higher Recursion Level

As discussed in Chapter 4, the recursion level directly above the system-in-focus should be studied when carrying out VSM investigations in order to analyse the system-in-focus in context. Therefore, the relevant recursion levels directly above the project team (recursion level 0) are described in this section. This section will describe the two higher recursion level models that were identified to be relevant to the system-in-focus when conducting the VSD process, as described in Chapter 4. The first higher level recursion model will be introduced to the reader and described in terms of the VSM. The information that is shared between this model and the project team will then be identified to explore the fourth question posed by this research before moving on to examine how this information is shared between the recursion level and the project team, in accordance with the fifth and final question posed in this research. The second higher recursion level model will then be presented to the reader and analysed in the same way.

5.3.1 VSM Level 0 – Council

During the system identification phase of the VSD process, the system-in-focus was identified to be embedded within two relevant higher-level systems. The first of these systems is relevant as it puts into context where the project team system sat within the system that commissioned the project – the council. It was necessary to model this system too as the council played a significant role in shaping the scope of the project.

This system was identified as:

- a system to **develop a proposal** to submit to Government to secure funding to increase respite provision for disabled children and their carers at local service providers

The system to achieve the purpose of developing a proposal was a much larger project team from the council and, as a result, this project team system is at Level 0 for this case study.

The bid proposal that the council were putting together was being guided by a specification sent to them from Government. The Project Manager stated that “*the most informative*

document that we've had is the [Government] document, the actual specification from the [Government] because that document is actually very clear what is necessary to do"¹³ for the bid. However, Project Team A were only carrying out a small part of the work necessary as part of this Government specification, as stated by the Project Manager "we're not covering all aspects of [the Government specification] because it's impossible at this moment in time and [the council] will have to do that later"¹³. As a result, the S1 units of the VSM at this level of recursion are defined as Project Team A and the council project team that conducted the rest of the Government bid proposal project. As the council project team would be using the findings generated by Project Team A, there was a strong need for the research findings information to flow from Project Team A to the council project team.

Given the need for information to flow from Project Team A to the council project team, S2 had a role to play in co-ordinating this dissemination of information. This was a function played by the council project team manager who arranged two meetings^{9,11} for Project Team A to discuss their findings with the council and ensured the report created by Project Team A was sent to each member of the council project team. As Project Team A and the council project team did not need to share any resources, S2 did not have a huge role to play beyond information co-ordination. A deadline for Project Team A to complete their research was imposed at the start of the project in the project specification but scheduling beyond that was not undertaken at this level of recursion for Project Team A.

The Government specification document and project specification provided S3 with the means with which to base monitoring and control activities. The monitoring and control activities between the council and project team are described in more detail in Section 5.3.2. S3 also played a role in allocating financial resources to Project Team A. The finances did not come from the council project team themselves but from another department within the council.

In defining the scope of the proposal bid, the Government specification document meant that S4 had little to do in terms of refining scope. Nevertheless, not all of the information from this specification seemed to be incorporated into the scope that S3 and S4 defined for the proposal bid. The Research Supervisor noted that "I think it would be fair to say that they had a modest understanding as to what the project was supposed to be before they commissioned it and they got a better understanding about what the project should have

*been after it was finished and despite our protestations throughout the project they still didn't quite listen in terms of [other service providers being consulted], in terms of broadening out the people who were involved, having a much more equal balance"*¹⁰. Despite Project Team A identifying gaps in their proposal bid, S3 appeared to dominate and kept the scope static from when it had been initiated. Project Team A did try to bridge some of the gaps found in the council's workings but where they did, they faced competition from another consultancy organisation in the council project team touting for work. As the Project Manager explained *"it's a shame, given that we identified the gap with [a key service provider group not being represented], which is a huge gap, that we probably didn't jump in fast enough to say that we'll do that part of it and that's just about [the consultant] was very sharp off the mark with that and that's something that we have got to bear in mind in future because if we do more work with [the council], [the consultant] is obviously sharp enough to see that he can piggyback on our knowledge really and use that to his consultancy's own end and that's something we've got to be cautious about"*²⁷. The Research Supervisor reflected back on this after the project was completed and stated that *"interestingly, the bit that [the consultant] did farm off to his friend was never delivered"*¹⁰. This left the gap still present for the council.

S4 did play a role in identifying future activities that Project Team A could be commissioned to carry out to help further support the council project team in developing their bid proposal. The Research Assistant commented on this process during the final meeting between the project team and the council at the end of the research project, *"the last part of the meeting was spent discussing future directions, although [the council] once again seemed reluctant to make any decisions. [The council] saw the lack of [one key service provider] involvement as a problem but seemed less enthusiastic about resolving it – they put barriers up like "the [service providers] probably won't have time to talk to us at short notice"*¹¹. The Research Assistant commented further about the consultant appearing again at this meeting, *"[the consultant] brought one of his consultancy friends along to this meeting – who had nothing to do with this project – to see if they could get any work from [the council]. [The consultant] and his friend requested to take the project team's findings and spend 2 days helping [the council] turn it into a final submission document for their bid – which [the council] appeared to accept"*¹¹.

The reason the gaps highlighted by Project Team A were not addressed seemed to be down to a very weak S5 in the council system. The Research Assistant highlighted that *"no-one*

from [the council] seemed willing to make a decision”¹⁶ when new directions for the proposal bid were highlighted. The Project Manager expanded on this stating that “my view is that within that particular little team they don’t have strong leadership in that team and because of that I think they’ve been floundering a bit in terms of what to put together, what to do – I think that because they’re so behind”²⁷. The council had a project manager operating at S3 for the proposal bid project team but the Project Team A Project Manager felt she was not receiving any support from S5 – and may not have had the required skills to carry out S5 activities herself, “I think it’s probably actually the person above [the council project team manager] is really in charge of this project, and I think that project manager has kind of been left on her own. What we don’t know is what experience she’s got of putting bids like this together, so that’s an unknown quantity. She’s obviously got some skills in social work because she’s talked about her social work skills – that doesn’t necessarily mean to say she’s got skills to put a bid together. I think in a way, although she’s got a consultant to work with who’s like her buddy consultant, I’m not sure that consultant is that clued up in terms of getting the bigger picture – that’s been my view that they’re quite good in the detail but to get an overview and a strategic vision, that I think is completely lacking”²⁷. The Project Manager further supported this feeling by stating that “I think it was the leadership above [the council project team manager] where there was a disconnection”¹² which manifested itself as “one of the reasons that they hadn’t really grasped what needed to go in to the [bid proposal] document and that’s just the circumstances of their team because it wasn’t that they weren’t working hard – they were working hard – but they were working in silos a bit”¹². The lack of this high level leadership appears to be the reason for S4 suggestions not being implemented – there was no-one in the council willing to take the decision to do so.

5.3.2 Information Shared between Level 0 – Council and Level 1 VSM

The highest rate of information sharing occurred between the Council VSM at Level 0 and the Level 1 VSM during the project scope definition phase. As described in Section 5.2.1, this was a process undertaken primarily between S3 and S4 at Level 1 and the council. It is this information flow that will now be described in the context of the communication channels in Figure 18:

Multi-Recursion Level Communication Channels

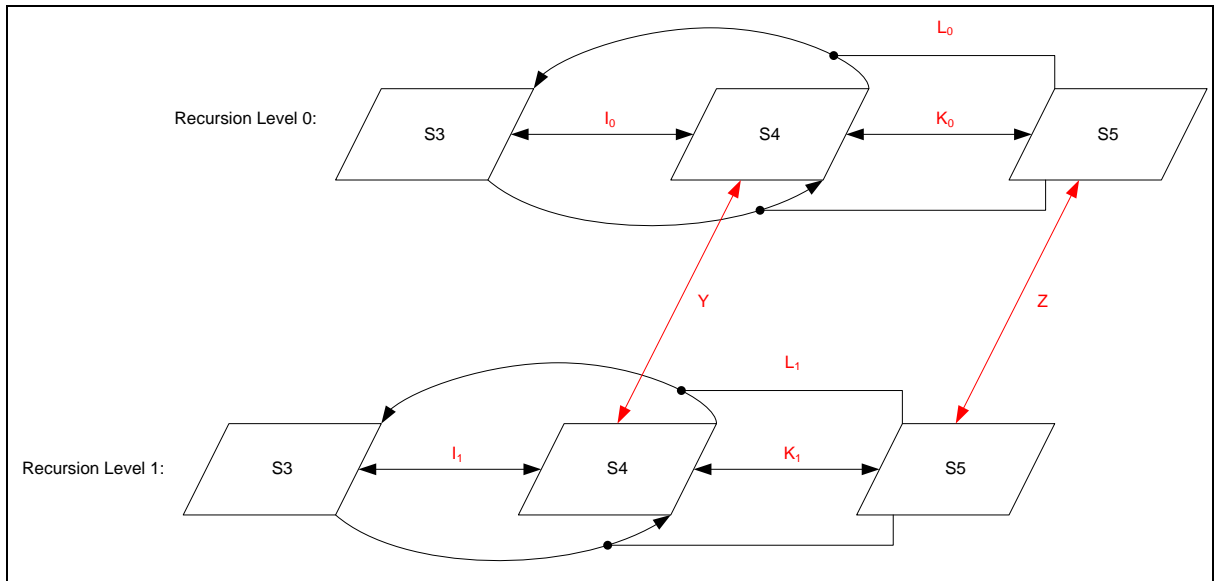


Figure 18

$S4_{\text{Level } 0}$ received the Government specification document that informed the council what needed to be undertaken for the overall project. This information was then shared with $S3_{\text{Level } 0}$ over communication channel I_0 in Figure 18 and $S3_{\text{Level } 0}$ determined what resources were available to carry out the overall project. This information was then communicated back to $S4_{\text{Level } 0}$ which sought ways to overcome the resources $S3_{\text{Level } 0}$ had identified as being unavailable and identified that Project Team A could help overcome this lack of resources. $S4_{\text{Level } 0}$ sent over communication channel K_0 the details of the resource unavailability and the potential method of overcoming it by using Project Team A to $S5_{\text{Level } 0}$ and $S5_{\text{Level } 0}$ gave the go-ahead to use Project Team A to $S4_{\text{Level } 0}$ using communication channel K_0 . $S4_{\text{Level } 0}$ then sent $S4_{\text{Level } 1}$ the details of the overall project and described the areas they would like help in over communication channel Y . $S4_{\text{Level } 1}$ then shared this information with $S3_{\text{Level } 1}$ using communication channel I_1 and $S3_{\text{Level } 1}$ determined what resources were available to carry out the tasks that the council required help in. $S3_{\text{Level } 1}$ and $S4_{\text{Level } 1}$ then used communication channel I_1 to discuss and develop a proposed project specification. This proposed project specification was then sent by $S4_{\text{Level } 1}$ to $S5_{\text{Level } 1}$ over communication channel K_1 , which then subsequently decided if the project proposal was acceptable. If it was not, $S5_{\text{Level } 1}$, $S4_{\text{Level } 1}$ and $S3_{\text{Level } 1}$ worked together to amend the proposed project specification until it was acceptable to $S5_{\text{Level } 1}$. Once it was, $S4_{\text{Level } 1}$ sent the project proposal to $S4_{\text{Level } 0}$ using communication channel Y . This information was then shared with $S3_{\text{Level } 0}$ over communication channel I_0 and $S3_{\text{Level } 0}$ determined what resources were still needed to carry out the overall project that the project proposal did not address. This information was then communicated back to $S4_{\text{Level } 0}$ which

sought ways to overcome the resources $S3_{\text{Level } 0}$ had identified as being unavailable and identified scope changes to either the project proposal or the overall project itself to overcome these resource issues. $S5_{\text{Level } 0}$ then determined if the project proposal was satisfactory to go-ahead. If it was not, then this was communicated to $S4_{\text{Level } 0}$ using communication channel K_0 and $S4_{\text{Level } 0}$ then sent $S4_{\text{Level } 1}$ the details of the proposed scope changes using communication channel Y . $S4_{\text{Level } 1}$ then shared this information with $S3_{\text{Level } 1}$ using communication channel I_1 and $S3_{\text{Level } 1}$ determined what resources were available to carry out the tasks in the new proposed scope. $S3_{\text{Level } 1}$ and $S4_{\text{Level } 1}$ then used communication channel I_1 to discuss and develop refinements to the proposed project specification. This refined proposed project specification was then sent by $S4_{\text{Level } 1}$ to $S5_{\text{Level } 1}$ over communication channel K_1 , which then subsequently decided if the refined project proposal was acceptable. If it was not, $S5_{\text{Level } 1}$, $S4_{\text{Level } 1}$ and $S3_{\text{Level } 1}$ all worked together to amend the proposed project specification until it was acceptable to $S5_{\text{Level } 1}$. Once it was, $S4_{\text{Level } 1}$ sent the project proposal back to $S4_{\text{Level } 0}$ which was then reviewed again as before. This process continued until $S5_{\text{Level } 0}$ decided that the proposal from $S4_{\text{Level } 1}$ was acceptable. This decision was then communicated by $S5_{\text{Level } 0}$ to $S5_{\text{Level } 1}$ over communication channel Z .

This process was undertaken over email by the project team sending each other revisions to a project proposal document which, when all team members agreed that it was acceptable, they would send over to the council and then the council would send revisions back. The Research Supervisor described scope creep occurring, which “*was inevitable it was going to happen because the client did not have a well defined scope and therefore they were constantly trying to get more but [the project team were] trying to stop that from happening... pretty much saying you don’t have enough time, the amount of time that is available is incredibly limited, we can either do a lot in not much detail or we can do a thinner one in more detail*”⁴. This scoping process also occurred in the first meeting the whole project team attended with the council. The Research Assistant described this meeting as “*previous to this meeting, [the council] has tried to widen the scope of the project to include aspects like quantitative data. Due to the time pressure, the project team went into this meeting with the objective of reducing the scope of the project to make it possible for us to carry out. This meeting also allowed the project team to discuss the draft proposal with [the council]. [The council] seemed very unsure of exactly what they wanted from the project and the first half of the meeting seemed to be them attempting to establish what it was they wanted... the second half of the meeting began to make a little more sense*

*but I still came away from the meeting very unsure about what [the council] actually wanted, if indeed they knew themselves*²⁰. Eventually, the project specification was approved by the council, although they continued to attempt to make changes after the final version had been submitted via email²⁸.

S3 of the project team also shared information on the progress of the project with S3 of the council team. The Research Supervisor stated that *“we need to constantly update [the council] so that they’re not going too far away from us to make sure that they are comfortable with the progress as well as comfortable with the scope of work that we’re producing”*⁴. The Research Supervisor also noted that the council project team manager *“will constantly be searching for information to see whether we’re doing our jobs right as she should be and we’ll be constantly making that easily available to her”*⁴. One example given by the Research Supervisor of this information sharing was that *“we’ll send [focus group feedback] documents to [the council project team manager] and she will be able to look through them, that will provide her with some feedback and it will provide her with an opportunity to do as much of a health check as she wants”*⁴. It is here that the VSM modelling of different recursion levels breaks down because the S1 Focus Group unit feedback documents from the Data Collection Level 2 VSM need to be shared with S3 of the Level 0 Council VSM. Additional information from the Data Collection Level 2 VSM, such as *“talk[ing] with people like [another member of the council project team] telling them how many people were there [at the focus group], telling them that [the participants] were relatively comfortable and that they were able to do it, give [the council] a very very quick “this is how much material we managed to cover in the last three hours” trying to put some impressions in [the council’s] mind”*⁴ is also not modelled in the VSM to be able to reach S3 in the Council Level 0 VSM. Informal feedback was also given to S3 of the council from the participants of the Focus Group S1 unit, with the Research Supervisor commenting that one of the participants *“is going to be going on the phone to [the council project team manager] in the next few days because she’ll have some other arrangements for interviews that she’ll be making and she’ll be feeding back to [the council project team manager] what her thoughts were on the running of the session”*⁴. The Research Assistant backed up this information flow stating that *“[the council project manager] had received positive feedback from the [participants] at the [focus group] and seemed impressed with the cognitive [group] maps that we had sent to her from that focus group”*⁶. The VSM does not provide a structure for information to move between Level 2 and Level 0 for this to directly happen.

***Finding:* a deficiency of the VSM is that it does not provide a structure for information to move directly between recursion levels that are two levels apart, for example between Level 2 and Level 0.**

S3 of the Project Team Level 1 VSM also sent S3 of the Council Level 0 VSM information about the funding for carrying out the research. This task was carried out by the Research Supervisor who sent the council a quote for the work by email and also sent two invoices for the work (one mid-way through the project and one once the project had been completed).

During the project, proposals for widening the project scope were shared between S4 of the Project Team Level 1 VSM and S4 of the Council Level 0 VSM. As discussed in Section 5.3.1, a key service provider group not being represented in the project was identified as a large gap by the project team. This information was relayed to the council in meetings held between the project team and the council. Another information flow between S4 of the Project Team Level 1 VSM and S4 of the Council Level 0 VSM were the two documents detailed in Section 5.1.2 that were sent by the project team via email to the council as proposals to extend the work with the council.

5.3.3 VSM Level 0 – University Business School Research Academy

During the system identification phase of the VSD process, the second relevant system that the system-in-focus was found to be embedded within is relevant as it puts into context where the system-in-focus sat within the organisational system that employed the project team – the University Business School Research Academy. It was necessary to model this system too because the system had a bearing on how the project team members conducted the research and also on how the relationship between the University Business School Research Academy and the council developed.

This system was identified as:

- a system to **carry out research** that addresses the needs of organisations

The system to achieve the purpose of carrying out research was a university research academy and, as a result, this departmental system is at Level 0 for this case study.

The University Business School Research Academy conducts a range of research projects of which the employees at the Business School work on. Project Team A was one of many such research project S1 units in this system.

S2 contains formal documents detailing university-specific codes of practice and standards to guide research project teams. There is not any formal S2 information co-ordination that goes on between project teams due to each project generally being independent. In some projects, employees may be working on other projects and communicate information from one project team to the other project team where relevant. Due to each project team forming when the need arises, there is no central co-ordination of activities that goes on between each project.

S3 is mainly responsible for allocating personnel resources. The Project Manager had worked with the council before and they had approached her to carry out more research. The Project Manager described the initial process of allocating personnel to Project Team A as *“I emailed everyone in the [University Business School Research Academy] to say that [the council had suggested some work and] was anybody willing out of the [University Business School Research Academy] to come to a meeting because they wanted to discuss more work and nobody had got any time to come – [the Research Supervisor] was actually the only person who offered to come to that meeting and I had worked with [him] before on [another project] so I was quite friendly with him and that’s how it came about really, to work together on this”*¹³. After that meeting the Research Supervisor described how he and the Project Manager determined the rest of the make up of the team *“in identifying the team we identified who would deliver against very tight timescales to [a high] level of quality and [the Research Assistant’s] name came up. We didn’t think about expanding the team any broader than that, largely because when you start to expand teams beyond small levels they start to become unwieldy so really the only thing that we used as an evaluation criteria was do people deliver”*⁴. Following this, the Research Assistant said the Research Supervisor *“sent me an email... inviting me to become part of [the project] team working on a project for the local council. I was interested because I am trying to increase my experience in consultancy and so indicated that I was interested. [The Research*

Supervisor] *then phoned me and we had a chat about the project and we moved on from there really*²⁴.

S4 had a particular role at this level of recursion in developing the relationship between the University Business School Research Academy and the council. The Project Manager highlighted that the project team “*were under pressure to make sure that we offered something because the client is too important*”¹³ because “*this is not just about this project, this is about developing a much longer-term relationship with [the council]*”¹³ and “*if we do this part well, my view is that we will get more research*”¹³. The Research Supervisor stated after the completion of the project “*this was their taster – [the council] said that – that we were on trial*”¹⁰. The Research Supervisor went on to detail several other projects that have since been commissioned by the council for the University Business School Research Academy to undertake. Reflecting on this, the Research Supervisor stated that “*I think the project has really helped to solidify our position within [the council], the amount of other things that this has led to has been extraordinary*”¹⁰ with “*so many other things happening*”¹⁰.

S5 activities are handled by a management team that are involved in strategic decisions about the direction of the University Business School Research Academy.

5.3.4 Information Shared between Level 0 – University Business School Research Academy and Level 1 VSM

Due to the project team members all working for the University Business School Research Academy, they were bound by the university-specific codes of practice and standards. For example, the project specification stated that the Research Supervisor would “*ensure the project meets quality levels of [the University Business School Research Academy]*”³. This information was therefore present at S2 of the Project Team Level 1 VSM having come from S2 of the University Business School Research Academy Level 0 VSM.

Finding: at the higher level of recursion, the highest rate of information sharing occurred between the Council VSM at Level 0 and the Level 1 VSM during the project scope definition phase. This process was described in detail in Section 5.3.2. Information on funding, project progress, potential scope increases to the project and

potential new projects was also shared between the Council and Project Team A recursion levels. University-specific codes of practice and standards were also shared between the University Business School Research Academy and Project Team A recursion levels.

5.4 Lower Recursion Level

As discussed in Chapter 4, the recursion level directly below the system-in-focus should be studied when carrying out VSM investigations in order to analyse the system-in-focus in context. Therefore, the relevant recursion levels directly below the project team (recursion level 2) are described in this section. This section will describe the three lower recursion level models that were identified to be relevant to the system-in-focus when conducting the VSD process described in Chapter 4. The first lower level recursion model will be introduced to the reader and described in terms of the VSM. The information that is shared between this model and the project team will then be identified to explore the fourth question posed by this research before moving on to examine how this information is shared between the recursion level and the project team, in accordance with the fifth and final question posed in this research. The second and third lower recursion level models will then be presented to the reader and analysed in the same way.

5.4.1 VSM Level 2 – Data Collection

During the system identification phase of the VSD process, three S1 units of the system-in-focus were identified. The first of these systems was identified as:

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- a system to **consult the number of participants** using the various methods as set in the project specification document

The project specification document specified that 63 people would be consulted as part of the data collection process. This project specification document stated that data would be collected through the three different methods already described in Section 5.2.1: focus groups, interviews and site visits. Documentation was also collected on Government policy and from the council. Each different data collection method therefore made up an S1 unit

of the VSM at this level of recursion. The project report describes the way data was collected using each method. For the focus groups, “*data was collected through a methodology called Journey Making*”⁷, which has already been described in Section 5.2.1. Focus group meetings were also recorded on to a digital voice recorder. For the interviews, the data was “*collected by face-to-face discussions with participants. When this was impossible, phone interviews were used. In most cases the interviews were recorded, with the permission of the interviewee. In addition [notes were] made by the interviewer during the interview*”⁷. For the site visits, these “*were summarised to inform the other members of the project team about lessons learned. These visits provided a useful context and helped the project team to explore some of the issues around access for disabled children and young people. The learning from these visits was incorporated into the data set for this project*”⁷. Documentation from the site visits was also collected where appropriate.

The Research Assistant commented that an “*interview/focus group/site visit schedule developed by [the council] gives us dates and times of various data collection activities*”²⁴. This provided the basis for S2 to co-ordinate the project team personnel and the participants to the various data collection activities. The project specification document provided the questions and the topics which the data needed to be collected for, providing the S1 units with a framework with which to operate. Accepted research methodology, such as the Journey Making methodology mentioned above and previous research experience, such as the Research Supervisor who said “*I’ve also taken over the role of workshop person, which is probably natural*”¹⁴ given their extensive experience of facilitating focus group workshops, also helped to enable the project team to carry out the S1 activities through S2.

The Research Assistant stated that the project team provided “*the dates we were each available to collect data*”¹⁸ to the council which S3 used for resource allocation purposes. The council also played a role in S3 by booking rooms to be used for the focus groups and some interviews by the project team members. In terms of monitoring, the Research Supervisor stated that the project team would “*internally, we will have checks, we’re going to record [the Research Assistant’s interviews] on to [his digital voice recorder] so I can listen to it in the car – you could assume that that will be a quality check... there was checks in there to make sure that the [questions being asked in the research] is correct – we did that today during the workshop – one of the questions didn’t work and so we benched it and we’ve learnt from that and so that’s another check*”⁴. On the data collection schedule

the council generated in S2, the Research Supervisor stated they needed to monitor that the right number and “*types of people*”⁴ participated in the data collection to ensure useful data was collected, as discussed in Section 5.2.1.

S4 played a very intensive role as the data collection schedule provided by the council in S2 had to be constantly revised and updated. The Research Assistant explained “*we’ve had a few issues with interviews being cancelled and participants not turning up. Also our schedule of appointments for each day tended to arrive from [the council] at around 4pm or 5pm the night before – so we didn’t know what we were doing or when we were doing it until quite late. It hasn’t caused a great deal of issues, it just gave us less time to prepare. I think because of the very tight timeframe for data collection, the [council] team have only a short time to get participants for each day so are maximising their time by leaving it late each day to send out the schedule. Mind you, some participants were only contacted at 4.30pm the day before they were due to attend a focus group – which gave them little time to prepare*”¹⁶. The Research Assistant suggested this “*also possibly resulted in fewer participants being able to attend focus groups as they were perhaps asked at too short notice*”⁸. Due to problems with obtaining participants, mid-way through the data collection S4 proposed to carry out telephone interviews to make it more convenient for participants to be contacted – rather than the participant having to drive to an office from their home to be interviewed. The council accepted this proposal and a number of telephone interviews were arranged which helped to increase the number of participants. At the end of the data collection period, the project team were still only able to consult with 52 participants during the project as opposed to the 63 stated in the project specification document.

S4 was engaged in a two-way communication process, having to also update the council as explained by the Research Assistant “*sometimes we have to update the client using phone or email if participants have failed to show up or there has been some problem with the schedule*”¹⁶. Details back from the council were not always immediately available with the Research Assistant noting that “*sometimes I’d ask a particular person in [the council] to give me some information, e.g. the contact details of a telephone interviewee or when a re-arranged interview was to be conducted, and they said they didn’t know because one of their colleagues was away at a meeting! The situation would have been greatly improved if the two people co-ordinating the schedule of appointments had worked together and shared the information so one could tell me it if the other was away. As the situation was, I ended up having to wait for the other person to come back before getting the*

information”¹⁶. S4 was also highly engaged with the Data Analysis VSM at Level 2 as the analysis constantly impacted upon the questions asked during subsequent data collection activities. For example, one potential finding emerged from the analysis that the project team discussed and the Research Supervisor asked the Research Assistant to ask questions specifically about this potential finding in all subsequent interviews conducted²⁹. S4 also proposed suggestions for changes to be made to the data collection process as the project progressed. One example was described by the Research Supervisor who said during the project he and the Research Assistant “*thought we could invite [one of the council project team] along to one of the [focus groups]*”¹⁴ as well as the participants.

S5 made decisions about such changes to the data collection process. In the example of the council member being invited to a focus group, the Research Supervisor stated that “[the Project Manager] *didn’t [think this was a good idea] and I didn’t feel strongly either way. I felt it was fine, we could have invited her along and let her see the methodology – [the Project Manager] felt it might cramp their style – I can see the argument either way it makes no difference whether she’s there or not*”¹⁴. The group discussed this particular point over email and the decision was taken in the end not to invite the council member to attend. S5 also involved all the project team members making decisions about the proposed changes to the data collection schedule by the council. For example, on one occasion, the council scheduled the Project Manager to carry out a series of interviews over a day but the Project Manager had another engagement which she was “*unaware of the date [of] at the time of providing available dates*”³⁰ to the council. The Project Manager therefore had to email the council to reject the proposed date and the council rescheduled the interviews. On another occasion the Project Manager was unable to carry out an interview due to time pressures, so it was decided that the Research Assistant would undertake that particular interview.

5.4.2 Information Shared between Level 2 – Data Collection and Level 1 VSM

Information from the project specification document developed at S3 of the Project Team Level 1 VSM was shared with S1 units, S2 and S3 of the Data Collection Level 2 VSM. Information on the data collection methods of the S1 units, the number of participants to be consulted (for S3 to be able to monitor enough participants were being consulted) and the

questions/topics to be researched for the S1 units is information discussed in the above section that was used by this level of recursion from the project specification.

S4 of the Data Collection Level 2 VSM also shared information with S4 of the Council VSM due to problems with obtaining participants. Mid-way through the data collection, S4 of the Data Collection Level 2 VSM proposed to carry out telephone interviews to make it more convenient for participants to be contacted – rather than the participant having to drive to an office from their home to be interviewed. The council accepted this proposal and a number of telephone interviews were arranged which helped to increase the number of participants. This is another example of information sharing (the S4 proposal) taking place between Level 2 and Level 0 of the VSM, which the VSM does not provide a structure for in the model as discussed in Section 5.3.2.

5.4.3 VSM Level 2 – Data Analysis

During the system identification phase of the VSD process, the second S1 unit of the system-in-focus was identified as:

- a system to **identify findings** that meet the research questions as set in the project specification document

The data collected in the Data Collection system at recursion level 2 was analysed by corresponding S1 units in the Data Analysis system. The project report described the process of analysing the interview data collected as “*each recorded interview was analysed by at least two of the project team – by the original interviewer and by one of the team who was not at the interview. Each analyst made notes about the interview and these were the focus of a forensic analysis conducted by the project team. Due to time pressures, interviews were not transcribed*”⁷. The project report described the analysis of the focus groups as “*we began our analysis by basing our maps on those built during the [first] workshop on the first day of data collection... revising the maps to broaden issues, add new themes and reshape the emerging results ... these maps were validated and further developed by the [second] focus group... they were also validated and further developed during the [final] focus group*”⁷. The analysis of the site visits was carried out by project team members reading the site visit summaries created in the Data Collection S1 unit and

the document analysis also involved reading the documentation obtained and using this learning as part of the analysis.

Due to all analysis methods contributing to the emerging focus group maps, as discussed in Section 5.2.2, there was a high level of interaction needed between the different S1 units to ensure the information was shared effectively. The Research Supervisor provided this information co-ordination role as part of S2 by operating as a central point between the other two project team members, as discussed in Section 5.2.1. However, the project team also came together four times to meet face-to-face and discuss the analysis so far. There were also meetings held over the phone and comments sent via email to discuss the emerging findings. Personnel co-ordination was driven mainly by common sense – the Research Assistant had mainly been involved with data collection from two groups, so took the lead on the analysis of that data and the Project Manager had mainly been involved with another group so they took the lead on the analysis of that data. The Research Supervisor played a role in the analysis of data from all groups. S2 did not provide any detailed schedule of activity but the project team were guided by the deadline for the presentation meeting with the council which meant that they needed to have completed enough analysis by then to be able to present their emerging findings at the meeting.

In S3, this deadline for the presentation was the date that was used to check that progress in the analysis was on track. This was not done explicitly but when the project team met they were able to see how far the analysis had come and ensure they were still able to make that deadline. The Research Supervisor provided a check on the analysis by comparing the emerging findings from the Research Assistant's recorded interviews to his own analysis, commenting that "*I want to check [my own findings] against something that's not from a workshop of my own facilitation – I prefer it to be something where I'm not in the room*"⁴. During the project team meetings/telephone calls/emails the project team were able to discuss each other's analysis and ensure it met with the objectives set out in the project specification, with the Research Supervisor commenting that during one project team meeting "*what we did today was another opportunity to check, to check that what came out of [the analysis meeting] was something useful*"⁴.

The Research Assistant commented on this process that "*there were a couple of points where [the Research Supervisor] and I felt a bit uneasy that we weren't concentrating*

enough on [one of the particular set of] issues that the project required⁸. This required S3/4 to check if the focus of the analysis needed to be changed. The Research Assistant said this was done at *“the presentation meeting before Christmas and the [council] didn’t highlight this issue then. Mind you, [the council manager] wasn’t there then – so it could still have been an issue that could have arisen after the project report had been submitted. But, as it was, the [council] seemed perfectly happy with the amount of focus we had put on [this particular set of] issues in the end⁸*. Any new directions emerging from the analysis that could be further analysed were also identified by S4 – one example being that a finding emerged from the analysis that the project team discussed and the Research Assistant then revisited the interview data to conduct further analysis surrounding this particular finding.

At S5, it was the project specification that really was used to determine if a particular line of analysis was worth pursuing. The project team all made decisions on what was relevant to pursue for more detailed analysis based upon the objectives in the project specification document and would discuss this in meetings/telephone conversations/emails with one another.

5.4.4 Information Shared between Level 2 – Data Analysis and Level 1 VSM

Information from the project specification document developed at S3 of the Project Team Level 1 VSM was shared with S2, S3 and S5 of the Data Analysis Level 2 VSM. Information on the objectives of the research (needed by S3 for ensuring the analysis was meeting the objectives and by S5 to determine if a particular line of analysis was worth pursuing) and the deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the project specification.

5.4.5 VSM Level 2 – Findings

During the system identification phase of the VSD process, the third S1 unit of the system-in-focus was identified as:

- a system to **disseminate findings** that are suitable to the council given the research objectives in a way that the council can understand

The project specification originally stated that the project team would have “2 *pre-Christmas meetings to brief [the council] on emerging findings*”³ and after these they would then “*submit [a] report to [the council] detailing the findings from the project*”³. Subsequently, the 2 pre-Christmas meetings were reduced to 1 due to the tight timeframe available during the project. The project team decided to structure the emerging findings meeting with a presentation, which is one S1 unit in the VSM at this level of recursion. The Research Assistant explained how the presentation was created “*whilst I carried out a phone interview halfway through [an analysis] meeting, [the Research Supervisor] and [the Project Manager] went off to prepare a draft of the presentation for [the council]. They then came back and talked me through the presentation*”³¹. The Research Supervisor and Research Assistant then made some minor changes to the draft presentation over email before the Research Assistant and Project Manager had a “*meeting [which] was to prepare for the presentation to [the council]. We changed a couple of points on the slides from the draft but nothing major was changed. [The Project Manager] asked one of her colleagues to photocopy the presentation slides to provide a handout for the [council] members*”³². The Research Assistant said that he and the Project Manager then met with the council members and held a “*meeting [which] was for the project team to present our initial findings to [the council]... [the Project Manager] and I talked [the council] through the hand-outs we had prepared. [The Project Manager] did a majority of the talking but I also added bits at the end of each slide when she asked me if there was anything else to add. I also discussed [some other points] – which caused quite a bit of discussion. [The council] seemed impressed with our findings*”⁹. The report, another S1 unit in the VSM at this level of recursion, was worked on by all three project team members. The Research Assistant was assigned by the Research Supervisor to “*write the first section of the report... that contextualises the project*”³³ before the Data Collection and Data Analysis phases of the project began. During the writing of the report, the Research Supervisor stated that the Research Assistant had “*taken alot of the raw data and turned it into text*”¹⁴ which the Research Assistant commented that he had “*been analysing the data I have collected and written it up into documents which I have sent out to [the Research Supervisor] and [the Project Manager]*”¹⁶. The Research Supervisor then commented that “*I’ve taken the text and turned it into a report*”¹⁴ which was supported by the Research Assistant who said that “*the analysis documents I have written have been used as the basis of the draft report*”¹⁶.

The Research Assistant stated that “[the Research Supervisor] *and I then refined this draft*”⁸ which the Research Supervisor remarked had led to “[the Research Assistant] *and I have taken on the role of getting the report to the first draft*”¹⁴. Once this first draft was completed, the Research Assistant stated that it was “*then passed it to [the Project Manager] to add the social policy and [one of the other service provider group] perspectives to the document*”⁸ which the Research Supervisor highlighted as the Project Manager undertaking “*the process of taking the report and turning it into a policy document*”¹⁴. The Research Assistant commented that all of the project team members then “*all went through an iterative process of refining the draft until we generated the final draft which [the Research Supervisor] sent to [the council]*”⁸.

The deadline of the presentation meeting and also the deadline for the submission of the report acted as a baseline for providing a schedule of activity at S2. The Research Supervisor also had a deadline for a first draft of the report to be completed by Christmas “*in the hope that I won’t need to put the time in after Christmas – I don’t have the time available in my allocation of time*”¹⁴ as “*I’ve got these different deadlines [in other projects] that I need to satisfy*”¹⁴. The Project Manager also had a deadline in early January to add her parts to the report to provide enough time for the rest of the project team to make any amendments necessary. The emerging findings in the presentation also informed the report so S2 had a role in ensuring that the information was effectively shared from the Presentation to the Report S1 units. However, as all of the project team members worked on both of these S1 units, it meant this information was already known. The Research Supervisor explicitly ensured the information from the presentation was included in the report and described the process as “*I synthesised Version 2 [of the draft report] with the stuff from the presentation*”³⁴. The Research Supervisor also set up a standard whereby the project team member who had made amendments on the latest draft report document would carry out “*increasing the version number of this doc when each new version is circulated – else we’ll get confused*”³⁵ and project team members would not know which was the latest draft version to work on. S2 also had to ensure that the findings were disseminated in a way that the council could understand. This did not prove to be a problem as the findings were not too specialised and did not require any specific non day-to-day language to communicate them.

At S3, the project team had to ensure their findings being disseminated were relevant to the research objectives set out in the project specification document. S3 also had to ensure

confidentiality was maintained and that the contents were correct. The Research Supervisor also stated that the project team “*need to check [the] structure is ‘right’*”³⁴ of the report. All these processes were undertaken by all project team members by reading the presentation/report after each set of changes had been made.

As the Presentation and Report S1 units were being carried out whilst the Data Analysis S1 unit at Level 2 described above was, this meant that S4 was constantly identifying new findings to be included in the presentation and report. S3 would check if these new findings were relevant based upon the research objectives set out in the project specification document. At S5, all members of the project team would make decisions as to what to include in the findings based upon the research objectives in the project specification.

5.4.6 Information Shared between Level 2 – Findings and Level 1 VSM

Information from the project specification document developed at S3 of the Project Team Level 1 VSM was shared with S2, S3 and S5 of the Findings Level 2 VSM. Information on the objectives of the research (needed by S3 for ensuring findings in the presentation and report were meeting the objectives and by S5 to determine if a particular finding was relevant to be included) and the deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the project specification.

As detailed in the above section, the Presentation and Report S1 units were being carried out at the same time the Data Analysis S1 units at Level 2 were being carried out. This meant that S4 of the Findings Level 2 VSM was constantly identifying new findings to be included in the presentation and report. However, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out. For example, the VSM does not provide an explicit link between the Interview Analysis S1 unit of the Data Analysis Level 2 VSM to S4 of the Findings Level 2 VSM. Similarly for the other S1 units of the Data Analysis Level 2 VSM, the model does not provide a direct link to S4 of the Findings Level 2 VSM.

***Finding:* a deficiency of the VSM identified is that, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out.**

***Finding:* at the lower level of recursion, information from the project specification document (such as research objectives, data collection methods, the number of participants to be consulted, questions/topics to be researched and deadlines) was shared between Project Team A and the lower recursion levels.**

5.5 Summary

This chapter presented the findings from analysing Project Team A. Project Team A was described in terms of the VSM and it was identified that the VSM provided an adequate representation of this project team.

The chapter then went on to explore the first question posed in this research as to what information exists at level 1 of recursion. The chapter provided evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of oscillation at this level of recursion. This meant that in terms of the comparison between Table 5 and the information present at this level of recursion, there was no evidence to support information being present about the gap between admitted and actual performance loss due to oscillations and its causes (ID16-17) or any evidence that could support the use of experiences with anti-oscillatory measures (ID18) from the project team. There was also no evidence of manipulation of external environment (ID21) or any evidence to support the algedonic signal (ID38) at this level of recursion. There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

The next section then moved on to the second and third questions posed in this research to identify what information is shared within the project team and whether the extended theoretical model presented in Table 5 and the communication channels in Figure 13 actually provided an adequate representation of this. The chapter provided evidence that

supports much of the information that Table 5 suggests is shared in viable systems at one level of recursion. However, there was no evidence of the algedonic signal (ID38) on communication channel M or information being shared across communication channel J to manipulate the external environment (ID21). As mentioned above, there was also no evidence that supported the presence of oscillation at this level of recursion and, therefore, the sharing of information on oscillation (ID16) was not able to be observed. There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

The following sections then looked at the recursion levels directly above and directly below the system-in-focus in order to analyse the project team in context. Each relevant recursion level was described in terms of the VSM and was then explored in detail to identify the information that was shared between each level of recursion, in accordance with the fourth question posed in this research. At the higher level of recursion, the highest rate of information sharing occurred between the Council VSM at Level 0 and the Level 1 VSM during the project scope definition phase. This process was described in detail in Section 5.3.2. Information on funding, project progress, potential scope increases to the project and potential new projects was also shared between the Council and Project Team A recursion levels. University-specific codes of practice and standards were also shared between the University Business School Research Academy and Project Team A recursion levels. At the lower level of recursion, information from the project specification document (such as research objectives, data collection methods, the number of participants to be consulted, questions/topics to be researched and deadlines) was shared between Project Team A and the lower recursion levels.

In accordance with the fifth and final question posed in this research, the analysis identified two deficiencies in the ability of the VSM to accurately model the information sharing between recursion levels for this project team. The first deficiency is that the VSM did not provide a structure for information to move directly between recursion levels that are two levels apart. Four instances of this information sharing happening in the project team were identified but the VSM was not able to model it as there is no communication channel in the model directly linking recursion Level 2 with recursion Level 0. The other deficiency identified was that, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out. This meant that it was not

possible for the VSM to provide a detailed account of the communication process to describe how the Data Analysis and Findings S1 units at Level 2 were working together.

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- ¹ Reflection Notes written on project team meeting 3
 - ² Email from Research Assistant to project team (6th January 2009)
 - ³ Project Specification Document
 - ⁴ Research Supervisor Interview 1
 - ⁵ Email sent from Research Assistant to Council (2nd December 2008)
 - ⁶ Reflection Notes written on council meeting 2
 - ⁷ Project Report Document
 - ⁸ Research Assistant Interview 3
 - ⁹ Reflection Notes written on council meeting 3
 - ¹⁰ Research Supervisor Interview 3
 - ¹¹ Reflection Notes written on council meeting 4
 - ¹² Project Manager Interview 3
 - ¹³ Project Manager Interview 1
 - ¹⁴ Research Supervisor Interview 2
 - ¹⁵ Reflection Notes written on project team meeting 9
 - ¹⁶ Research Assistant Interview 2
 - ¹⁷ Email from Research Supervisor to Research Assistant (29th October 2008)
 - ¹⁸ Reflection Notes written on project team meeting 5
 - ¹⁹ Email from Research Supervisor to project team (19th November 2008)
 - ²⁰ Reflection Notes written on council meeting 1
 - ²¹ Email from Research Supervisor to project team (12th November 2008)
 - ²² Email from Research Supervisor to project team (10th March 2009)
 - ²³ Email sent from Research Assistant to project team (5th December 2008)
 - ²⁴ Research Assistant Interview 1
 - ²⁵ Reflection Notes written on project team meeting 14
 - ²⁶ Reflection Notes written on project team meeting 15
 - ²⁷ Project Manager Interview 2
 - ²⁸ Email from council to project team (23rd November 2008)
 - ²⁹ Email from Research Supervisor to Research Assistant (14th December 2008)
 - ³⁰ Email from Project Manager to council (25th November 2008)
 - ³¹ Reflection Notes written on project team meeting 18
 - ³² Reflection Notes written on project team meeting 19
 - ³³ Email from Research Supervisor to Research Assistant (24th November 2008)
 - ³⁴ Email from Research Supervisor to project team (20th December 2008)
 - ³⁵ Email from Research Supervisor to project team (14th December 2008)

Chapter 6

Project Team B Analysis

6.0 Introduction

This chapter presents the findings from analysing Project Team B, following the same structure as Chapter 5. As discussed in Chapter 5, for reasons of brevity this chapter will present in less detail those findings that replicate ones made from analysing Project Team A. Instead, this chapter will give a much stronger focus on presenting areas where the analysis of Project Team B and Project Team A provided different results.

6.1 Project Team B and the VSM

This section begins by providing a short background introduction to Project Team B before describing the project team in terms of the VSM. This section will then examine the fit between the VSM and the project team to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

6.1.1 Background Introduction

Project Team B worked together on a research project from October 2006 to July 2009 which was being carried out by staff in a university. The project aimed to research the development of a computer system to provide advice for scientists who were involved in public engagement activities. This project team consisted of three members, who all worked for the university, and have been assigned the following labels in this research to aid the reader identify them: a Principal Investigator, a Co-Investigator and a Research Fellow.

The research undertaken by the project team was an action research approach to inform the production of a computer system holding a repository of advice and guidance for scientists

carrying out public engagement activities. The research consisted of collecting data from a range of scientists conducting public engagement activities to identify how these activities were currently conducted and the issues involved in doing so. Data was collected using focus groups and through the collection of various relevant literature. This data was then analysed to identify the requirements that scientists had for the computer system and the findings from this led to the design and production of a prototype computer system. User testing by scientists carrying out public engagement activities was then carried out using the prototype with data being collected on the suitability of the prototype for these users. Data was collected using a variety of methods, including focus groups, participant observation and questionnaires. This data was then analysed to inform the re-design of the prototype and the findings from this research were disseminated to the academic community through conference papers and presentations, as well as academic journal papers. The Co-Investigator stated that overall he felt that the project had “*actually run relatively smoothly*”¹ and the Principal Investigator felt that “*it’s progressed extremely well*”². The Co-Investigator said that at the end of the project the computer system had been successfully developed and that it was “*certainly ready for use... and I think it works really well now so I’m really happy with that*”¹.

At the very start of the project, the roles of the different members of the project team were defined by the project members. The Principal Investigator was defined as taking a supervisory role of “*facilitating*”³ and “*making sure it all works and oiling the wheels*”³ of the project to “*make sure that we deliver what we said we were going to deliver*”³. The Co-Investigator was classed as “*a primary researcher*”³ on the project who would carry out some of the primary activities of the project along with the Research Fellow but also maintain a “*day to day management*”⁴ role. The Research Fellow was defined as being “*the person who’s actually going to be doing the research... he’s going to be going out and using focus groups, he’s going to be writing questionnaires, and all of those things*”³.

6.1.2 VSM Level 1

This section will present Project Team B in terms of the VSM before moving on to a discussion to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

As described in Chapter 4, the VSD process was used to generate the VSM for Project Team B. During the system identification phase of the VSD process the system was identified as:

- a system to **carry out research** into how public engagement activities are conducted to inform the design, delivery and evaluation of a computer system holding a repository of advice and guidance for scientists carrying out public engagement activities

The system to achieve the purpose of carrying out research was the project team and, as a result, the project team system is the system-in-focus for this case study. The remaining steps of the VSD process were then undertaken for this level of recursion, generating the components of the VSM which will now be described.

- S1 units are the activities that the project team must carry out to achieve its purpose. At this level of recursion, these activities were very similar to Project Team A, in that data needed to be collected, analysed and findings disseminated. One difference between the two project teams, however, was that the analysis was also used to inform the “*produc[tion of] a [computer system repository] of advice and guidance for those interested in participating [in] public engagement activities*”⁵. Therefore, in order for the project team system to achieve its purpose of carrying out research, it needed to undertake four main activities: data collection, data analysis, computer system production and dissemination of findings and it is these activities that make up the S1 units of the Level 1 VSM.
- S2 dampens oscillations between the S1 units and co-ordinates them to achieve synergy. As with Project Team A, the data for Project Team B showed that there was a high level of dependency between the different S1 units, with the Data Collection S1 unit sharing information with the Data Analysis S1 unit and the Data Analysis S1 unit sharing information with the Computer Production and Findings S1 units. Due to this

high level of dependency between S1 activities, it was important that S2 was able to perform its anti-oscillatory function, in particular by co-ordinating the four S1 activities to ensure that relevant information was passed between them. The Co-Investigator played a particularly significant role in ensuring the co-ordination of information between activities, supported by their statement that they would play a “*coordinating/management role... in terms of the kind of day to day management, the interaction between myself, [the Principal Investigator] and [the Research Fellow] particularly*”⁴.

- S3 is responsible for monitoring and controlling the S1 units. At the very beginning of the project, very clear objectives for each primary activity in terms of key dates and milestones were formulated into a document that was given to each of the members of the project team. The Principal Investigator commented on these objectives that “*we made it quite clear, the outcomes and how we’d evaluate it and measure it*”³. The monitoring and control process is described in Section 6.2.1. Allocating the resources was also an activity that S3 needed to perform. The Principal Investigator played a role in this and stated that it was his job to “*make sure [the primary activities] get the resources*”³ they needed. One of the key resources that needed to be managed was time and, as with Project Team A, the project team members had other responsibilities that impacted upon the level of time they could allocate to conducting the project. The Co-Investigator highlighted that there were many other commitments that he and the Principal Investigator had during the project and said “*we have a number of different quite large scale projects running through at the same time... so there will be a process of working through [this] project as well as managing a number of other things at the same time... we’re all going to be trying to do an awful lot of things at the same time*”⁴. However, the Research Fellow was able to support this resource allocation to some extent by working full-time on the project.
- S3* conducts audits for S3. The Co-Investigator was responsible for conducting audits to ensure quality, where he would “*proof read*”⁶ documents generated by the S1 units.
- S4 is responsible for seeking out potential future directions for the system. As with Project Team A, S4 was involved with S3 in determining the scope of the project and was a joint process undertaken by the project team with the funding organisation, as described in Section 6.3.2. S4 also had to ensure that the project team was aware of

where the future of the project was going and the next steps that were needed to be done. The Principal Investigator was particularly pro-active in S4 activities by meeting with various senior staff members at the university to identify “*some of the other things that are going on in the university and the faculty and how that can feed in [to the project]*”². Project Team B also used a Steering Group (composed of university personnel) who “*already do these kinds of [science engagement] activities in different ways and stuff*”⁴ and a Sharing Group (composed of the same type of members but from organisations outside of the university) to help S4 identify relevant developments in the external environment that could be used to reflect and make suggestions on potential changes to the project. S4 also looked to the future for the project team with the Co-Investigator looking for future directions. The Co-Investigator said the project team were able to obtain funding for a 6 month extension to this project to enable them “*to rework the graphic design... we managed to get some more money from [another funder] to help us to do this – so this has extended the project life a little bit longer than we initially had*”¹. The project team also identified another potential 3 projects to carry out, although the Co-Investigator said at the end of the project that they had not yet submitted any further bids to carry out these proposals but stated that “*we have plans to*”¹.

- S5 carried out the overall decision making processes of the project team. The Co-Investigator was seen to have the final say in any decisions with the Principal Investigator stating that “*I see this pretty much as [the Co-Investigator’s] project*”⁷ and so was given responsibility for determining the overall direction of the project.

6.1.3 VSM Level 1 – Model Suitability

As described above, the project team undertook four main activities – data collection, data analysis, computer system production and findings dissemination. It co-ordinated these activities in the manner described by S2 and carried out monitoring and controlling on the four main activities as described in S3. The S4 activity of defining project scope has not fully been explained by the VSM at this level of recursion but this is because it has been found to be a multi-level recursion process that is described further when the interaction between the funding organisation and the project team is explored in Section 6.3.2. S5 described the Co-Investigator’s role in handling necessary decisions for the project team.

There were no other processes described in the data that the VSM failed to model for this level of recursion.

6.2 Information within Project Team B

This section will explore the first three research questions concerning the information generated and shared at level 1 recursion in Project Team B.

6.2.1 Information Present/Not Present at Level 1

This section presents the evidence for information present in the project team VSM at level 1 recursion in accordance with the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information present in the project team at this level of recursion that does not fit into the extended theoretical model.

There were 23 information domains which were found to be very similar to Project Team A. External environment information (ID1 in Table 5) was generated by participants involved in the Data Collection S1 activity. Goals set by, performance and modus operandi of the primary activities in S1 (ID2), expected performance of S1 activities (ID4) and organisational goals (ID3) were formulated at the beginning of the project into a bid proposal and key dates and milestones document that was given to each of the members of the project team. As described in Section 6.1.2, the Principal Investigator commented that these objectives were set to be very clear and measurable, highlighting that *“I think the key thing is, it’s the same with any kind of research proposal, that you need to clearly state what your objectives are and how you’re going to measure when you’ve achieved those objectives”*³. To monitor and control (ID5) that the project was meeting the goals set, the Principal Investigator said they were providing a *“check and a balance”*⁷ to ensure that the project was *“deliver[ing] what we said we were going to deliver”*³. The Co-Investigator stated that *“we’ve got [the key dates and milestones], in our heads”*⁶ and *“we meet on a weekly basis... to obviously check on progress”*⁶ to ensure that these key dates and milestones were being met. As with Project Team A, the data showed that there was a high level of interdependency between the different S1 units (ID12) in Project Team B with the *“data collection and analysis of focus group interviews will begin after the first [focus]*

group has been completed and will be an ongoing and iterative process”⁸. As with Project Team A, the S1 activities in Project Team B needed two key resources (ID19) – personnel and time – that were allocated (ID20). Personnel were allocated for the project team from the higher recursion level of the university, as discussed in Section 6.3.3. Time allocation was an issue in the same way it had been for Project Team A, with the Co-Investigator stating that *“it’s certainly a tight deadline... there isn’t a lot of room for slippage”*⁶, and project members were also involved in other projects at the same time as conducting this one, as discussed in Section 6.1.2. The project team tried to manage the time issue, with the Principal Investigator stating that when one member of the project team had a heavy workload, the other project team members would increase the time they put into the project and vice versa, *“I think [the Co-Investigator] has had more time to devote to [the project] as his teaching commitments have declined and one of the reasons why I have not been quite so involved is my teaching commitments have [recently] taken off so that’s why [the Co-Investigator] said I’m in the state he was a year ago”*². This method was effective with the project team managing to complete the project on time with the Co-Investigator saying that, whilst it was *“really difficult to actually manage the two big projects [this project and the other one he was working on] at the same time... I don’t think [this project] suffered at any point”*¹. The Co-Investigator was responsible for ensuring quality and would conduct audits (ID28) through *“proof read[ing]”*⁶ documents generated by the S1 units. In terms of proposals for innovation made by S4 (ID22-ID27, ID29-31 and ID33-36), many came from the project scope definition process, which was found to be a multi-level recursion process, as it was with Project Team A, and is discussed further in Section 6.3.2. In terms of identifying developments in the relevant environment (ID32) of the organisation, the Principal Investigator was particularly pro-active in this as detailed in Section 6.1.2. Project Team B also used a Steering Group and Sharing Group for this purpose, as described in Section 6.1.2. There were also future project opportunities arising in the relevant environment of the project team with the Co-Investigator constantly looking for future directions that were *“emerging as we go along”*⁶. As described in Section 6.1.2, the project team managed to secure funding to carry out an extension to the project and also identified a further 3 potential projects.

There were 14 information domains which were found to be different to Project Team A. The Steering Group, described in Section 6.1.2, enabled the project team to manipulate the external environment (ID21) to get people across the university interested in the project. The Co-Investigator stated this was the intention in that *“if I go and advertise the kind of*

*stuff we're doing within a department, it will have an effect but if you give it to somebody who is well known in the department who actually sits within a department, you know it's a different level of confidence I think in the information given by someone who is already situated within a department"*⁴.

A goal and performance misalignment (ID6) occurred where the Co-Investigator commented that *"the analysis took slightly longer than we thought"*⁶. The Co-Investigator felt that the causes (ID7) for this were that *"it was harder to recruit focus group participants than I thought it would be"*⁶. The consequences (ID7) of this meant that the Co-Investigator felt that *"we are probably a month [behind] than where we actually said that we would be"*⁶ in the key dates and milestones document. During times when the project began to fall behind schedule, the Co-Investigator said he decided that the action to counter this goal and performance misalignment by S1 (ID8 and ID9) was to run some primary activities in *"parallel"*⁶ to bring the project back on schedule.

In terms of operational information (ID10), the Research Fellow was assigned to *"prepare [an] internal report"*⁸ at three different stages in the project. These internal reports provided the project team with a record of their progress during the course of the project, for example one report *"discuss[ed] the methods for data collection and analysis, as well as the preliminary results from the initial focus group study that will guide the development and design of the [computer system]"*⁹.

Given the high level of dependency between S1 activities, discussed above, it was important that S2 was able to perform its anti-oscillatory function. In terms of actual oscillations (ID13), there were some issues with information sharing between S1 units. The causes of the gap between the admitted and actual performance loss due to oscillations (ID17) were through having to run some of the Data Analysis and Computer System Production S1 activities at the same time in order to bring the project back on schedule. The Co-Investigator stated that *"this is where the pragmatic approach comes in in terms of saying we'll have several activities working in parallel, so the analysis of the groups and then informing the [computer system] has dovetailed in to each other [only] to an extent"*⁶. This meant that the Data Analysis S1 unit was unable to fully inform the Computer System Production S1 unit as satisfactorily as it could have done, if the data analysis tasks had been completed prior to beginning the production of the computer system. The Co-Investigator was aware that a performance loss due to this oscillation (ID14) was that it

could lead to issues with the computer system design as it had not been informed by the full analysis. One particular example of this described by the Co-Investigator was that the project team had already begun to produce a database for part of the computer system, which initial analysis had shown to be “*one of the recommendations which came out of the focus group study*”⁶. However, whilst the Co-Investigator felt that “*my guess is that’s a relatively unproblematic recommendation*”⁶ he was aware (ID18) that if subsequent analysis that still needed to be done showed that “*if [other people] absolutely hate it then we’ll just have to withdraw it*”⁶ as a post-hoc measure (ID11). Nevertheless, the Co-Investigator did feel that, despite the norms for admitted performance loss (ID15) due to problems with information sharing needing to be minimal and the gap being larger (ID16) than this, it was necessary to run the two S1 unit activities in parallel because “*you couldn’t let it slack, because it’s certainly a tight deadline*”⁶.

As with Project Team A, the culture (ID37) in the project team was similar in many ways to the culture of the university with the Co-Investigator highlighting that “*the [university] is quite good at doing things in a fairly informal way*”⁴. It was the informality in Project Team B that made it differ slightly from Project Team A in terms of culture. Whilst Project Team A members tended only to meet reactively when there was a clear need to do so, the Principal Investigator highlighted the informal nature of Project Team B meetings, “*I think informal is quite important... [it’s a] simple thing to do, for half an hour go with someone for coffee... it enables people to talk a little bit more about their concerns or any, kind of, worries. They may not have any, in which case, you might talk about football or the other things that are going on*”⁷. The Co-Investigator was also conscious that there was a small chance that there could be cultural tension in the project team “*because you’re working across the kind of [hard] science-social science divide that exists*”⁴ as the members were drawn from different functional areas of the university. However, there was no evidence to suggest this actually caused a problem for the team during the project.

Finding: the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of algedonic signal (ID38) at this level of recursion. There were also 14 information domains which were found to be different to Project Team A, highlighting differences when oscillation is present. There was also no evidence of any other types of information

being present at this level of recursion that are not present in Table 5 that contributed to the viability of the organisation.

6.2.2 Information Shared/Not Shared at Level 1

This section presents the evidence for information shared within the project team VSM at level 1 recursion in relation to the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information shared within the project team at this level of recursion that does not fit into the extended theoretical model.

The communication channels discussed in Chapter 3 that supported information sharing at this level of recursion are provided in Figure 19 of the Project Team B VSM, which has been adapted from the generic VSM diagram of communication channels presented in Figure 13. The greyed out communication channels are not explored at this level of recursion as they represent communication channels at a lower level of recursion which are examined in Section 6.4.

Project Team B VSM and Communication Channels

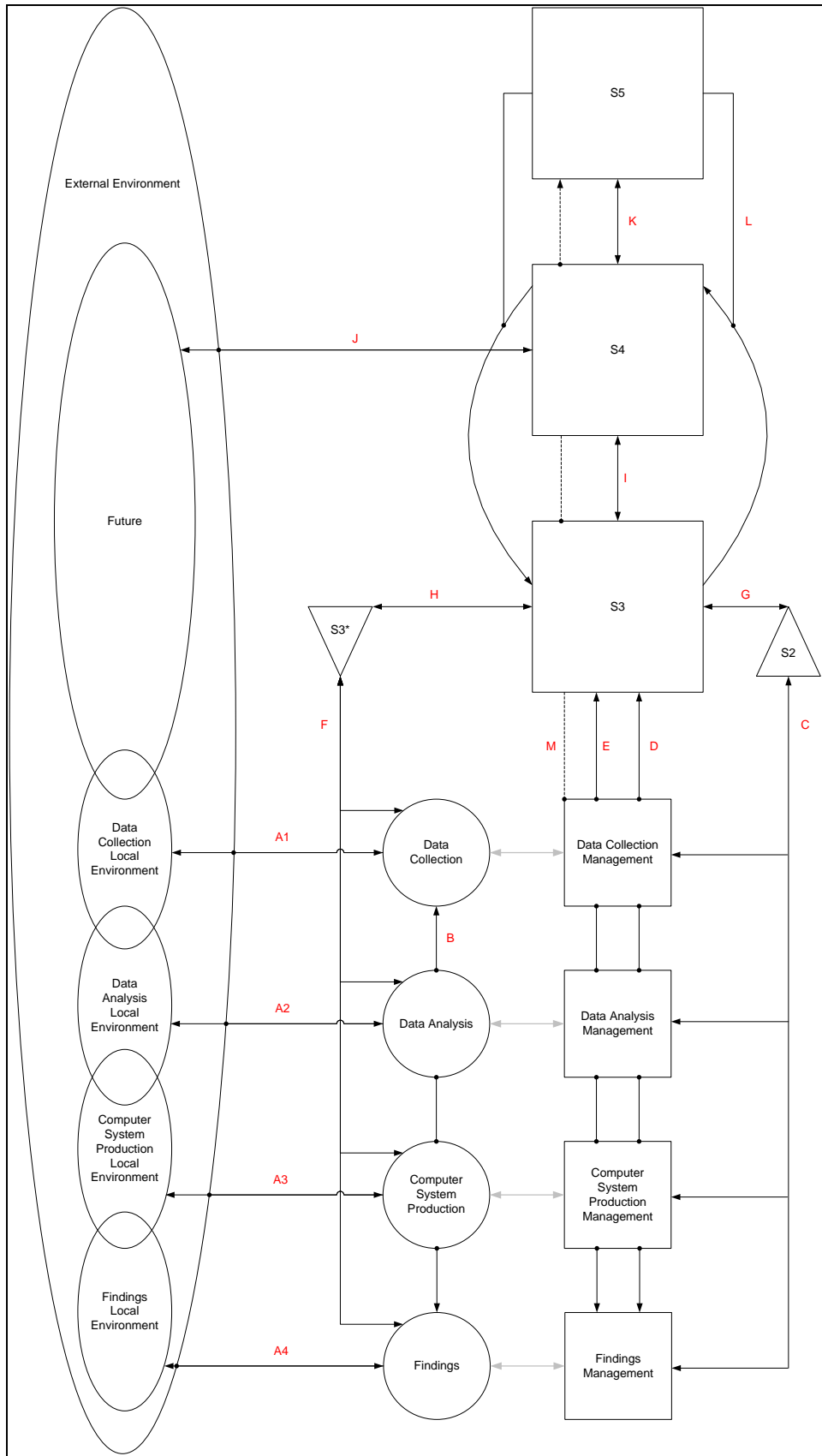


Figure 19

As with Project Team A, the research data was collected from participants in the external environment, and participants were briefed and debriefed before and afterwards by project team members, demonstrating a two-way sharing of information (ID1) across communication channel A1 between the external environment and the Data Collection S1 unit. Project Team B also used information from outside the project team shared across communication channel A3 to assist in performing the Computer System Production S1 unit. The Co-Investigator stated that the project team would use people from the computer department “*who will come in and help us design the [computer system] so they’ll be involved in that*”⁴. This communication was also two-way, with the project team having to provide a specification as to how they wanted the computer system designed through a “*briefing meeting for the project consultants*”⁸. Project Team B also shared information with the wider academic community via communication channel A4 through “*prepar[ing] projects reports for web-based and peer-reviewed publication*”⁸ and carrying out “*conference, science festival... dissemination of the initial results*”⁸.

S4 also engaged with the external environment through communication channel J by engaging with a Steering Group as discussed in Section 6.1.2. Project Team B met with this Steering Group “*every three months roughly*”⁶ to help S4 identify relevant developments in the external environment that could be used to reflect and make suggestions on potential changes (ID22) to the project by the group providing “*comments on how we’re going to do [the research] and to refine the structure... on the way we do these kind of things*”⁴. As highlighted in Section 6.1.2, Project Team B also made use of a Sharing Group for the same purpose consisting of members from organisations outside of the university who had knowledge of, or an interest in, science public engagement. The Principal Investigator stated that as well as these “*face to face meetings*”³, other information about progress was also shared outside these meetings across communication channel J with these groups “*because we’re quite a disparate group, not only across the University, but also regionally, that electronic exchange of information is important*”³ and that this information sharing needed to be as succinct as possible because “*a lot of these people won’t have time built into their schedules to do this... they wouldn’t necessarily have time to look at the detailed information. So we may need to work out ways of providing executive summaries and kind of key points for the people who are particularly busy so they can at least keep track of what’s going on*”³. Another reason for this information sharing across communication channel J was that the project team were also

using the Steering Group to manipulate the external environment (ID21) to get people across the university interested in the project, as discussed in Section 6.2.1.

In terms of S1 unit to S1 unit information sharing, the interdependences between the four S1 units have already been highlighted in Section 6.1.2. In order to carry out analysis, the Data Analysis S1 unit needed the data collected from the Data Collection S1 unit across communication channel B. The Data Analysis S1 unit also had to provide the analysis to the Computer System Production and Findings S1 units so that the computer system could be produced and findings could be disseminated. Commenting on this information sharing, whilst Project Team B relied on “*a lot of email traffic*”⁷, the Co-Investigator said that when going through something in detail, such as sharing information from the Data Analysis S1 unit to inform the design in the Computer System Production S1 unit, “*you can’t do that by email, you’ve got to sit face-to-face... you just couldn’t do that easily any other way*”⁶.

As with Project Team A, the goals set by, performance and modus operandi of the primary activities in S1 (ID2) were shared between the S1 units and S2 across communication channel C which enabled S2 to provide the schedule of activity and determine if there was any oscillation. The Principal Investigator said “*I think the discussions that we have are based around, are informed by the milestones. So, we know what the milestones are, so the discussions we have are all about meeting the short, medium and long-term milestones*”¹⁰. As discussed in Section 6.2.1, at one stage information on progress from the S1 units shared across communication channel C enabled S2 to identify oscillation was occurring above its required minimal level (ID15 and ID16) between the Data Analysis and Computer System Production activities. As discussed in Section 6.2.1, the Co-Investigator decided to allow this oscillation to take place due to time constraints and informed the S1 units across communication channel C that the anti-oscillatory measure (ID11) would be to conduct the post-hoc measure described in Section 6.2.1.

The goals set by, performance and modus operandi of the primary activities in S1 (ID2) were shared between the S1 units and S3 across communication channel D which enabled S3 to carry out the monitoring of performance. As discussed in Section 6.2.1, the monitoring and control practices by S3 (ID5) involved weekly meetings and the project team created a specific time-slot to do this, with the Co-Investigator stating that these meetings “*last for at least an hour... and then we just continue on if necessary, and that seems to work fine*”⁶. The Principal Investigator also said that he would “*make sure that I*

*can make myself available at quite short notice*⁷ if something needed to be discussed urgently. The Co-Investigator emphasised the importance of face-to-face communication for this aspect of the project *“because its kind of such a complex project... you need to be able to talk to each other regularly to make sure [it’s] going in the right direction”*⁶. This regular meeting enabled the Co-Investigator to ensure the project was kept *“on track”*⁶ in terms of time and meeting the objectives set. As discussed in Section 6.2.1, a goal and performance misalignment (ID6) occurred with the analysis taking longer than expected (ID7). This information was sent from the Data Analysis S1 unit across communication channel D in one of these monitoring and control meetings and S3 took the decision and informed S1 units to take the *“pragmatic approach”*⁶ of *“working in parallel”*⁶ described above to get the project back on track. As highlighted in Section 6.2.1, auditing (ID28) was undertaken through the Co-Investigator proof reading documents obtained from the S1 units using communication channel F, with any discrepancies found being sent to S3 over communication channel H so that it could work with the S1 units to *“finalise”*⁶ the documents.

As well as the regular weekly meetings for monitoring performance, the research showed that a lot of information was shared on an *“informal basis”*⁷. The Principal Investigator stated that *“I usually bump into [the Research Fellow] when he’s in the department, usually it’s having a conversation with him about how it’s going and what are the issues”*⁷. The Principal Investigator felt that it was important to *“develop a relationship with people, which is a relationship of trust... ensur[ing] that on both sides that you are communicating”*⁷ and that through this informal approach to information sharing it allowed the other project team members to *“feel that they can tell me things and I can then give them advice”*⁷. The Co-Investigator supported this and stated that *“knowing these people on a personal level, I think obviously is extremely useful”*⁴ for sharing information. The Principal Investigator also commented that he and the Co-Investigator were *“bumping into each other and talking about [the project] on an informal basis all the time as well”*⁷. The Co-Investigator suggested that there was less informal information sharing that occurred between himself and the Research Fellow, *“it’s not as if I bump into him in the corridor very often because he’s in a different building”*⁶ although he did acknowledge that informal sharing occurred *“occasionally”*⁶ in this way.

Organisational goals (ID3) were determined and explicated in the bid proposal and were shared with S4 where they were used during the scope definition phase discussed in

Section 6.3.2. These goals were also shared with S3 and used at the start of the project to determine the lower level goals for the S1 units. The expected performance of the primary activity (goals for S1 activity) (ID4) were then written up into the key dates and milestones document and shared using communication channel E to inform the S1 activities what they should be doing.

In terms of operational information (ID10), the Research Fellow would use information across communication channel C from the S1 units to “*prepare [an] internal report*”⁸ at three different stages in the project to provide the project team with a record of their progress, as discussed in Section 6.2.1.

As identified in Section 6.2.1, the S1 activities needed two key resources – personnel (as discussed in Section 6.3.3) and time. The amount of time required was driven by the need for meeting the overall project team objectives. The needs of S1 (ID19) informed the resource allocation (ID20) process across communication channel E. As identified in Section 6.2.1, project team members were working on other things at the same time as this project and, therefore, an important communication needed to take place so that each member would “*know where we are*”⁴ in terms of each members’ “*points of pressure*”⁴ throughout the project. This sharing of information allowed the project team to manage the time issue, with the Principal Investigator stating that when one member of the project team informed the other members they had a heavy workload, the other project team members would increase the time they put into the project and vice versa, as discussed in Section 6.2.1.

In terms of sharing the goals set by, performance and modus operandi of the primary activities in S1 (ID2) with S4, this was not done explicitly but this information was used to inform decisions by the project team members about innovation proposals. As with Project Team A, the proposals for innovation made by S4 (ID22), reviews by S3 of proposals for innovation (ID29), finalised plans for adaptation of organisational goals (ID30) and regulatory measures to counter the imbalance between S3 and S4 (ID31) were found not to be shared at one single recursion level. This information sharing process is dealt with as a multi-recursion level process in Section 6.3.2.

Cultural knowledge (ID37) was found to be present within each of S1-S5. The Co-Investigator highlighted that the project team followed “*a fairly informal way, while*

*retaining a very formal kind of set of rules*⁴. The key dates and milestones document provided a very formal structure to goals and evaluation criteria and meetings were given a specific time-slot “*on a weekly basis*”⁶. However, this formality was also combined with an informal nature, especially with the format of meetings which had no formal agenda or minutes taken and, as described in Section 6.2.1, members would also just meet for coffee and discuss the project.

Finding: the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is shared in viable systems at one level of recursion. However, there was no evidence of the algedonic signal (ID38) on communication channel M. There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

Finding: Table 12 shows how the extended theoretical model relates to the final version of the coding scheme developed for level 1 recursion in Project Team B. Table 12 shows in black where the information domains from the extended theoretical model matched those found through coding the data and the information domains that did not match the coding of the data are shown in grey. There was no evidence of any other failure of the extended theoretical model to match the data coding for this level of recursion:

Coding Scheme for Project Team B Recursion Level 1

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
1	External environment information	G, A	A				A	
2	Goals set by, performance and modus operandi of the primary activities in S1		G, A	A	A	A	A	
3	Organisational goals		A		A		A	G, A
4	Expected performance of the primary activity (goals for S1 activity)		A		G, A			
5	Monitoring and control practices by S3		A		G, A			
6	Goal and performance misalignment		A		G, A			
7	Causes and consequences of goal and performance misalignment		G, A		G, A			
8	Actions to counter goal and performance misalignment by S1		G, A					
9	Heuristics to implement counteractions		G, A					
10	Operational information		A	G, A				
11	Anti-oscillatory measures		A	G, A				
12	Interdependencies between S1 activities			G, A				
13	Actual oscillations			G, A				
14	Actual performance loss due to oscillations			G, A				
15	Norms for admitted performance loss due to oscillations (goals for S2)			A	G, A			
16	Gap between norm for admitted and actual performance loss due to oscillations			A	G, A			
17	Causes of the gap between admitted and actual performance loss due to oscillations			G, A				
18	Experiences with anti-oscillatory measures			G, A				
19	Problems and needs of the management of S1 activities		G, A		G, A			
20	Resource allocation		A	G, A	G, A			
21	Manipulation of external environment	A					G, A	
22	Proposals for innovation made by S4				A		G, A	A
23	Desired goals for S1 based on proposals for innovation				G, A			
24	Gap between desired and current goals of S1				G, A			
25	Required capacity for reorganisation of S1 activities				G, A			
26	Actual capacity for reorganisation of S1 activities				G, A			
27	Gap between required and actual capacity for reorganisation of S1 activities				G, A			
28	Auditing				A	G, A		
29	Reviews by S3 of proposals for innovation				G, A		A	A
30	Finalised plans for adaptation of organisational goals (a joint S3 and S4 product)				G, A		G, A	A
31	Regulatory measures to counter the imbalance between S3 and S4				A		A	G, A
32	Developments in the relevant environment of the organisation						G, A	
33	Norms for balance between S3 and S4							G, A
34	Actual imbalance between S3 and S4							G, A
35	Causes of imbalance between S3 and S4							G, A
36	Experiences with regulatory measures to counter the imbalance between S3 and S4							G, A
37	Cultural knowledge	A	A	A	A	A	A	G, A
38	Algedonic signal	G, A	G, A	G, A	G, A	G, A	G, A	A

Table 12

6.3 Higher Recursion Level

Following the same format as in Chapter 5, this section will describe the two higher recursion level models that were identified to be relevant to the system-in-focus when conducting the VSD process. The information that is shared from/to these models will be detailed, in accordance with the fourth and fifth research questions.

6.3.1 VSM Level 0 – Funding Organisation

During the system identification phase of the VSD process, the system-in-focus was identified to be embedded within two relevant higher-level systems. The first of these systems is relevant as it puts into context where the project team system sat within the system that commissioned the project – the funding organisation. It was necessary to model this system too as the funding organisation played a role in shaping the scope of the project and also monitoring its progress.

This system was identified as:

- a system to **provide the relevant level of funding** to enable Project Team B to carry out research to inform the production of a computer system holding a repository of advice and guidance for scientists carrying out public engagement activities

The system to achieve the purpose of providing the relevant level of funding was an independent organisation that invests private and public money into innovative projects across a number of sectors and, as a result, this funding organisation is at Level 0 for this case study.

Project Team B managed to secure funding through the funding organisation and Project Team C, detailed in Chapter 7, also secured funding through this funding organisation. The two project teams therefore make up two of the S1 units at this level of recursion.

The funding organisation identified that Project Team C were “*running a complementary project*”⁸ to Project Team B. As a result, at S2 the funding organisation installed a Facilitator to take on the role of facilitating information sharing between the project teams. Project Team B recognised that “*it’s important that we do use [our] information to inform each other*”³ and provided an example in that “*within the research we have done so far, we do have findings which I think that would be useful for [Project Team C]*”⁶. The two project teams in the initial stages of their projects shared some information and in the first two meetings between the project teams were observed to share some core information about their project objectives with each other^{11,12}. However, there were oscillation problems noted throughout the projects with the project teams not sharing much information with one another. The project teams stated that they had “*not had a chance to meet up and talk*”⁷, with Project Team B saying that “*at the moment, communication... [between us] is pretty poor*”⁷ and that they had “*not really exchanged ideas and information*”⁷ with one another. Potential reasons for this included the Facilitator becoming “*incapacitated for a bit*”⁷ through illness, the projects not having a “*common goal*”¹ and also an “*issue around intellectual property*”³ where each project team wanted to maintain the ownership rights to findings they made, in order to produce academic conference papers and journal publications and were slightly concerned about sharing the information in case the other project team disclosed it.

Through the analysis conducted on the Funding Organisation Level 2 VSM, there were weaknesses found in the S3, S4 and S5 activities. This stemmed from the fact that the Principal Investigator stated that the funding organisation is “*not awarding any money in [the science engagement] areas anymore ... so while [the funding organisation] was still funding [the two projects], it wasn't something that they were really interested in anymore*”³. As a result, S4 did not carry out any activities that looked for developments in the external environment in this research area. However, during the project scope definition phase the funding organisation had a strong initial interest in the research and S4 was involved in defining the scope as detailed in Section 6.3.2. With the funding organisation no longer interested in science engagement, it led to the overall goals in S5 no longer being centred around what the two project teams were doing. This was highlighted by the Principal Investigator saying that the funding organisation’s “*objectives have changed a bit, so I'm not sure where [these projects] fit in with them anymore*”⁷. At S3, the funding organisation did continue to oversee the completion of these “*legacy*”⁶ projects through a third party agent but the research showed that it was not really that engaged in S3 activities. Project Team B stated that they sent the funding organisation an occasional progress update but did not have “*a great deal of contact with [the funding organisation]*”⁷. Project Team C supported this by saying that the funding organisation was not really that “*interested in the intellectual content... [which] was more valuable*”¹³. Given the lack of monitoring from S3, Project Team C felt that it “*gives you a certain sense of liberty*”¹³ but there was a real fear amongst the project teams that they might “*end up saying, look we've done this, and [the funding organisation] saying, well that's not what we wanted you to do*”⁷.

6.3.2 Information Shared between Level 0 – Funding Organisation and Level 1 VSM

The highest rate of information sharing occurred between the Funding Organisation VSM at Level 0 and the Level 1 VSM during the project scope definition phase. The Principal Investigator stated that “*the initial bid team was [another person] and I who went to [the funding organisation] and were looking at ways of developing [science engagement] activities within the institution, so originally we were much more interested in changing attitudes within the institution*”³. The Co-Investigator said that “*we didn't hear anything else for a long time until the initial bid had gone in and I think had come back with requests for changes*”⁴. The scope definition process then followed the same pattern

described in Section 5.3.2 for Project Team A, with the Funding Organisation coming back with requests for changes, which eventually changed the initial project bid into “*something very different than what we intended*”³.

The Project Team Level 1 VSM S3 sent the Funding Organisation Level 0 VSM S3 “*a little update every so often just to give [the funding organisation] an idea of what progress is*”⁶. The Co-Investigator described this process as “*what’s tended to happen is we’ve got milestones written into our contract and each milestone has a small amount of money associated with it... so, as we get towards the end of each milestone that triggers an email from [the funding organisation] to me saying “I need some kind of formal report from you, just saying what you’ve been up to and have you achieved [the] milestone” and then we write him a little report*”¹. The Principal Investigator explained that this ‘formal’ report was a very small update with little real content “*because it wasn’t [the original funding organisation] it didn’t need so much justification because it was that kind of third party role*”². The Funding Organisation Level 0 VSM S3 would then inform the Project Team Level 1 VSM S3 whether the milestone was signed off as “*yay or nay*”¹.

6.3.3 VSM Level 0 – University

During the system identification phase of the VSD process, the second relevant system that the system-in-focus was found to be embedded within is relevant as it puts into context where the system-in-focus sat within the organisational system that employed the project team – the university. It was necessary to model this system too because the system had a bearing on how the project team members conducted the research.

This system was identified as:

- a system to **carry out research** that addresses the needs of society

The system to achieve the purpose of carrying out research was a university and, as a result, this organisational system is at Level 0 for this case study.

The University conducts a range of research projects of which the employees at the University work on. Project Team B was one of many such research project S1 units in this system.

S2 contains formal documents detailing university-specific codes of practice and standards to guide research project teams. One such standard process was described by the Co-Investigator, “*we have a very structured set of stage gate processes... so we do things called [V]1s which are just plans. They go to the whole team to be commented on, the revisions are made and come back as a first full draft which is a [V]2 and then you go through another set of essentially peer review comments, and come back with a [V]3 which should be pretty much a kind of polished draft. And my guess is that will happen certainly within the [Project Team B] steering group*”⁴.

S3 was mainly responsible for allocating personnel resources. Describing the recruitment process, the Principal Investigator stated that “*the initial bid team was [another person] and I who went to [the funding organisation]*”³. However, because the initial bid required certain changes and “*because [the Co-Investigator] has a lot of expertise in this area, he was drafted in just over a year ago to put the bid together with me and to submit it. So, there were two or three of us started off way back but in the end it was just [the Co-Investigator] and I who submitted it*”³. Once the bid had been accepted, the project team used the money to recruit a “*post-doctoral Research Fellow*”¹⁴ for the project.

S4 had a particular role at this level of recursion in trying to increase and develop the research the university undertook in science engagement and S5 activities were handled by a senior-level team that were involved in strategic decisions about the direction of the University.

6.3.4 Information Shared between Level 0 – University and Level 1 VSM

Due to the project team members all working for the University, they were bound by the university-specific codes of practice and standards, such as the “*stage gate processes*”⁴ described by the Co-Investigator above. This information was therefore present at S2 of the Project Team Level 1 VSM having come from S2 of the University Level 0 VSM.

There was also information shared between S4 of the Project Team Level 1 VSM and S4 of the University Level 0 VSM in terms of the Principal Investigator identifying a potential project that looked at “*how we should be using the [computer system] as an institution and how we can build on that and also how we can build it into a much bigger vision for our public engagement activities*”².

Finding: at the higher level of recursion, the highest rate of information sharing occurred between the Funding Organisation VSM at Level 0 and the Level 1 VSM during the project scope definition phase. Information on funding and project progress was also shared between the Funding Organisation and Project Team B recursion levels. University-specific codes of practice and standards, as well as information on potential new projects, were also shared between the University and Project Team B recursion levels.

6.4 Lower Recursion Level

Following the same format as in Chapter 5, this section will describe the four lower recursion level models that were identified to be relevant to the system-in-focus when conducting the VSD process. The information that is shared from/to these models will be detailed, in accordance with the fourth and fifth research questions.

6.4.1 VSM Level 2 – Data Collection

During the system identification phase of the VSD process, four S1 units of the system-in-focus were identified. The first of these systems was identified as:

- a system to **consult the number of participants** using the various methods as set in the focus group study plan and key dates and milestones documents

Data collection took the form of “*focus group interviews; participant observation of a series of... public engagement activities; and a questionnaire-based study*”¹⁴ and “*compiling reports, books and papers on... public engagement*”⁸. Each different data collection method therefore made up an S1 unit of the VSM at this level of recursion. The

focus group plan detailed the number and type of participants, topics and format of the focus groups to be used and described that “*the groups will be recorded digitally*”⁵ using “*portable audio equipment capable of recording multiple voices*”⁵ to collect audio data from the people engaging in the activities of the focus group. The key dates and milestones document provided a guide for the data collection in the same way as the project specification document in Project Team A did, as described in Section 5.4.1, and shows that the Research Fellow was the main person responsible for conducting these data collection tasks, although the Co-Investigator also assisted.

The remainder of S2-S5 were very similar to Project Team A described in Section 5.4.1, with the key dates and milestones document providing the scheduling of the activities for S2 and enabling S3 to conduct monitoring and control processes based upon this. Also, as with the Project Team A interviews, S4 for Project Team B was involved with having to engage in “*quite a bit of juggling around dates for actually holding some of these [focus] groups*”⁶ due to problems with getting participants to attend and S5 made decisions about such changes to the data collection process.

6.4.2 Information Shared between Level 2 – Data Collection and Level 1 VSM

Information from the key dates and milestones document developed at S3 of the Project Team Level 1 VSM was shared with S1 units, S2 and S3 of the Data Collection Level 2 VSM. Information on the data collection methods of the S1 units and deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the key dates and milestones document.

6.4.3 VSM Level 2 – Data Analysis

During the system identification phase of the VSD process, the second S1 unit of the system-in-focus was identified as:

- a system to **identify findings** that meet the research questions as set in the focus group study plan and key dates and milestones documents

The data collected in the Data Collection system at recursion level 2 was analysed by corresponding S1 units in the Data Analysis system. “Each [focus group] session was... fully transcribed for analysis. Once collected the data from the questionnaires, storyboards and transcripts were coded”⁹ with “detailed analysis of the questionnaires and focus group data”⁹ then taking place that was “following an inductive or ‘grounded’ approach”⁹. The Co-Investigator stated that this analysis was conducted using “computer assisted qualitative data analysis software... things like ATLAS-TI which is just a software program but it allows you to analyse large amounts of qualitative data”⁶. The Co-Investigator said that “in terms to analysing data obviously [the Research Fellow] and I have done the guts of that together”⁶.

The remainder of S2-S5 were very similar to Project Team A described in Section 5.4.2. With all the analysis methods contributing to the emerging themes, there was a high level of interaction needed between the different S1 units to ensure the information was shared effectively. S2 did not need to co-ordinate this information sharing explicitly as both the Research Fellow and Co-Investigator were working together on the different analysis methods. The key dates and milestones document provided the scheduling of the analysis activities for S2 and enabled S3 to conduct its monitoring and control processes based upon this. At S3, the Principal Investigator also checked the project was meeting the goals laid out in the key dates and milestones document, which also enabled S5 to make decisions on any changes necessary.

6.4.4 Information Shared between Level 2 – Data Analysis and Level 1 VSM

Information from the key dates and milestones document developed at S3 of the Project Team Level 1 VSM was shared with S2, S3 and S5 of the Data Analysis Level 2 VSM. Information on the objectives of the research (needed by S3 for ensuring the analysis was meeting the objectives and by S5 to determine if a particular line of analysis was worth pursuing) and the deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the key dates and milestones document.

6.4.5 VSM Level 2 – Computer System Production

During the system identification phase of the VSD process, the third S1 unit of the system-in-focus was identified as:

- a system to **produce a computer system repository** of advice and guidance for those interested in participating in public engagement activities

There were three elements to the production of the computer system repository: designing the computer system, developing the computer system architecture and developing the content to be held in the computer system repository. These three elements made up the S1 units at this level of recursion. The Principal Investigator stated that designing the computer system and developing its architecture S1 units would use external consultants from the computer department “*who will come in and help us design the [computer system] so they’ll be involved in that*”⁴. The development of content to be held in the computer system repository was “*collaboratively produced by practitioners and social researchers*”¹⁴ that the project team identified during the focus groups and through other contacts they had.

The remainder of S2-S5 were very similar to other lower recursion levels of Project Team A described in Section 5.4. The deadlines for these activities were provided in the key dates and milestones document and enabled S2 and S3 to conduct their scheduling and monitoring processes. The quality and relevance of what was produced by the S1 units were evaluated by the Data Analysis Level 2 VSM through the Data Collection Level 2 VSM “*conduct[ing] authentic user testing ‘in the field’ of the activities in the [exemplars in the computer system repository] with at least eight [public engagement] practitioners (two for each [exemplar]) and a range of participants. Participants and [public engagement] practitioners to complete feedback questionnaires... [and project team] to conduct participant observation of a selection of these activities and interview the [public engagement] practitioners*”⁸ and enabled S4 to determine, and S5 to decide on, any necessary changes required to the computer system.

6.4.6 Information Shared between Level 2 – Computer System Production and Level 1 VSM

Information from the key dates and milestones document developed at S3 of the Project Team Level 1 VSM was shared with S2 and S3 of the Computer System Production Level 2 VSM. Information on the deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the key dates and milestones document.

As detailed in the above section, the designing the computer system and developing its architecture S1 units were being carried out at the same time the Data Analysis S1 units at Level 2 were being carried out. This meant that S4 of the Computer System Production Level 2 VSM could be identifying new findings to be included/revised in the design and development of the computer system. However, as with the Findings Level 2 VSM in Project Team A described in Section 5.4.6, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out. For example, in this instance, the VSM does not provide an explicit link between the Focus Group Analysis S1 unit of the Data Analysis Level 2 VSM to S4 of the Computer System Production Level 2 VSM. Similarly between the other S1 units of the Data Analysis Level 2 VSM, the model does not provide a direct link to S4 of the Computer System Production Level 2 VSM.

***Finding:* as in Project Team A, a deficiency of the VSM identified is that, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out.**

6.4.7 VSM Level 2 – Findings

During the system identification phase of the VSD process, the fourth S1 unit of the system-in-focus was identified as:

- a system to **disseminate findings** that are suitable given the research objectives in a way that the academic community can understand

As detailed in Section 6.2.2, the project team disseminated findings through journal publications, conference papers, science festival papers and web publications and, as a result, each of these activities make up the S1 units at this level of recursion. The Co-Investigator and Research Fellow both worked together on these particular S1 activities with each taking the lead role for some and an assistant role for others.

The remainder of S2-S5 were very similar to Project Team A described in Section 5.4.5. The deadline for many of these activities were provided in the key dates and milestones document and enabled S2 and S3 to conduct their scheduling and monitoring processes. As with Project Team A, the project team had to ensure their findings being disseminated were relevant to the research objectives set out in the key dates and milestones document, which the Principal Investigator carried out, enabling S5 to make decisions on any changes necessary.

6.4.8 Information Shared between Level 2 – Findings and Level 1 VSM

Information from the key dates and milestones document developed at S3 of the Project Team Level 1 VSM was shared with S2, S3 and S5 of the Findings Level 2 VSM. Information on the objectives of the research (needed by S3 for ensuring findings being disseminated were meeting the objectives and by S5 to determine if a particular finding was relevant to be included) and the deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the key dates and milestones document.

***Finding:* at the lower level of recursion, information from the key dates and milestones document (such as research objectives, data collection methods and deadlines) was shared between Project Team B and the lower recursion levels.**

6.5 Summary

This chapter presented the findings from analysing Project Team B. Project Team B was described in terms of the VSM and it was identified that the VSM provided an adequate representation of this project team.

The chapter then went on to explore the first question posed in this research as to what information exists at level 1 of recursion. The chapter provided evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of algedonic signal (ID38) at this level of recursion. There were also 14 information domains which were found to be different to Project Team A, highlighting differences when oscillation is present. There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the organisation.

The next section then moved on to the second and third questions posed in this research to identify what information is shared within the project team and whether the extended theoretical model presented in Table 5 and the communication channels in Figure 13 actually provided an adequate representation of this. The chapter provided evidence that supports much of the information that Table 5 suggests is shared in viable systems at one level of recursion. However, there was no evidence of the algedonic signal (ID38) on communication channel M. There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

The following sections then looked at the recursion levels directly above and directly below the system-in-focus in order to analyse the project team in context. Each relevant recursion level was described in terms of the VSM and was then explored in detail to identify the information that was shared between each level of recursion, in accordance with the fourth question posed in this research. At the higher level of recursion, the highest rate of information sharing occurred between the Funding Organisation VSM at Level 0 and the Level 1 VSM during the project scope definition phase. Information on funding and project progress was also shared between the Funding Organisation and Project Team B recursion levels. University-specific codes of practice and standards, as well as

information on potential new projects, were also shared between the University and Project Team B recursion levels. At the lower level of recursion, information from the key dates and milestones document (such as research objectives, data collection methods and deadlines) was shared between Project Team B and the lower recursion levels.

In accordance with the fifth and final question posed in this research, the analysis identified a deficiency of the ability of the VSM to accurately model the information sharing between recursions for this project team. This deficiency was highlighted in the previous chapter to also be present for Project Team A in that, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out. This meant that it was not possible for the VSM for Project Team B to provide a detailed account of the communication process to describe how the Data Analysis and Computer System Production S1 units at Level 2 were working together.

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- ¹ Co-Investigator Interview 4
 - ² Principal Investigator Interview 4
 - ³ Principal Investigator Interview 1
 - ⁴ Co-Investigator Interview 1
 - ⁵ Focus Group Plan document
 - ⁶ Co-Investigator Interview 2
 - ⁷ Principal Investigator Interview 2
 - ⁸ Key Dates and Milestones document
 - ⁹ Interim Report document
 - ¹⁰ Principal Investigator Interview 3
 - ¹¹ Project Team B Meeting 1
 - ¹² Project Team B Meeting 2
 - ¹³ Project Team C Principal Investigator Interview 2
 - ¹⁴ Project Website

Chapter 7

Project Team C Analysis

7.0 Introduction

This chapter presents the findings from analysing Project Team C, following the same structure as Chapter 5. As discussed in Chapter 5, for reasons of brevity this chapter will present in less detail those findings that replicate ones made from analysing Project Team A. Instead, this chapter will give a much stronger focus on presenting areas where the analysis of Project Team C and Project Team A provided different results.

7.1 Project Team C and the VSM

This section begins by providing a short background introduction to Project Team C before describing the project team in terms of the VSM. This section will then examine the fit between the VSM and the project team to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

7.1.1 Background Introduction

Project Team C worked together on a research project from October 2006 to July 2009 which was being carried out by staff in a university. The research investigated how culture in universities could be changed to increase the level of engagement between scientists and the general public. This project team initially consisted of three members, who all worked for the university, and have been assigned the following labels in this research to aid the reader identify them: a Principal Investigator, a Co-Investigator and a Research Fellow. As discussed in Section 7.2.1, mid-way through the first year of the project, this project team restructured themselves by removing the Research Fellow role and replacing the Co-Investigator with a new one. To aid the reader identify the new Co-Investigator they have been assigned following label: New Co-Investigator.

The research undertaken by the project team was conducted in two stages, with the first stage undertaken to understand the issues involved in science engagement with the public. Data was collected for this phase through interviewing key staff at universities and through the collection of various relevant literature. The findings from this were then used to support the second stage of the research, which was action research through working with universities to support them in increasing their science engagement activities. Universities were invited to develop 12-month science engagement projects that Project Team C could then support in their implementation. Data was collected for this phase through regular contact with the universities implementing the science engagement projects and a series of focus group meetings between Project Team C and these universities. This data was then analysed and the findings from this research were disseminated to the academic community through conference papers and presentations, as well as academic journal papers. In the end, the project was delivered 6 months later than had originally been planned. Reflecting back the Principal Investigator stated that “*at the beginning [the goals] were way too ambitious and not doable*”¹ with the New Co-Investigator commenting that the project had originally set out to carry out “*culture change in every university in the UK... so, we have fallen just a weeney (sarcasm) bit short, but I think the [result] is interesting*”².

At the very start of the project, the roles of the different members of the project team were defined by the project members. The Research Fellow classified their role as “*doing the hands on research*”³. The Co-Investigator was on hand to offer “*supervision*”³ with their main responsibility being the day-to-day management. The Principal Investigator defined their primary role in the project as being “*to drive it*”⁴.

7.1.2 VSM Level 1

This section will present Project Team C in terms of the VSM before moving on to a discussion to determine whether the VSM actually provided an adequate representation of this project team, as discussed in Chapter 4.

As described in Chapter 4, the VSD process was used to generate the VSM for Project Team C. During the system identification phase of the VSD process the system was identified as:

- a system to **carry out research** into how culture in universities could be changed to increase the level of engagement between scientists and the general public

The system to achieve the purpose of carrying out research was the project team and, as a result, the project team system is the system-in-focus for this case study. The remaining steps of the VSD process were then undertaken for this level of recursion, generating the components of the VSM which will now be described.

- S1 units are the activities that the project team must carry out to achieve its purpose. The data collection for the first phase of the project was in the form of “*desk based reviews*”⁵ of relevant literature/documentation and “*phone interviews... [with] university staff with responsibilities for science engagement*”⁵. These “*interviews were analysed and coded*”⁶ to produce findings that were disseminated in the Phase 1 Report and also via an academic “*paper*”⁷, “*conference*”⁷ and “*e-bulletin*”⁷. These findings informed the support given in the second phase of the project, where the project team supported “*action learning sets*”⁶ to implement science engagement projects in universities. Data was collected for this phase through the project team engaging in “*on-going monitoring*”⁷ of the universities implementing the projects and also through the project team conducting a series of “*workshops*”⁷ held with these universities to “*help think round practical issues and respond to participating [universities’] project needs*”⁷. This data was then analysed to develop “*case studies*”⁸, with the “*outcomes of these action learning projects*”⁶ disseminated through “*e-bulletin*”⁷ and a “*final report*”⁷ with the intention for them to “*help other university based scientists and engineers who wish to initiate changes or to develop their practices*”⁶. Therefore, in order for the project team system to achieve its purpose of carrying out research, it needed to undertake three main activities: data collection, data analysis and dissemination of findings and it is these activities that make up the S1 units of the Level 1 VSM.
- S2 dampens oscillations between the S1 units and co-ordinates them to achieve synergy. The data showed that there was a high level of dependency between the

different S1 units, with the Data Analysis and Findings S1 units informing the subsequent Data Collection S1 activities, as in Project Team A and B. Similar to Project Team A and B, the project team created a schedule in the form of a milestones document. As discussed in Section 7.2.1, this was initially inadequate for S2 to conduct its scheduling activities effectively. As the Research Fellow was mainly left to coordinate the S1 activities initially, co-ordinating information flow between the S1 units was generally handled by this single person. However, the Co-Investigator said that they would also be “*facilitating, convening whatever meetings are needed*”⁹ in order to share necessary information.

- S3 is responsible for monitoring and controlling the S1 units. The Co-Investigator was mainly responsible for this and stated that they were taking a “*moderator/evaluator role*”⁹ that would enable them to provide direction as to how “*this is how we are going to do it on the ground*”⁹. The Co-Investigator also carried out the “*practical things like sorting out budgets and things*”⁹.
- S3* conducts audits for S3. The New Co-Investigator was responsible for conducting audits to ensure quality and would read through reports to “*find typos and stuff*”¹⁵.
- S4 is responsible for seeking out potential future directions for the system. S4 was involved with S3 in determining the scope of the project and, in the same way as Project Team B, was a joint process undertaken by the project team with the funding organisation. The Co-Investigator played a role in seeking future directions for the project and was observed in one meeting to actively look on the Internet for developments that may impact on the project¹⁰. However, using the same approach as Project Team B, Project Team C used a Sharing Group as the main vehicle from the external environment to inform S4 of the VSM, as was described in Section 6.1.2. The Co-Investigator and Principal Investigator also discussed issues about the project with colleagues from outside the project team, who were also working in the research topic area¹¹.
- S5 carried out the overall decision making processes of the project team. The Principal Investigator had the final say in decisions and stated that their role involved “*shaping the vision... to shape it, to drive it, to kind of define the boundaries*”⁴ and so was given responsibility for determining the overall direction of the project.

7.1.3 VSM Level 1 – Model Suitability

As described above, the project team undertook three main activities – data collection, data analysis and findings dissemination. The activities in S2, S3 and S4 are very similar to those described for Project Teams A and B. S5 described the Principal Investigator’s role in handling necessary decisions for the project team. There were no other processes described in the data that the VSM failed to model for this level of recursion.

7.2 Information within Project Team C

This section will explore the first three research questions concerning the information generated and shared at level 1 recursion in Project Team C.

7.2.1 Information Present/Not Present at Level 1

This section presents the evidence for information present in the project team VSM at level 1 recursion in accordance with the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information present in the project team at this level of recursion that does not fit into the extended theoretical model.

There were 13 information domains which were found to be very similar to Project Team A. External environment information (ID1 in Table 5) was generated by participants involved in the Data Collection S1 activity. Goals set by, performance and modus operandi of the primary activities in S1 (ID2) and organisational goals (ID3) were set right at the start of the project in a short summary document¹². In terms of operational information (ID10), a “*progress report*”⁷ was produced at three different stages in the project that provided the project team with a record of their progress during the course of the project. As discussed in Section 7.1.2 there was a high level of interdependency between S1 activities (ID12). The potential for oscillations (ID13) in terms of co-ordinating information flow between the S1 units was low as it was handled by a single person – initially the Research Fellow and then subsequently the New Co-Investigator. However,

the delay in the data collection (as discussed in greater detail later in this section) impacted upon the timescales for the Data Analysis and Findings S1 activities, with the project team having to put back all the project activities by 6 months (ID11, 13-18). As with Project Team B, the cultural knowledge (ID37) of the project team was a mixture of social science and hard science sub-cultures as its members were drawn from different functional areas of the university. This was highlighted by the Principal Investigator who said that “*my research has been in [hard science] so the way that we tackle things is a bit different*”⁴. This was supported by the Co-Investigator who said “*there’s an interesting tension between the grounded scientists and the theorising problematising social scientists*”⁹.

There were 23 information domains which were found to be different to Project Team A. Through conducting the VSD process, S3 was found to be particularly weak in this project team. Whilst the broad aim for the project team had been set out by S5, there were no specific milestones for the project developed at S3. The Research Fellow felt the project team ended up being “*reactive as opposed to proactive*”³ due to this lack of expected performance of the primary activities (ID4), as they felt tasks were just being carried out when an event caused them to be done, as opposed to the project team following a particular plan. The Co-Investigator was particularly worried about this reactive approach, so much so that he said he would even “*occasionally wake up over this*”¹³. Whilst it was felt to be “*crucial*”¹³ to create a delivery plan to guide the project team, a delivery plan was also seen as necessary to identify the needs for S1 (ID19) to determine resource allocation (ID20). In this respect, the Principal Investigator stated “*what we need to get better at doing is forward planning*”¹³ as she was worried that “*will the people that we want to do [the various activities in the project] be available? ... my guess is at the moment we’ll be saying, oh right we’re ready now, we need somebody now*”¹³ and that no-one would be available at that time. The Research Fellow supported this fear, stating “*I think we have to be really clear who is going to do what*”³.

The strength of S4 in the project team further exacerbated the problem of failing to identify resource allocations. The Principal Investigator and Co-Investigator were both active in scanning the external environment for developments (ID32) to identify potential changes to the project. However, through S3 not knowing which resources were being used in the current tasks, it could not look at innovation proposals from S4 (ID22) and determine if enough resources were available to implement them (ID23-27). As a result, incomplete innovation proposal reviews were completed by S3 (ID29), causing problems for S5. At

S5, the Principal Investigator was an exceptionally visionary person who “*would like to change the planet so, you know, why not aim for that?*”⁴. This led S5 to add some innovation proposals from S4 to the project goals (ID30) without a proper review being conducted of whether there were enough resources to do so. An example of this happened in one meeting¹⁴ where adding an extra research question to the project was suggested, which S5 chose to do, resulting in a large extra goal for S1 (ID3). This addition to S1 left the Research Fellow feeling “*really, really uneasy because I don’t think what we’re coming up with is achievable in 2 years*”³ and that “*there was so much kind of vision and aspiration going on that it was too big – what we were trying to go for and what we were saying that we could achieve*”¹³. This caused the Research Fellow to lead further calls for a delivery plan to be created at S3, identifying the tasks needed to be completed so that the project team could “*set priorities*”³ and “*narrow down a bit*”¹³ the number of less important tasks in S1.

Through S3 not defining the expected performance of tasks and their deadlines, monitoring practices (ID5) could also not be formally set to determine whether tasks had been achieved satisfactorily or take actions to rectify them (ID7-9). This added to “*worries*”³ about how the project team could check that the project was “*going to be a quality achievement? ... there’s a lot of credibility going on and if we don’t get the process right or what have you, you know, then credibility becomes an issue. So I think we have to be really, really careful about those things ’cos right now there’s an awful lot of credibility around science and community engagement... we don’t want to upset that credibility*”³.

The causes (ID35) for the strength of S4 and weakness of S3 discussed above created too strong an imbalance between S3 and S4 (ID33-34). To address this (ID31), although also partly forced by unavoidable personal circumstances, the project team decided to change its structure (ID36). The project team decided it would employ “*students who could do chunks*”¹³ of the S1 activities and provide them with “*a very rigid question*”¹⁵ format to give them enough guidance to carry out the tasks, which forced the project team to develop a “*very clear project plan now with specific tasks*”¹³. Through these students assisting in the S1 activities there was no longer a need for a full-time Research Fellow on the project and so the Research Fellow left the team to work on a different project at the university. The original Co-Investigator also left the university around the same time and therefore had to be replaced in the project team by a new one, henceforth called New Co-

Investigator. Project tasks that the students were unable to undertake, due to lack of experience or time, also became part of the New Co-Investigator's role.

The students used by the project team were postgraduate students being funded to develop their research skills and “*apply that in a practical situation under supervision*”¹⁶. This supervision, undertaken by the New Co-Investigator, provided a much stronger S3 that issued “*checklists*”¹⁶ to the students to provide clear performance goals (ID4). At various stages of the project, the students also wrote up aspects of their work, with the New Co-Investigator saying that when they had “*written bits up... I've checked that and we've moved along in that sort of way*”¹⁶ to enable the identification of any goal and performance misalignment (ID6). Whilst some of the students did struggle to conduct the data collection, as cold calling telephone interviews are “*not everybody's [thing] – it's quite a hard thing to do... it's not something that comes naturally to people*”¹⁵, the reorganisation of the project team did provide the performance goals the team appeared to need. The New Co-Investigator also became responsible for conducting quality audits (ID28) and undertook proof reading to “*find typos and stuff*”¹⁵.

After the reorganisation of the project team, S3 could also regularly check “*how things are going relative to the milestones*”¹⁷ since a delivery plan had now been created to enable the identification of any goal and performance misalignment (ID6). However, due to the initial weak S3 and the subsequent structural change in the project team, the New Co-Investigator stated “*the thing that has slipped has been time... I think [the project] is now 6 months or 9 months longer than [the] original timetable*”¹⁶. This was supported by the Principal Investigator stating that “*we are behind, we negotiated a 6 month increase in timeframe with [the funder]*”¹⁷.

The delivery plan created after the re-organisation enabled the project team to become “*focused... [with] clear phases and stages*”¹⁶, enabling S3 to determine the needs for S1 (ID19) for resource allocation (ID20). Using this, S3 was also then able to look at S4 innovation proposals (ID22) and determine if enough resources were available to implement them (ID26-27). As a result, S3 could now complete accurate innovation proposal reviews (ID29) to determine their feasibility, which led to S5 changing project goals (ID3) later on in the project to become “*slightly more ambitious in scope*”¹⁶, but this time S5 had the confidence that the resources were available to achieve these more ambitious goals.

Finding: the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of manipulation of external environment (ID21) or algedonic signal (ID38) at this level of recursion. There were also 23 information domains which were found to be different to Project Team A, showing a large difference in how the information domains react to having a strong S3 compared to a weak S3. There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the organisation.

7.2.2 Information Shared/Not Shared at Level 1

This section presents the evidence for information shared within the project team VSM at level 1 recursion in relation to the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information shared within the project team at this level of recursion that does not fit into the extended theoretical model.

The communication channels discussed in Chapter 3 that supported information sharing at this level of recursion are provided in Figure 20 of the Project Team C VSM, which has been adapted from the generic VSM diagram of communication channels presented in Figure 13. The greyed out communication channels are not explored at this level of recursion as they represent communication channels at a lower level of recursion which are examined in Section 7.4.

Project Team C VSM and Communication Channels

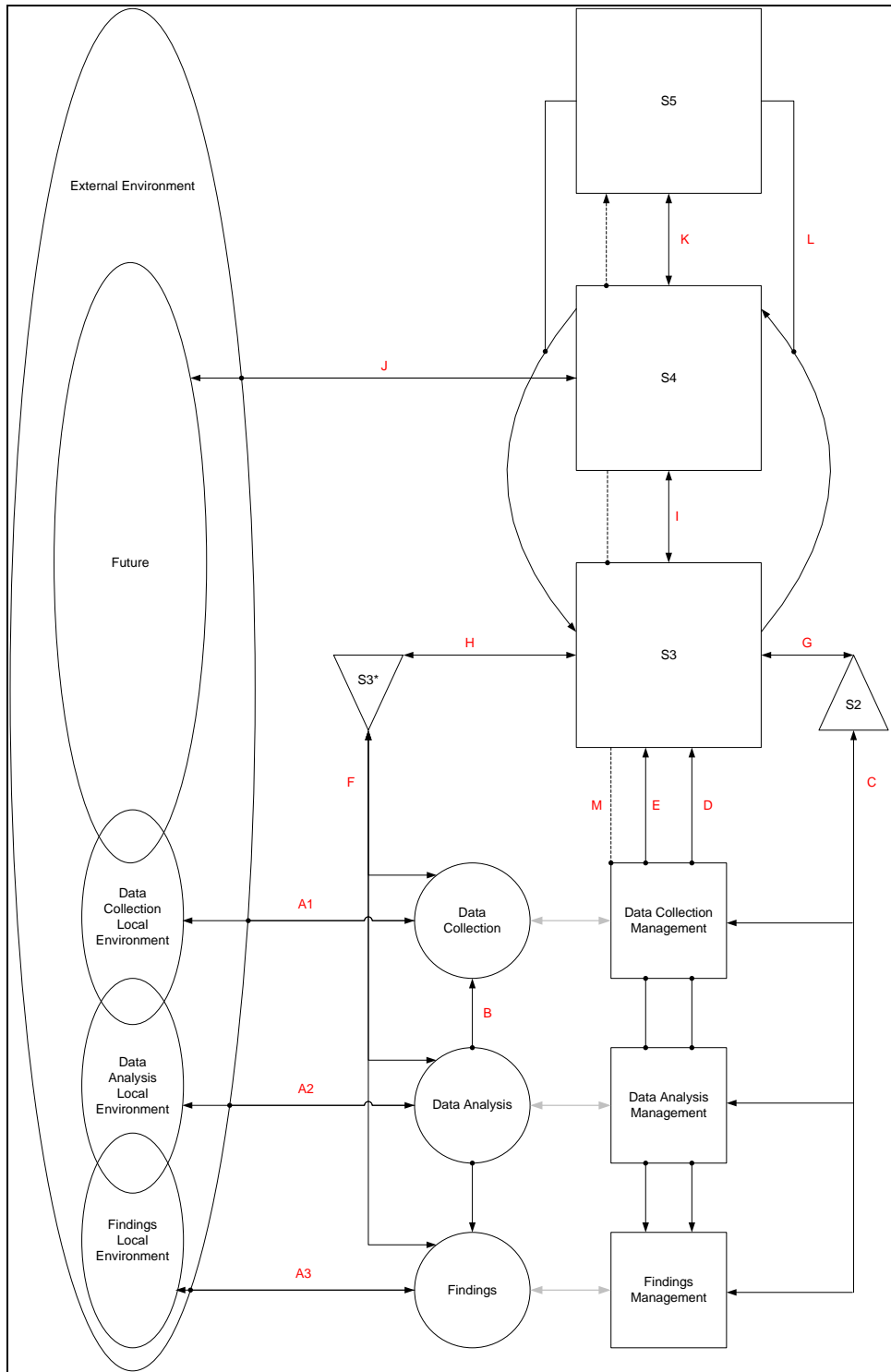


Figure 20

Once the initial problems with S3 discussed above were resolved, information sharing occurred very similarly to the way it did in Project Team A in a number of information domains. The information domains that were similar will now be summarised briefly. Information was shared between the external environment (ID1) using communication channel A1 by the Data Collection S1 unit. As discussed in Section 7.1.2, telephone

interviews and workshops were used to collect data, with the workshops also providing an opportunity for the project team to provide advice to participants. S4 also communicated over communication channel J with a “*sharing group*”⁷ in the external environment in the same way Project Team B did as described in Section 6.2.2. S4 also scanned the environment for potential developments that may affect the project, through methods such as those discussed in Section 7.1.2, e.g. the Co-Investigator looking on the Internet for developments that may impact on the project¹⁰. In terms of S1 unit to S1 unit information sharing, the interdependences between the three S1 units have already been considered in Section 7.1.2. In order to carry out analysis, the Data Analysis S1 unit needed the data collected from the Data Collection S1 unit across communication channel B. The Data Analysis S1 unit also had to provide the analysis to the Findings S1 units so that the findings could be disseminated. Due to the S1 activities being co-ordinated by a single person – initially the Research Fellow and then subsequently the New Co-Investigator – oscillatory information (ID11, 15-16) was not shared explicitly. However, the 6 month delay in the Data Collection S1 unit discussed in Section 7.2.1 did mean that the project milestones document needed to be updated to share the new timeframe between S2 and the S1 units via communication channel C. The goals set by, performance and modus operandi of the primary activities in S1 (ID2) were shared between the S1 units and S2 across communication channel C which enabled S2 to ensure the schedule of activity was being followed and determine if there was any oscillation. Organisational goals (ID3) were explicated in the bid proposal document, enabling it to be shared across all S1 to S4. As discussed in Section 7.2.1, the expected performance of the primary activities (ID4) were shared across communication channel D from the New Co-Investigator issuing the students with checklists and students writing up aspects of their work and sending them to the New Co-Investigator to check (ID5). This allowed the New Co-Investigator to feedback any goal and performance misalignment (ID6) to the students across communication channel D and discuss any causes and consequences (ID7) with them. As highlighted in Section 7.2.1, auditing (ID28) was undertaken through the New Co-Investigator proof reading documents obtained from the S1 units using communication channel F, with any discrepancies found being sent to S3 over communication channel H. In terms of operational information (ID10), as discussed in Section 7.2.1 S2 would use information across communication channel C from the S1 units to produce a progress report at three different stages in the project to provide the project team with a record of their progress.

As with Project Team A, the S1 activities needed two key resources – personnel and time. The amount of time required was driven by the need for meeting the overall project team objectives. The needs of S1 (ID19) were identified when formulating the project milestones document after the project team was restructured, enabling S3 to conduct resource allocation (ID20). Personnel were allocated at a higher level of recursion, in the same way that it was in Project Team A. Time was allocated through discussions that the New Co-Investigator had with the Principal Investigator when the original project milestones were being reviewed and amended by the New Co-Investigator after the project team restructured.

As with Project Team B, the proposals for innovation made by S4 (ID22), reviews by S3 of proposals for innovation (ID29), finalised plans for adaptation of organisational goals (ID30) and regulatory measures to counter the imbalance between S3 and S4 (ID31) were found to be a multi-recursion level process between the Funding Organisation Level 0 VSM and the project team when the project bid was being developed. Once the project began, this process was observed¹³ to also be handled at level 1 recursion through project meetings with face-to-face discussions about future directions taking place between all project team members before a decision at S5 was made.

As with Project Teams A and B, cultural knowledge (ID37) was found to be present within each of S1-S5. The project team were less structured than Project Team B, who had a much tighter key dates and milestones document providing a very formal structure to goals and evaluation criteria than Project Team C did. Equally, meetings for Project Team C were based on when each member was free rather than the more regular time-slot approach of Project Team B's weekly meetings. This was linked to the amount of time that project team members had available to meet, with the Research Fellow noting that the “[Principal Investigator] *is only around so much and she does her media work and she's getting ready to go off for several weeks... and [the Co-Investigator] obviously has his other job*”³.

In terms of sharing information, Project Team C was similar to Project Team A in its reliance on technology rather than the more face-to-face communication of Project Team B. As with Project Team A, the reliance on email stemmed from the differing work locations of the members and the amount of time they each had available. The Principal Investigator often worked abroad, making it difficult for immediate information sharing to occur because “*a lot of times it's just trying to get hold of [the Principal Investigator] and*

get the answers out of her because she's just all over the place"³. The Co-Investigator was also extremely busy, with the Research Fellow saying that "*weeks will go by and I won't see him or have any contact with him 'cos he's off doing whatever he's doing, his kind of projects and stuff*"³. As a result, the project team felt that e-mail was "*key*"¹⁷ for their information sharing and there were several documents that had "*gone backwards and forwards and [development of them been] iterated*"¹⁷ over e-mail. Project Team C also used "*phone*"¹⁷ and "*text*"¹⁷ when the Principal Investigator was abroad to communicate between members. As with Project Team A, Project Team C had face-to-face meetings when it was "*appropriate with where we are in the bit of work*"¹⁶, although the frequency of them "*varies a lot*"¹⁷ and, at one stage in the research, the project team had a "*two month gap and then a three month gap*"¹⁷ where members did not engage in any meetings at all. The heavy reliance on electronic communication appeared to restrict the amount of information shared. For example, in one interview¹⁷, the Principal Investigator admitted that she did not really know what had happened in the project for the previous three weeks as there had not been a project team meeting to update her, which she felt would "*have been really nice*"¹⁷ if there had have been to support her in her S4 role of future planning.

Finding: the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is shared in viable systems at one level of recursion. However, there was no evidence of the algedonic signal (ID38) on communication channel M or information being shared across communication channel J to manipulate the external environment (ID21). There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

Finding: Table 13 shows how the extended theoretical model relates to the final version of the coding scheme developed for level 1 recursion in Project Team C. Table 13 shows in black where the information domains from the extended theoretical model matched those found through coding the data and the information domains that did not match the coding of the data are shown in grey. There was no evidence of any other failure of the extended theoretical model to match the data coding for this level of recursion:

Coding Scheme for Project Team C Recursion Level 1

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
1	External environment information	G, A	A				A	
2	Goals set by, performance and modus operandi of the primary activities in S1		G, A	A	A	A	A	
3	Organisational goals		A		A		A	G, A
4	Expected performance of the primary activity (goals for S1 activity)		A		G, A			
5	Monitoring and control practices by S3		A		G, A			
6	Goal and performance misalignment		A		G, A			
7	Causes and consequences of goal and performance misalignment		G, A		G, A			
8	Actions to counter goal and performance misalignment by S1		G, A					
9	Heuristics to implement counteractions		G, A					
10	Operational information		A	G, A				
11	Anti-oscillatory measures		A	G, A				
12	Interdependencies between S1 activities			G, A				
13	Actual oscillations			G, A				
14	Actual performance loss due to oscillations			G, A				
15	Norms for admitted performance loss due to oscillations (goals for S2)			A	G, A			
16	Gap between norm for admitted and actual performance loss due to oscillations			A	G, A			
17	Causes of the gap between admitted and actual performance loss due to oscillations			G, A				
18	Experiences with anti-oscillatory measures			G, A				
19	Problems and needs of the management of S1 activities		G, A		G, A			
20	Resource allocation		A	G, A	G, A			
21	Manipulation of external environment	A					G, A	
22	Proposals for innovation made by S4				A		G, A	A
23	Desired goals for S1 based on proposals for innovation				G, A			
24	Gap between desired and current goals of S1				G, A			
25	Required capacity for reorganisation of S1 activities				G, A			
26	Actual capacity for reorganisation of S1 activities				G, A			
27	Gap between required and actual capacity for reorganisation of S1 activities				G, A			
28	Auditing				A	G, A		
29	Reviews by S3 of proposals for innovation				G, A		A	A
30	Finalised plans for adaptation of organisational goals (a joint S3 and S4 product)				G, A		G, A	A
31	Regulatory measures to counter the imbalance between S3 and S4				A		A	G, A
32	Developments in the relevant environment of the organisation						G, A	
33	Norms for balance between S3 and S4							G, A
34	Actual imbalance between S3 and S4							G, A
35	Causes of imbalance between S3 and S4							G, A
36	Experiences with regulatory measures to counter the imbalance between S3 and S4							G, A
37	Cultural knowledge	A	A	A	A	A	A	G, A
38	Algedonic signal	G, A	G, A	G, A	G, A	G, A	G, A	A

Table 13

7.3 Higher Recursion Level

Following the same format as in Chapter 5, this section will describe the higher recursion level model that was identified to be relevant to the system-in-focus when conducting the VSD process. The information that is shared from/to this model will be detailed, in accordance with the fourth and fifth research questions. A relevant higher recursion level model that will not be discussed in this section is the Funding Organisation, as this has already been discussed in Section 6.3.

7.3.1 VSM Level 0 – University

During the system identification phase of the VSD process, the relevant system, other than the Funding Organisation described previously in Section 6.3, that the system-in-focus was found to be embedded within is relevant as it puts into context where the system-in-focus sat within the organisational system that employed the project team – the university. It was

necessary to model this system too because the system had a bearing on how the project team members conducted the research.

This system was identified as:

- a system to **carry out research** that addresses the needs of society

The system to achieve the purpose of carrying out research was a university and, as a result, this organisational system is at Level 0 for this case study.

The University conducts a range of research projects of which the employees at the University work on. Project Team C was one of many such research project S1 units in this system. At S2 a dedicated science engagement department enabled co-ordination to take place between science engagement project S1 units. This co-ordination enabled a two-way transfer of information in that “*what the [department] has learnt already, has helped to shape this project*”¹⁷ and in the other direction “*looking at culture change in [this project] will help to inform [other projects within the department]*”¹⁷. Information was shared between science engagement projects through having a “*group of people who are active in [science engagement] right across the university who, come together to share good practice, and throughout the research project we’ve talked with them what our plans have been*”¹⁷. Information was also shared between science engagement projects through specific project-to-project meetings, as was observed by the researcher when members from Project Team C and members from another project team came together to discuss issues from their respective projects¹¹. As with Project Teams A and B, S2 also contained formal documents detailing university-specific codes of practice and standards to guide research project teams.

S3-S5 were found to be the same as for Project Teams A and B at this level of recursion, with S3 allocating personnel resources to work on the project, S4 identifying potential new research projects to undertake and S5 activities being handled by a senior-level team that are involved in strategic decisions about the direction of the University.

7.3.2 Information Shared between Level 0 – University and Level 1 VSM

In the same way Project Teams A and B were, due to the project team members all working for the University, they were bound by the university-specific codes of practice and standards. This information was therefore present at S2 of the Project Team Level 1 VSM having come from S2 of the University Level 0 VSM.

There was also information shared between S4 of the Project Team Level 1 VSM and S2 of the University Level 0 VSM in terms of operational information from what the science engagement department had learnt previously to the project team and also to enable the co-ordination of information sharing between the science engagement project teams at the university. However, whilst communication channel C in Figure 13 of the VSM provides a link between S1 units and S2, it does not provide a detailed structure for this information sharing to be carried out. For example, the VSM does not provide an explicit link between S4 of Level 1 and S2 of Level 0 for this to directly happen.

Finding: a deficiency of the VSM identified is that, whilst communication channel C in Figure 13 of the VSM provides a link between S1 units and S2, it does not provide a detailed structure for this information sharing to be carried out.

Finding: at the higher level of recursion, operational information and information on project progress was shared between the University and Project Team C recursion levels. Project Team C also showed the same results as Project Teams A and B in that university-specific codes of practice and standards were shared between the University and Project Team C recursion levels.

7.4 Lower Recursion Level

Following the same format as in Chapter 5, this section will describe the three lower recursion level models that were identified to be relevant to the system-in-focus when conducting the VSD process. The information that is shared from/to these models will be detailed, in accordance with the fourth and fifth research questions.

7.4.1 VSM Level 2 – Data Collection

During the system identification phase of the VSD process, three S1 units of the system-in-focus were identified. The first of these systems was identified as:

- a system to **consult the number of participants** using the various methods as set in the project milestones document

As discussed in Section 7.1.2, data collection activities involved three key tasks - “*desk based reviews*”⁵ of relevant literature/documentation, “*phone interviews... [with] university staff with responsibilities for science engagement*”⁵ and a series of “*workshops*”⁷. Each different data collection method therefore made up an S1 unit of the VSM at this level of recursion. The remainder of S2-S5 were very similar to Project Teams A and B, with the project milestones document providing the scheduling of the activities for S2 and enabling S3 to conduct its monitoring and control processes based upon this.

7.4.2 Information Shared between Level 2 – Data Collection and Level 1 VSM

Information from the project milestones document developed at S3 of the Project Team Level 1 VSM was shared with S1 units, S2 and S3 of the Data Collection Level 2 VSM. Information on the data collection methods of the S1 units and deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the project milestones document.

7.4.3 VSM Level 2 – Data Analysis

During the system identification phase of the VSD process, the second S1 unit of the system-in-focus was identified as:

- a system to **identify findings** that meet the research aims as set in the project bid proposal and project milestones documents

The data collected in the Data Collection system at recursion level 2 was analysed by

corresponding S1 units in the Data Analysis system. The Phase 1 report described the process of analysing the interview data collected as “*interviews were analysed and coded*”⁶. The workshops in the Data Collection S1 unit were analysed through “*reflective processes*”¹⁵ both during the workshops and afterwards with the New Co-Investigator saying “*after each meeting we’ll do notes... and then I write back to [the participants] about what we’ve been talking about*”¹⁵. The remainder of S2-S5 were very similar to Project Teams A and B, with the project milestones document providing the scheduling of the analysis activities for S2 and enabling S3 to conduct its monitoring and control processes based upon this. The project bid proposal provided the overall goals the analysis was working to for S3 and S5.

7.4.4 Information Shared between Level 2 – Data Analysis and Level 1 VSM

Information from the project bid proposal and project milestones documents developed at S3 of the Project Team Level 1 VSM was shared with S2, S3 and S5 of the Data Analysis Level 2 VSM. Information on the objectives of the research (needed by S3 for ensuring the analysis was meeting the objectives and by S5 to determine if a particular line of analysis was worth pursuing) and the deadlines in the project (for S2 and S3 to co-ordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the project bid proposal and project milestones documents.

As detailed in the above section, the Workshop Data Analysis S1 unit was being carried out at the same time the Workshop Data Collection S1 unit in the Data Collection Level 2 VSM was being carried out. This meant that S4 of the Data Collection Level 2 VSM was constantly being sent new issues to collect data on by the Data Analysis Level 2 VSM. However, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out. For example, the VSM does not provide an explicit link between the Workshop Data Analysis S1 unit of the Data Analysis Level 2 VSM to S4 of the Data Collection Level 2 VSM.

Finding: as in Project Teams A and B, a deficiency of the VSM identified is that, whilst communication channel B in Figure 13 of the VSM provides a link between

different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out.

7.4.5 VSM Level 2 – Findings

During the system identification phase of the VSD process, the third S1 unit of the system-in-focus was identified as:

- a system to **disseminate findings** that are suitable given the research objectives in a way that the academic community can understand

Findings were disseminated “*through [the] website, via an e-bulletin, through conference and other presentations*”⁵, through an academic “*paper*”⁷, as well as a “*final report*”⁷. As a result, the S1 units at this level of recursion were defined as Website, E-Bulletin, Journal Publications, Conference Papers, Presentations and Report. The remainder of S2-S5 were very similar to Project Teams A and B. The deadlines for many of these activities were provided in the project milestones document and enabled S2 and S3 to conduct their scheduling and monitoring processes. The project bid proposal provided the overall goals the findings needed to report on for S3 and S5.

7.4.6 Information Shared between Level 2 – Findings and Level 1 VSM

Information from the project bid proposal and project milestones documents developed at S3 of the Project Team Level 1 VSM was shared with S2, S3 and S5 of the Findings Level 2 VSM. Information on the objectives of the research (needed by S3 for ensuring findings being disseminated were meeting the objectives and by S5 to determine if a particular finding was relevant to be included) and the deadlines in the project (for S2 and S3 to coordinate and monitor progress) is information discussed in the above section that was used by this level of recursion from the project bid proposal and project milestones documents.

Finding: at the lower level of recursion, information from the project bid proposal and project milestones documents (such as research objectives, data collection

methods and deadlines) was shared between Project Team C and the lower recursion levels.

7.5 Summary

This chapter presented the findings from analysing Project Team C. Project Team C was described in terms of the VSM and it was identified that the VSM provided an adequate representation of this project team.

The chapter then went on to explore the first question posed in this research as to what information exists at level 1 of recursion. The chapter provided evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence to support the presence of manipulation of external environment (ID21) or the algedonic signal (ID38) at this level of recursion. In contrast to Project Team A, there were 23 information domains which were found to be different in the project team – which generally stemmed from problems with an initial weak S3 and particularly from a poor definition of expected performance of each primary activity (ID4). There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

The next section then moved on to the second and third questions posed in this research to identify what information is shared within the project team and whether the extended theoretical model presented in Table 5 and the communication channels in Figure 13 actually provided an adequate representation of this. The chapter provided evidence that supports much of the information that the revised theoretical model in Table 5 suggests is shared in viable systems at one level of recursion. However, there was no evidence of the algedonic signal (ID38) on communication channel M or information being shared across communication channel J to manipulate the external environment (ID21). There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the project team.

The following sections then looked at the recursion levels directly above and directly below the system-in-focus in order to analyse the project team in context. Each relevant

recursion level was described in terms of the VSM and was then explored in detail to identify the information that was shared between each level of recursion, in accordance with the fourth question posed in this research. At the higher level of recursion, the Funding Organisation was identified but not discussed as this has already been done in Section 6.3. University-specific codes of practice and standards, as well as operational information and information on project progress were shared between the University and Project Team C recursion levels. At the lower level of recursion, information from the project bid proposal and project milestones documents (such as research objectives, data collection methods and deadlines) was shared between Project Team C and the lower recursion levels.

In accordance with the fifth and final question posed in this research, as with Project Teams A and B, the analysis identified a deficiency in the ability of the VSM to accurately model the information sharing between recursions for this project team. The deficiency identified was that, whilst communication channel B in Figure 13 of the VSM provides a link between different S1 units of the same recursion, it does not provide a detailed structure for this information sharing to be carried out. This meant that it was not possible for the VSM to provide a detailed account of the communication process to describe how the Data Collection and Data Analysis S1 units at Level 2 were working together. The analysis also identified another deficiency in that, whilst communication channel C in Figure 13 of the VSM provides a link between S1 units and S2, it does not provide a detailed structure for this information sharing to be carried out. This meant that it was not possible for the VSM to provide a detailed account of the communication process to describe how the Project Team at Level 1 and the University at Level 0 were sharing information.

¹ Principal Investigator Interview 4

² New Co-Investigator Interview 4

³ Research Fellow Interview 1

⁴ Principal Investigator Interview 1

⁵ Project Website

⁶ Phase 1 Report document

⁷ Project Milestones document

⁸ Project Leaflet document

⁹ Co-Investigator Interview 1

¹⁰ Reflection Notes written on project team meeting 4

¹¹ Reflection Notes written on project team meeting 3

¹² Project Team Short Summary document

¹³ Project Team Meeting 4

-
- ¹⁴ Project Team Meeting 2
 - ¹⁵ New Co-Investigator Interview 3
 - ¹⁶ New Co-Investigator Interview 2
 - ¹⁷ Principal Investigator Interview 2

Chapter 8

Company A Analysis

8.0 Introduction

This chapter presents the findings from analysing Company A, following the same structure as Chapter 5. As discussed in Chapter 5, for reasons of brevity this chapter will present in less detail those findings that replicate ones made from analysing Project Team A. Instead, this chapter will give a much stronger focus on presenting areas where the analysis of Company A and Project Team A provided different results.

8.1 Company A and the VSM

This section begins by providing a short background introduction to Company A before describing the company in terms of the VSM. This section will then examine the fit between the VSM and the company to determine whether the VSM actually provided an adequate representation of this company, as discussed in Chapter 4.

8.1.1 Background Introduction

Company A was a design and printing company offering a complete range of print services including graphic design, production, storage and delivery. The company employed a total of 35 staff as described below:

- 1 Managing Director who was “*responsible for corporate strategy and marketing of the [company]*”¹
- 5 External Salespeople conduct selling activities on behalf of the company, acting as a “*single point of contact*”² for each customer

- 4 Internal Salespeople who were responsible for “*producing enquiries on the MIS [Management Information System]*”³ for “*costing and estimating*”⁴ work to generate quotes for the customer
- 1 Production Co-ordinator who “*co-ordinates all production control and administration matters at [the company]*”¹
- 3 Artwork Designers who are responsible for “*developing the actual artwork*”⁵ to be used in print jobs
- 3 Reprographics Designers who conduct “*all the pre-print work*”⁵ by taking the design and “*tweaking it so we can use it... and run[ning] it to plate [a stencil-type object used to guide inkflow in the production stage] which then goes out to the press*”⁶
- 1 Design Studio Director who is “*part of the senior management team heading up the pre-press side of the business, which is the studio [and] the reprographics department*”⁵
- 1 Accountant who would “*do the accounts from start to finish*”⁷
- 1 Production Manager with “*overall responsibility for all production*”⁸
- 7 Print Operatives who would operate the presses to produce the printwork
- 5 Finishing Operatives who would take the printwork and apply any finishing to the job, such as folding or fastening pages together
- 3 Distribution Workers who would despatch printwork to customers

At the time of data collection, Company A was growing quickly through expanding its production capacity and the Managing Director was in the process of “*looking at a business at the moment to acquire*”⁹. This had led to the company turning around its performance substantially from making a loss in 2006 to making a predicted profit of around £160,000 by the end of 2008. During the data collection period, the Managing Director felt the organisation was competing in a saturated market where they were experiencing pressure on their prices and, as a result, their profit margins. Due to this, the company were looking for ways to operate more effectively and efficiently.

8.1.2 VSM Level 1

This section will present Company A in terms of the VSM before moving on to a discussion to determine whether the VSM actually provided an adequate representation of this company, as discussed in Chapter 4.

As described in Chapter 4, the VSD process was used to generate the VSM for Company A. During the system identification phase of the VSD process the system was identified as:

- a system to **provide print solutions** to customers

The system to achieve the purpose of providing print solutions was the company and, as a result, the company system is the system-in-focus for this case study. The remaining steps of the VSD process were then undertaken for this level of recursion, generating the components of the VSM which will now be described.

- S1 units are the activities that the company must carry out to achieve its purpose. The company defined their purpose as a “*supplier of design, print and associated services*”⁸. Customers were “*predominately... print customers*”⁵ who would “*supply their artwork on disk*”⁵ which the company would then print on their presses. The company also had a design studio where the Design Artists would create artwork for clients as Company A “*also have a reasonable pot of [customers] who are actually coming to us for the origination, for the artwork as well as the print*”⁵. In terms of associated services, the company had a small number of customers that they provided with “*technical support, consultancy, large format graphics, print management or general facilities management*”² and also provided some “*training to individual staff members or groups*”² in organisations. Therefore, in order for the company system to achieve its purpose of providing print solutions, it needed to undertake three main activities: design, print production and associated services and it is these activities that make up the S1 units of the Level 1 VSM.
- S2 dampens oscillations between the S1 units and co-ordinates them to achieve synergy. The Associated Services S1 unit had very little dependency upon the other S1 activities and so S2 did not play any significant role for it. However, there was a particularly high level of dependency between the Design and Print Production S1

units, as the designs that were created by Company A were used for the printwork. This dependency meant that it was important that S2 performed its anti-oscillatory function to ensure the finalised artwork was received by the Print Production S1 unit. This anti-oscillatory function took the form of *“production planning is conducted upon a day to day basis, making certain that all orders received for design/printing are placed into the system correctly to ensure that the customer’s delivery requirements are met”*¹⁰. This role was carried out by the Production Co-ordinator who, upon receipt of an order, would *“book them in, get delivery dates, take them down into either the [Print Production] department if they’ve supplied a disk or down into the [Design] studio if they need artwork”*¹¹. This booking is then used to schedule the Design S1 unit to ensure that it provides the work to the Print Production S1 unit on time, as *“the documentation that’s supplied with it has got all the deadlines for when the proof is required for, etc. – so basically that’s [the Design] running sheet then”*⁵. The Production Co-ordinator would then ensure the Production Manager got *“a copy of [the order] and he’ll put it on to his schedule so I make sure he’s got that... also I keep a schedule for [a Distribution Worker] and every job is added on to that schedule of the delivery day, so every day he’ll get a printout of that so he can just look at that... so he knows exactly what he’s got going out because sometimes jobs don’t come through do they and if he hasn’t got them or any knowledge of them, he won’t know they’ve got to go out, so I make sure that’s updated”*¹¹.

- S3 is responsible for monitoring and controlling the S1 units. The Managing Director took a very hands-on role in monitoring the Design and Print Production S1 activities. The Managing Director said that they liked to walk around the factory often to ask people what they were doing and where they had been, etc.¹² The Managing Director said that *“people who work hard have no problem with it... [whilst] people who don’t work hard will try to avoid me”*¹². In one example, the Managing Director walked around the factory and had a discussion with an employee about a job and found out that he was just about to print the job on to the wrong type of paper¹³. The Managing Director was also keen to use these walks around the factory to monitor that staff were working effectively and, in one example, said he noticed that one employee had been on a personal telephone call for a *“long time”*¹² and that he was going to talk to the employee about it later on that day¹². In another example, the Managing Director walked around the factory and noticed some staff were absent, at which point he asked colleagues where these staff members were¹². The Production Co-ordinator also played

an active role in S3 activities in terms of checking the schedules to ensure jobs were being delivered on time, *“I check them off against my delivery schedule, if there are any there that haven’t been delivered and I’ve still got them on schedule... then I’ll go and question them with [the Distribution Workers] – why haven’t they gone out?”*¹¹. The Accountant also produced *“management accounts at the end of the month”*⁷ each month to monitor the financial performance of the company.

- S3* conducts audits for S3. If a customer complained about a job, the Production Coordinator would conduct an audit of what happened, *“if a customer’s got a problem with a job, they’ll ring through [and] speak to me, I’ll go down and find out what’s happening with it or why it’s gone wrong”*¹¹. Staff skills were also sometimes audited at the company and *“staff training [was] recommended by managers and undertaken as required”*². An example of training needs being identified and training then being undertaken was that one of the External Salespeople had been given some time off work to undertake some managerial training¹⁴.
- S4 is responsible for seeking out potential future directions for the system. This activity can be broken down into two particular activities for Company A – sales and strategy. In terms of sales, the External Salespeople were responsible for generating sales through existing clients by *“try[ing] and develop[ing] them, look[ing] at a client and what we do for them at the moment, look[ing] at what we can offer them now that we couldn’t before and then try[ing] and get[ing] the client aware of that”*¹⁵. External Salespeople would also attempt *“making new contacts – cold calls”*¹⁶. The Managing Director was also involved in generating new business from larger organisations and *“does 70-80% of the presentations on the bigger companies that we’re going out to”*¹⁷. In terms of strategy, the Managing Director was responsible and was always looking to *“implement the things so that we just continuously improve”*⁹. An example of the Managing Director carrying out S4 activities was him seeking to acquire the business previously mentioned in Section 8.1.1.
- S5 carried out the overall decision making processes of the company. The Company Profile document states that *“strategic and major operational matters are dealt with through monthly board meetings, with decisions/policy being communicated via managers into the business”*². However, overall the data showed that the Managing Director was responsible for S5 activities. The other senior staff in their interviews

showed that they really only concentrated on the day-to-day issues of running their departments. The Managing Director said that “*we have done quite a lot of things [in the past year] – it is all totally driven by me*”¹⁴ and he felt that other “*people here struggle to take on management responsibilities*”¹⁴.

8.1.3 VSM Level 1 – Model Suitability

As described above, the company undertook three main activities – design, print production and associated services. It co-ordinated these activities in the manner described by S2 and carried out monitoring and controlling on the three main activities as described in S3. The activity of seeking out potential future directions for the system is described in S4. S5 described the Managing Director’s role in handling necessary decisions for the company. There were no other processes described in the data that the VSM failed to model for this level of recursion.

8.2 Information within Company A

This section will explore the first three research questions concerning the information generated and shared at level 1 recursion in Company A.

8.2.1 Information Present/Not Present at Level 1

This section presents the evidence for information present in the company VSM at level 1 recursion in accordance with the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information present in the company at this level of recursion that does not fit into the extended theoretical model.

There were 28 information domains which were found to be very similar to Project Team A. External environment information (ID1 in Table 5) was generated by customers of the company through them generating artwork themselves or at least generating some of the images to be used in the design. An example of this was a job done for a customer requiring a food preparation leaflet to be designed, who “*will take all the photographs*”¹⁷

and then provide them to the Artwork Designers. The organisational goals (ID3) were “*to help buyers solve their print and print related problems by contracting with us as a single supplier of design, print, print management and associated services*”². The monitoring and control practices by S3 (ID5) were described in Section 8.1.2. One goal and performance misalignment (ID6) that sometimes occurs is if S1 fails to manage the design or development process properly leading to printwork being incorrect. A cause of this (ID7) was described when the customer makes corrections to a proof of a design and the Design Artists “*didn’t do as [they] were asked, [they] didn’t change this on the proof*”¹⁸, leading to an incorrect version of the artwork being sent through to production. The consequences (ID7) “*when a mistake does happen, it’s normally costly*”¹⁷ as the actions (ID8 and ID9) “*involve reprinting the job*”¹⁸ because “*it’s no good to anybody else, if you put a hole in the wrong place in a lump of metal you can recycle that metal, put it wrong with 10,000 letterheads, it’s not much use to anybody else is it – that’s the problem*”¹⁷. In terms of the algedonic signal (ID38), External Salesperson 2 stated that if problems did arise it was important to be “*making yourself known to the heads of the departments and making them aware of any possible problems that might be coming along with a certain job*”¹⁶. Audits (ID28) were also conducted as described in Section 8.1.2.

The interdependencies between S1 activities (ID12) and anti-oscillatory measures (ID11) have already been discussed in Section 8.1.2. The data provided no evidence to support any oscillation (ID13-14 and ID16-18) but the norms for admitted performance loss due to oscillation (ID15) were minimal as “*the nature of our business these days is getting very much on demand print, where [customers] leave such a small lead time to get the job produced*”¹⁵ that there is not any room for delays in scheduling.

The S1 activities needed two key resources (ID19) – personnel with sufficient time to do the work and money to purchase the raw materials used in the printwork. The time needed to carry out the work was negotiated and allocated (ID20) prior to the company accepting the order (an S3/S4 process described below). The financial resources were allocated (ID20) by the Accountant who “*maintains a regularly updated Schedule of Approved Suppliers in the Sage computer system... all suppliers are chosen [from the] approved schedule*”¹⁰. Financial resources to fulfil orders were not tightly controlled at this level of recursion and purchases did not need to be signed off or checked prior to being made, with staff members having their “*own purchase order book... once [the Accountant] gets the invoices she comes down and takes the relevant page from the purchase order book*”¹⁹.

There were two types of activity S4 was responsible for as described in Section 8.1.2 – sales and strategy. In terms of sales, developments in the relevant environment of the company (ID32) were customers generating a potential need to have design or printwork carried out for them. This need was communicated through the methods discussed in Section 8.2.2 below and considered (ID22). When such a potential is communicated, S3 and S4 had to work out whether to try to take the work on (ID23-27, ID29, ID31 and ID33-36) and External Salespeople would fill out a Job Information Sheet detailing all the requirements of a job²⁰. For larger jobs, External Salesperson 3 described the process as “we sit down with [the Managing Director] and turn around and say “are these people too big for us? Are these people the right size for us?”, we look at it, program it and ... “are we good for them?”, when we’ve approached them, we know they’ll be good for us, can we offer what they’re looking for?”¹⁷. For smaller jobs, the Managing Director did not get involved but External Salespeople would still discuss the job with other departments to ensure the necessary personnel had sufficient time available to conduct the work and then also discuss it with Internal Salespeople to determine if the job was financially viable, “obviously the [External Salespeople] all want to win as much [work] as they can but [Internal Salespeople’s] job is to try and get as much as we can for a job... there’s no point in having a lot of work going through the machinery and the company if you’re not making profit”³. In both larger and smaller jobs the finalised plans for adaptation of organisational goals (ID30) would be in the form of a quote which, if accepted by the customer, would lead to the scheduling activities occurring as described in Section 8.1.2. In terms of strategy, developments may include industrial changes in the form of merger and acquisition opportunities or new technological advances. The Managing Director was responsible for this as described in Section 8.1.2.

There were 5 information domains which were found to be different to Project Team A. The goals set by, performance and modus operandi of the primary activities in S1 (ID2) were different in two respects. As shown in the project teams analyses, the goals for the S1 activities in the project teams were very precise and had clear performance indicators associated with them. At the company level of recursion in Company A, the precise goals for each S1 activity were very much dependant upon the customer requirements of each job but the more general expected performance of each primary activity (ID4) were “efficient delivery of the goods and services offered”¹⁰, “effective communication with customers”¹⁰ and “proper management of any design or development processes”¹⁰.

However, the real (ID2) difference was that the *modus operandi* was much more formalised and rigid for Company A than in any of the project teams, with procedures for S1 fully documented by the company¹⁰. These documents held cultural knowledge (ID37) for the company too, which was again significantly different from the project teams. The culture was much more bureaucratic at this level of recursion than the project teams were, with the company providing staff with a Company Manual detailing how the company worked and how they were expected to work within the company⁸. Furthermore, “*process controls [that] are written as procedures for the organisation forming formal standards requiring achievement during the production and design process*”¹⁰ were “*made available for all staff*”¹⁰. The company also supplied a document to External Salespeople outlining how to sell in the form of an “*easy reference guide when talking to customers about what we are and what we can offer*”²¹. External Salesperson 4 commented that “*the turnover of staff is very low... some of them have been working at [Company A] and even [at the] company it was before for a long time together*”¹⁸. This led to an ingrained culture at the company which caused the Managing Director to feel that staff were stuck in their ways and unreceptive to change, saying “*if I put another 50% of my effort into actually trying to improve what I have got here, I might improve it by 5% so I turnaround and think “why do I bother?”*”. *What I want to see here is aspiring people moving forward*”¹⁴.

There was a substantially higher level of operational information (ID10) generated in Company A than in the project teams. One type of operational information that the company kept was “*all the jobs [and] all the quotes are all on the [computer] system and there are various methods and ways of finding them... [and] we’ve got a hard copy that goes in the filing cabinet in alphabetical order*”³ so “*you’ve got a papertrail to backtrack everytime*”³. This was important for the company as there was a significant “*amount of jobs that go through a [customer] and some of them are very similar*”¹⁶ and by keeping previous quotes and job details it meant that the company could look up and find the relevant information to redo jobs more quickly than having to get that information again from scratch. This operational information also enabled Internal Salespeople to “*know what the price was last time [the job was done and] they can match it up, whereas the danger is if they can’t do that they could put a cheaper price in... you [need to] try and keep [the price for customers] consistent*”¹⁶. Other operational information (ID10) in Company A included “*a preferred supplier list*”¹⁶, “*previous management review records*”¹⁰, “*quality audit reports*”¹⁰, “*staff suggestions*”¹⁰, “*staff training records*”¹⁰, “*non-*

conformance records”¹⁰, “*customer satisfaction records*”¹⁰ and “*equipment maintenance records*”¹⁰.

In contrast to the project teams, Company A was also very involved in manipulation of external environment (ID21) activities to increase sales. External Salesperson 1 described one such attempt in that “*not all the printers [a customer does] deal with have got [a certain environmental] certification, so it’s something that gives us an edge against the other printers and I want to get [the customer] environmentally aware and I’m trying to get them to think more of using the [environmentally certified] logo and [environmentally certified] papers... so if I can get them to approve the artwork with the logo on, that gives us an edge that it’s got to come to us rather than one of the other printers*”¹⁵.

***Finding:* the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of oscillation at this level of recursion. This meant that in terms of the comparison between Table 5 and the information present at this level of recursion, there was no evidence to support information being present about ID13-14 and ID16-18. There were also 5 information domains which were found to be different to Project Team A. There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the organisation.**

8.2.2 Information Shared/Not Shared at Level 1

This section presents the evidence for information shared within the company VSM at level 1 recursion in relation to the extended theoretical model presented in Table 5. Once this evidence has been presented, this section looks at the information shared within the company at this level of recursion that does not fit into the extended theoretical model.

The communication channels discussed in Chapter 3 that supported information sharing at this level of recursion are provided in Figure 21 of the Company A VSM, which has been adapted from the generic VSM diagram of communication channels presented in Figure 13. The greyed out communication channels are not explored at this level of recursion as

they represent communication channels at a lower level of recursion which are examined in Section 8.4.

Company A VSM and Communication Channels

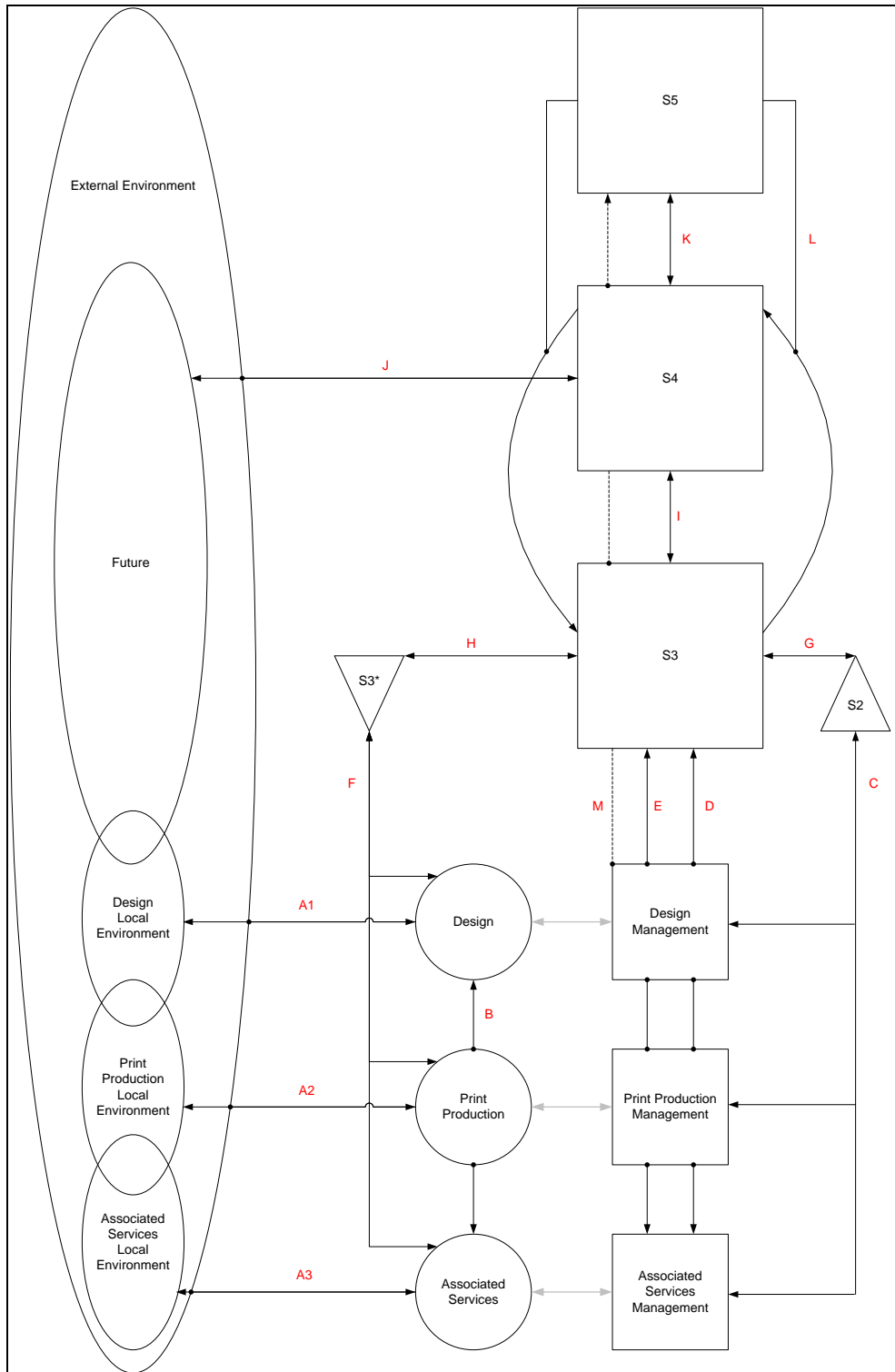


Figure 21

Design requirements, production requirements and associated service requirements would be discussed between each S1 unit and the external environment (ID1) across communication channel A1-3 respectively. For simple design work, such as letterheads, design discussions took place between the salespeople and the customer when the work is quoted for but for more detailed design work “customers either come in [to the design studio] or occasionally we’ll go out and see [them]”²² and discuss their design requirements with the Artwork Designers. Proofs of the artwork also had to be sent between the Design S1 unit and customers to ensure the design was right, “some people still like to see a hard copy, some people are quite happy to see a pdf emailed out to them”⁵ and then “it’s normally backwards and forwards until they’re happy with the end product”²² at which point “once it’s approved, we make sure we get a sign off from the customer, either it be an email or whether its a proof form that’s been signed off”²². The Print Production S1 unit would communicate with customers, “if a customer has requested a delivery date then I’ll get that off [the Production Manager], once it’s in the schedule I’ll go back to the customer with that delivery date”¹¹ and would also communicate with suppliers to outsource jobs to do work the company could not do, for example “if there’s cut outs on the job, where the job has got to be sent to a finishing house to be cut and creased”¹⁷. The Associated Services S1 unit would also communicate with the external environment, for example as part of consultancy for one advertising agency, External Salesperson 3 would go to the agency’s clients and discuss the print options on behalf of the advertising agency, as “it’s much better if I go with them sometimes... I may be in a poistion to know more about print and say [to the agency’s customer] “no you don’t want it like that””. In terms of S1 unit to S1 unit information sharing, the interdependences between the three S1 units have already been considered in detail in Section 8.1.2 and so the Print Production S1 unit needed the design created from the Design S1 unit across communication channel B in order to print it. This information was shared electronically from Design to Print Production through “a server... called Volume 1 – it’s just like a big hard drive really”²² and the Design Artists “put [the electronic design file] on Volume 1... and then tell [the reprographics staff] where it is [on] Volume 1... and then they take it from there”²².

The goals set by, performance and modus operandi of the primary activities in S1 (ID2) were shared between the S1 units and S2 across communication channel C in the form of production planning meetings as discussed in Section 8.1.2, which enabled S2 to ensure the schedule of activity was being followed and determine if there was any oscillation. The

goals set by, performance and modus operandi of the primary activities in S1 were shared between the S1 units and S3 across communication channel D which enabled S3 to carry out the monitoring and control practices (ID5) using the expected performance of each primary activity (ID4) as discussed in Sections 8.1.2 and 8.2.1. One goal and performance misalignment (ID6) shared across communication channel D was identified in Section 8.2.1 in terms of printwork being incorrect because Design Artists failed to make corrections to a proof of a design before sending it through to Print Production. Misalignments such as this would be verbally discussed between the Production Manager and the Production Co-ordinator, who would “*go down [to Print Production] and find out what’s happening with it or why it’s gone wrong*”¹¹. In terms of sharing the goals set by, performance and modus operandi of the primary activities in S1 with S4, this did not need to be shared explicitly as the Managing Director was extremely knowledgeable about what the company was doing from his walks around the factory, as discussed in Section 8.1.2. However, this information was used to inform decisions by S3 about innovation proposals, as discussed in Section 8.2.1. Organisational goals (ID3) were also not explicitly shared with S4 as the Managing Director, who decided these at S5, was the person responsible for determining if innovation proposals were relevant – such as whether any potential “*diversification of services*”²³ fitted in with the overall organisation goals to ensure they were “*bringing the right things into the pot*”²³.

The operational information (ID10) described in Section 8.2.1 was sometimes requested and shared across communication channel C to enable the Print Production or Design S1 units to redo repeat jobs quickly. This operational information was held by the Internal Salespeople in the computer system and a filing cabinet and could be given in response to verbal requests for it from either the Production Manager or Artwork Designers. The preferred supplier list could also be accessed by the S1 units through the “*Sage computer system*”¹⁰.

As discussed in Section 8.2.1, job time constraints often meant there was not any room for delays in scheduling and so oscillation needed to be kept to a minimum (ID15). The anti-oscillatory measures (ID11) discussed in Section 8.1.2 show face-to-face communication occurred between the Production Co-ordinator at S2 and the S1 units via communication channel C.

As identified in Section 8.2.1, the S1 activities needed two key resources (ID19) – money and personnel with sufficient time. As highlighted in Section 8.2.1, the financial resources were not tightly controlled at this level of recursion with staff members using their “*own purchase order book*”¹⁹ that did not need to be signed off or checked prior to purchasing resources. This meant that communication channel E was not used at this level of recursion for this type of resource allocation. Personnel resource allocation also happened at a lower level of recursion (described in Section 8.4) in response to the S3/S4 process described below of determining if the personnel resources were available to carry out work (ID20). As described in Section 8.1.2, audits (ID28) in response to customer complaints were carried out by the Production Co-ordinator who would verbally discuss the complaint with the necessary staff member(s). In terms of the algedonic signal (ID38), as described in Section 8.2.1 staff members would make problems known to heads of departments. This information tended to be shared face-to-face, given that the office and factory were joined together and quite small, which enabled this to be done easily. For example, External Salesperson 5 said “*we sit in an open plan office that we sit together [in] and we’re chatting throughout the day about various issues and various matters that arise*”²⁴.

As discussed in Section 8.2.1, the proposals for innovation made by S4 (ID22) came in two forms – sales and strategy. In terms of sales, communication channel J was used to pick up developments in the relevant environment of the organisation through customers contacting the company directly or through External Salespeople making “*cold calls*”¹⁶ to customers. Customers would contact the company directly through “*you might get an email*”²⁴ or “*you might get a telephone call*”²⁴ to discuss their requirements with External Salespeople for new work. For cold calling, Company A were “*going on a bit of a campaign on new business and ways we’re going to do that [are] we’re going to start cold calling, we’re going to do it through actually physically knocking on the door, sending mailers out and looking at databases*”²⁴. External Salesperson 1 commented on the knocking on the door strategy as “*if I’m driving past somewhere and I think “oh, I’ve never called in there”, I will call in and leave a card and try and get somebody’s name to approach*”¹⁵ and External Salesperson 4 stated that “*you look in the newspapers or the yellow pages or the internet [or] just word of mouth, if somebody says “go and have a chat with them or give them a ring” then obviously it saves alot of the hard work*”¹⁸. The External Salespeople would also go to their current customers’ offices sometimes to “*pop round and see people, perhaps have a cup of tea with them and say “oh, what have you got coming up?”*”¹⁶. As discussed in Section 8.2.1, reviews by S3 of proposals for innovation

(ID29) occur for larger jobs by the External Salespeople holding meetings (ID31) with the Managing Director to determine if a job is financially viable. For smaller jobs, External Salespeople discussed (ID31) the job with other departments to ensure the necessary personnel had sufficient time available to conduct the work and also discussed (ID31) it with Internal Salespeople to determine if the job was financially viable. The finalised plans for adaptation of organisational goals (ID30) would be in the form of a quote which would be sent through communication channel J via “*if they’re big jobs... sometimes they’ll want hard copy quotes but 9 times out of 10 we email or fax [quotes] back*”¹⁵. In terms of strategy, developments may include industrial changes (from VSM recursion level 0 – discussed in Section 8.3) in the form of merger and acquisition opportunities or new technological advances. The Managing Director was responsible for identifying these as described in Section 8.1.2.

Company A also engaged in manipulation of external environment (ID21) activities to increase sales through communication channel J, as described in Section 8.2.1. External Salesperson 1 built on the description given in Section 8.1.2 by saying “*I try and pick two or three [clients] a week, where I try and develop them... [I] look at what we can offer them now what we couldn’t before and then try and get the client aware of that and thinking down those lines. Then every so often go back to the client and chase them up and say “have you had any thoughts on it, is it something we can take forward?” and that’s the way you grow the business really – keep going back to people and drum it into them that we can do more for them*”¹⁵.

Cultural knowledge (ID37) was found to be present within each of S1-S5. The culture within the company was quite bureaucratic and staff tended to focus on current work and seemed not really interested in any new developments. For example, at S1 and S2 documents^{8,10} detailed how everything worked and there was little need for deviation from these practices as there was no real variety in the type of work received. Much of this cultural knowledge was shared across the entire VSM for Company A through these documented policies and procedures. As described in Section 8.2.1, the low staff-turnover also contributed to the culture with the Managing Director feeling that staff were stuck in their ways and unreceptive to change, leading to potential S3/S4 innovations having a lower chance of success.

Finding: the preceding discussion provides evidence that supports much of the information that the revised theoretical model in Table 5 suggests is shared in viable systems at one level of recursion. However, as stated in Section 8.2.1 there was no evidence that supported the presence of oscillation at this level of recursion and, therefore, the sharing of information on oscillation (ID16) was not able to be observed. There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the company.

Finding: Table 14 shows how the extended theoretical model relates to the final version of the coding scheme developed for level 1 recursion in Company A. Table 14 shows in black where the information domains from the extended theoretical model matched those found through coding the data and the information domains that did not match the coding of the data are shown in grey. There was no evidence of any other failure of the extended theoretical model to match the data coding for this level of recursion:

Coding Scheme for Company A Recursion Level 1

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
1	External environment information	G, A	A				A	
2	Goals set by, performance and modus operandi of the primary activities in S1		G, A	A	A	A	A	
3	Organisational goals		A		A		A	G, A
4	Expected performance of the primary activity (goals for S1 activity)		A		G, A			
5	Monitoring and control practices by S3		A		G, A			
6	Goal and performance misalignment		A		G, A			
7	Causes and consequences of goal and performance misalignment		G, A		G, A			
8	Actions to counter goal and performance misalignment by S1		G, A					
9	Heuristics to implement counteractions		G, A					
10	Operational information		A	G, A				
11	Anti-oscillatory measures		A	G, A				
12	Interdependencies between S1 activities			G, A				
13	Actual oscillations			G, A				
14	Actual performance loss due to oscillations			G, A				
15	Norms for admitted performance loss due to oscillations (goals for S2)			A	G, A			
16	Gap between norm for admitted and actual performance loss due to oscillations			A	G, A			
17	Causes of the gap between admitted and actual performance loss due to oscillations			G, A				
18	Experiences with anti-oscillatory measures			G, A				
19	Problems and needs of the management of S1 activities		G, A		G, A			
20	Resource allocation		A	G, A	G, A			
21	Manipulation of external environment	A					G, A	
22	Proposals for innovation made by S4				A		G, A	A
23	Desired goals for S1 based on proposals for innovation				G, A			
24	Gap between desired and current goals of S1				G, A			
25	Required capacity for reorganisation of S1 activities				G, A			
26	Actual capacity for reorganisation of S1 activities				G, A			
27	Gap between required and actual capacity for reorganisation of S1 activities				G, A			
28	Auditing				A	G, A		
29	Reviews by S3 of proposals for innovation				G, A		A	A
30	Finalised plans for adaptation of organisational goals (a joint S3 and S4 product)				G, A		G, A	A
31	Regulatory measures to counter the imbalance between S3 and S4				A		A	G, A
32	Developments in the relevant environment of the organisation						G, A	
33	Norms for balance between S3 and S4							G, A
34	Actual imbalance between S3 and S4							G, A
35	Causes of imbalance between S3 and S4							G, A
36	Experiences with regulatory measures to counter the imbalance between S3 and S4							G, A
37	Cultural knowledge	A	A	A	A	A	A	G, A
38	Algedonic signal	G, A	G, A	G, A	G, A	G, A	G, A	A

Table 14

8.3 Higher Recursion Level

Following the same format as in Chapter 5, this section will describe the higher recursion level model that was identified to be relevant to the system-in-focus when conducting the VSD process. The information that is shared from/to this model will be detailed, in accordance with the fourth and fifth research questions.

8.3.1 VSM Level 0 – Print Industry

During the system identification phase of the VSD process, the system-in-focus was identified to be embedded within one relevant higher-level system. This system is relevant as it puts into context where the company sat within its industry. It was necessary to model this system too because, as was shown in the Level 1 VSM, the industry played a significant role in shaping the future activities of the company.

This system was identified as:

- a system to **produce printwork** that addresses the needs of organisations

The system to achieve the purpose of producing printwork was the print industry and, as a result, this print industry system is at Level 0 for this case study.

The Managing Director said that there were “*11,500 print companies in the UK*”¹⁴. Company A was one of these such print organisation S1 units in this system. S2 contains documents detailing formal regulations and criteria for achieving certain standards and accreditations in the industry. There is not any formal S2 information co-ordination that goes on between organisations due to each organisation being independent, although some communication may occur if print organisations outsource jobs to each other. With each S1 unit being independent, there are few monitoring and control activities at S3. Those that do exist include industry standards and accreditation monitoring, as well as the normal accountancy and legal obligations of organisations in the UK. At S4, developments in print technology may occur. There is no overall S5 that makes decisions for the industry as a whole.

8.3.2 Information Shared between Level 0 – Print Industry and Level 1 VSM

Due to the company being “ISO9001:2000 accredited and ISO14001, ISO12647 registered”¹ and “FSC and PEFC Chain of Custody certified”² the company was bound to the regulations and criteria these standards entailed. As described in Section 8.1.2, the Managing Director found out that an employee was just about to print a job on to a type of non-environmentally friendly paper¹³. Due to this job needing to be printed on environmentally approved paper, the Managing Director claimed that had this job been printed on the wrong paper it could have cost the company their FSC accreditation¹³. This information was therefore present at S2 of the Company A Level 1 VSM having come from S2 of the Industry Level 0 VSM. At S4, developments in the industry were also monitored by S4 of the Company A Level 1 VSM, such as the merger and acquisition opportunities described in Section 8.1.1.

***Finding:* formal regulations and criteria for achieving certain standards and accreditations in the industry and developments in the industry were shared between the Print Industry and Company A recursion levels.**

8.4 Lower Recursion Level

Following the same format as in Chapter 5, this section will describe the three lower recursion level models that were identified to be relevant to the system-in-focus when conducting the VSD process. The information that is shared from/to these models will be detailed, in accordance with the fourth and fifth research questions.

8.4.1 VSM Level 2 – Design

During the system identification phase of the VSD process, three S1 units of the system-in-focus were identified. The first of these systems was identified as:

- a system to **produce the artwork design** to be used in printwork for customers

As discussed in Section 8.1.1, there were 3 Artwork Designers who were responsible for “developing the actual artwork”²⁵ to be used in print jobs and each of these Artwork Designers made up an S1 unit at this level of recursion. At S2, delegation of work was undertaken by the Design Studio Director who “once [a job]’s all been quoted for and the costs have been accepted that then will come down to me and then I delegate it to whichever person in the studio is actually going to undertake that particular piece of work”⁵. As with Project Team A, the Design Studio Director based delegation of work on their knowledge of staff member skills, “all the people down in the studio, even though they’re all producing artwork to a very, very good standard, some people have got things that they’re particularly good at – so if it was a multiple page brochure or a newsletter or something like that, I know straight away, immediately, who I’d give that to. If on the other hand it was a bit of corporate identity, rebranding, logo design I know who that would go to, so it’s just people’s different skillsets and knowing how to get the best out of those individuals”⁵. Once this work had been allocated to a Design Artist they received the Job Information Sheet and quote, “obviously the documentation that’s supplied with it has got all the deadlines when the proof’s required for, etc. – so basically that’s their running sheet then”⁵. At S3, this schedule of activity was monitored by the Design Studio Director and “if, however, there’s an issue and that deadline can’t be met then [the Design Artist]’ll come back to me and then I can speak to the specific sales rep or direct to the client regarding timescales if we need to”⁵. Design Artists also sent proofs out to customers, as described in Section 8.2.2, to ensure that the artwork produced met the customer requirements. S4 would then receive any alterations requested by the customer to the proof, which would then be carried out and another proof sent and then the process was described as “it’s normally backwards and forwards until they’re happy with the end product”²². S5 activities were handled by the Design Studio Director who was “part of the senior management team heading up the pre-press side of the business”⁵.

8.4.2 Information Shared between Level 2 – Design and Level 1 VSM

Information from the quote and Job Information Sheet documents developed at S3/S4 of the Company A Level 1 VSM was shared with S1 units, S2 and S3 of the Design Level 2 VSM. Information on the job requirements (for the S1 units) and the schedule (for S2 co-ordination and S3 monitoring) is information discussed in the above section that was used by this level of recursion from the quote and Job Information Sheet documents.

S2 at this level of recursion also shared operational information with S2 of the Company A Level 1 VSM, for example the “*preferred supplier list*”¹⁶ described in Section 8.2.1 was used for Artwork Designers to make purchases. S2 at this level of recursion also held “*equipment maintenance records... in the computer system*”¹⁰ that formed part of the maintenance records at S2 of the Company A Level 1 VSM, discussed in Section 8.2.1. Therefore, operational information (preferred supplier lists and maintenance information) was shared between S2 at this level of recursion and S2 of the Company A Level 1 VSM.

8.4.3 VSM Level 2 – Print Production

During the system identification phase of the VSD process, the second S1 unit of the system-in-focus was identified as:

- a system to **produce the printwork** for customers

There were three S1 units identified for Print Production at this level of recursion – Reprographics, Printing and Finishing. Reprographics use the artwork received to generate a “*plate [a stencil-type object used to guide inkflow in the production stage] which then goes out to the press*”⁶, Printing use the presses to print the artwork and Finishing take the printwork and apply any finishing to the job, such as folding or fastening pages together prior to despatching it to the customer. At S2, the Production Co-ordinator was responsible for scheduling in Reprographics and would bring the quote and Job Information Sheet documents to the Reprographics Studio and “*puts it in our in-tray and then we work through the job’s in the order they come in – there’s three of us in the room so as soon as one person finishes a job [they] pick up the next one*”⁶. The Production Manager was responsible for scheduling in Printing and Finishing. The quote and Job Information Sheet documents would provide the scheduling information and the Production Manager would input this into tables in Microsoft Word on his computer to schedule jobs, deleting jobs that had been completed from these tables¹³. However, the Managing Director felt that this scheduling system was not ideal because the production schedule had to be “*laboriously typed in*”¹⁴, so the Production Manager did not always do so and instead “*keeps far too much [scheduling] information in his head*”¹⁴. At S3, the Production Manager would be shown jobs by the staff as they were being produced to check them and he would also

supply any resources that were needed by staff, for example at one point during a meeting, the Production Manager left to get some paper/ink for an employee¹³. At S4, the Production Manager was “*responsible for technical development and, evaluation and introduction of new processes and techniques*”⁸. S5 activities were handled by the Production Manager who had “*overall responsibility for all production*”⁸.

8.4.4 Information Shared between Level 2 – Print Production and Level 1 VSM

Information from the quote and Job Information Sheet documents developed at S3/S4 of the Company A Level 1 VSM was shared with S1 units, S2 and S3 of the Print Production Level 2 VSM. Information on the job requirements (for the S1 units) and the schedule (for S2 co-ordination and S3 monitoring) is information discussed in the above section that was used by this level of recursion from the quote and Job Information Sheet documents.

S2 at this level of recursion also shared operational information with S2 of the Company A Level 1 VSM, for example the “*preferred supplier list*”¹⁶ described in Section 8.2.1 was used by the Production Manager to purchase raw materials. S2 at this level of recursion also held “*records [that] are retained for each machine*”¹⁰ of “*periodic maintenance appropriate to the level of use and in line with manufacturer’s guidelines*”¹⁰ that formed part of the maintenance records at S2 of the Company A Level 1 VSM, discussed in Section 8.2.1. Therefore, operational information (preferred supplier lists and maintenance information) was shared between S2 at this level of recursion and S2 of the Company A Level 1 VSM.

8.4.5 VSM Level 2 – Associated Services

During the system identification phase of the VSD process, the third S1 unit of the system-in-focus was identified as:

- a system to **deliver associated services** to customers

As described in Section 8.1.2, the company had a small number of customers that they provided with “*technical support, consultancy, large format graphics, print management*

or general facilities management”² and also provided some “*training to individual staff members or groups*”². As such, each of these services formed an S1 unit at this level of recursion. The S1 units had little co-ordination or monitoring and control as they were done on an ad-hoc basis, with relevant staff members only becoming involved if the specific job required their input. Each staff member would become responsible for each of their own projects at the next lower level of recursion. For example, External Salesperson 3 was solely responsible for providing a print management service to a customer.

8.4.6 Information Shared between Level 2 – Associated Services and Level 1 VSM

Given the ad-hoc nature of the associated services and the fact that the company only supplied a small number of customers with these services, there was insufficient evidence in the data collected to determine the nature of information shared between the Company A Level 1 VSM and the Associated Services Level 2 VSM.

Finding: at the lower level of recursion, information from the quote and Job Information Sheet documents (such as job requirements and deadlines) and operational information (such as preferred supplier lists and maintenance information) was shared between Company A and the lower recursion levels.

8.5 Summary

This chapter presented the findings from analysing Company A. Company A was described in terms of the VSM and it was identified that the VSM provided an adequate representation of this company.

The chapter then went on to explore the first question posed in this research as to what information exists at level 1 of recursion. The chapter provided evidence that supports much of the information that the revised theoretical model in Table 5 suggests is present in viable systems. However, there was no evidence that supported the presence of oscillation at this level of recursion. This meant that in terms of the comparison between Table 5 and the information present at this level of recursion, there was no evidence to support information being present about ID13-14 and ID16-18. There were also 5 information

domains which were found to be different to Project Team A. There was also no evidence of any other types of information being present at this level of recursion that are not present in Table 5 that contributed to the viability of the company.

The next section then moved on to the second and third questions posed in this research to identify what information is shared within the company and whether the extended theoretical model presented in Table 5 and the communication channels in Figure 13 actually provided an adequate representation of this. The chapter provided evidence that supports much of the information that the revised theoretical model in Table 5 suggests is shared in viable systems at one level of recursion. However, as mentioned above, there was no evidence that supported the presence of oscillation at this level of recursion and, therefore, the sharing of information on oscillation (ID16) was not able to be observed. There was also no evidence of any other types of information being shared at this level of recursion that are not present in Table 5 that contributed to the viability of the company.

The following sections then looked at the recursion levels directly above and directly below the system-in-focus in order to analyse the company in context. Each relevant recursion level was described in terms of the VSM and was then explored in detail to identify the information that was shared between each level of recursion, in accordance with the fourth question posed in this research. At the higher level of recursion, formal regulations and criteria for achieving certain standards and accreditations in the industry and developments in the industry were shared between the Print Industry and Company A recursion levels. At the lower level of recursion, information from the quote and Job Information Sheet documents (such as job requirements and deadlines) and operational information (such as preferred supplier lists and maintenance information) was shared between Company A and the lower recursion levels.

In accordance with the fifth and final question posed in this research, and in contrast to Project Teams A, B and C, the analysis of Company A did not suffer from any deficiencies in the VSM's ability to model information sharing between recursion levels.

¹ Company Information document

² Company Profile document

³ Internal Salesperson 1 Interview

⁴ Internal Salesperson 2 Interview

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- ⁵ Design Studio Director Interview
 - ⁶ Reprographics Designer 1 Interview
 - ⁷ Accountant Interview
 - ⁸ Company Manual document
 - ⁹ Company Director Meeting 3
 - ¹⁰ Company ISO9001 Manual document
 - ¹¹ Production Co-ordinator Interview
 - ¹² Reflection Notes written on Company Director Meeting 2
 - ¹³ Reflection Notes written on Company Director Meeting 1
 - ¹⁴ Company Director Meeting 6
 - ¹⁵ External Salesperson 1 Interview
 - ¹⁶ External Salesperson 2 Interview
 - ¹⁷ External Salesperson 3 Interview
 - ¹⁸ External Salesperson 4 Interview
 - ¹⁹ Reprographics Designer 2 Interview
 - ²⁰ Job Information Sheet document
 - ²¹ Company Key Selling Points and Capabilities document
 - ²² Design Artist 1 Interview
 - ²³ Company Director Meeting 2
 - ²⁴ External Salesperson 5 Interview
 - ²⁵ Design Studio Director Interview

Chapter 9

Discussion

9.0 Introduction

This research set out to increase understanding about the role that information plays in sustaining viability in organisational systems. The research has contributed significantly to our understanding of the VSM, through investigating the five specific questions identified in Chapter 3. These findings provide insight in to the mechanics of the VSM and build on the diagnostic and design capability of the VSM to provide assistance on how organisations can manage their information to sustain viability. However, this research has also highlighted some wide ranging issues that extend far beyond the inner-workings of the VSM. This chapter discusses these findings first, which provide the context for discussion of the five research questions in the subsequent parts of this chapter. This chapter then concludes by highlighting the limitations of this research.

9.1 Implications

As shown in Chapter 2, the VSM has been successfully applied in the literature to a wide range of situations and proved a useful lens through which to identify problems that organisations are having with structures and processes. This research appears to provide further support for this with it, for example, identifying a range of issues for Project Team C, including the problems at S1, S3 and S4 with monitoring and control and resource allocation discussed in Chapter 7. Given the wide body of literature detailing the use of the VSM in real-world interventions, its applicability to help diagnose organisation problems is relatively well established. However, part of the inspiration for undertaking this research came from the criticism of Schwaninger and Ríos (2008) that the VSM is unable to provide much help with detailed information and communication structures, with them calling for new theories to be explored about the way people interact and what information they need in the VSM.

Chapter 3 identified that there was limited literature available on this particular area, supporting this claim of Schwaninger and Ríos (2008). Through this research extending our understanding of information in the VSM, it has enabled the further development of the VSM as an analytical tool that organisations can use to diagnose cybernetic strengths/weaknesses. As discussed in Chapter 2, the established VSD process delivers a rigorous methodology to diagnose potential threats to the viability of organisations. However, as shown in Chapters 2 and 3, there has been no methodological approach available to carry out the final stage of the VSD process, i.e. “*check that all information channels, transducers and control loops are properly designed*” (Flood and Jackson, 1991, pp. 95). This research has contributed to providing this through developing a qualitative framework that researchers can use to conduct the final stage of the VSD process. Through using Table 5 as a structure for qualitative data coding of information domains in a viable system, researchers can analyse what information is generated in an organisation and compare it to the information domains required to achieve viability (indicated by a “G” in Table 5). Once this coding has taken place, Table 5 can then be used to further analyse information sharing in the organisation through comparing where information should be applied (indicated by an “A” in Table 5) in the VSM, compared to where that information is presently being shared in the organisation.

However, if Table 5 is to be used as a qualitative coding tool in the VSD process, it should be kept in mind that the VSD process is said by Flood and Jackson (1991) to only be applicable in situations where the purpose of the system can be agreed. The VSD process offers no way of resolving disputes about what the purpose of the system is in the analysis. Should such a situation arise, this approach may need to be combined with another tool, such as Soft Systems Methodology (Checkland, 1981; Checkland and Scholes, 1990), to establish initial agreement on the purpose of the system being analysed. The combination of VSM and SSM has been carried out before (Munro and Mingers, 2002; Ormerod, 1999) and further research into the potential merging of the two approaches may extend the VSM to resolve any dissonance between the perceptions of system purpose.

Whilst this research has developed a tool that managers can use to diagnose communication in organisations to help maintain viability, during the course of this research it became apparent that the notion of ‘viability’ in the VSM may be somewhat narrowly defined. Beer (1979) defines viability as the ability of a system to maintain a separate existence and survive on its own. However, is this all that organisations really

strive to achieve? Chamanski and Waagø (2001) suggest that company success can be defined in a variety of ways, including survival, but also in terms of growth, sales, market share, employment and profitability. Furthermore, these authors argue that a company will strive for different types of success dependant upon the lifecycle of that company, for example survival and growth may be the most appropriate for companies in the start-up and development stages of their lifecycle, whilst profitability may supersede these once the development of the firm becomes more stable. Project team success has also been defined in numerous ways in the literature (Belassi and Tukel, 1996), with the classic 'Iron Triangle' (Atkinson, 1999) defining it in terms of achieving the project objectives on time, within budget and to the necessary standard of quality. As shown with Project Team C, the project team maintained a separate existence (and therefore viability) throughout the project lifetime, however they suffered from VSM-related problems, such as S4 initially dominating S3, and delivered the project 6 months late. This appears to support Jackson (1988) and Sutton (1995) who note that social systems can still maintain a separate existence when not adhering to the VSM. The 6 month delay further supports the stance of Yolles (2005) who suggests that the VSM structure actually leads to effectiveness and not necessarily existence, with non-viable organisations just suffering from crises that viable organisations do not suffer from.

The problem of identifying what organisations strive to achieve is highlighted by Belout and Gauvreau (2004), who acknowledge that it is dependent upon which interest groups perspective (e.g. stakeholders, management, customers or employees) is taken. Pinto and Mantel (1990, pp. 274) highlight that success is viewed by people in different ways, with "*what constitutes project failure for one organisation may be viewed as success in another*". Success can also be relative to historical performance, for example McManus and Wood-Harper (2007) highlight a case where a project was delivered "*20 weeks late and was 56% over budget*" but was nevertheless considered a success by both the client and the project managers, with these authors commenting that it was a "*good result based on client's previous track record in information systems delivery*". Furthermore, the nature of organisations also causes them to strive for different achievements, e.g. charities and NGOs will not be striving for profit and market share in the same way as a blue-chip companies might. Given the significant differences between what organisations strive for, it would appear that survival is the only aspiration that is generalisable to all organisations. Viability therefore seems the most appropriate condition for the VSM to aspire to provide, given that it was designed to be applicable to all organisational systems. Given this,

perhaps the VSM should not be seen as a single organisational intervention approach but seen more as tool that can help to deliver survival and the ability to maintain a separate existence as a **platform** from which organisations can build on to achieve their particular aspirations for success. This implies that combining tools with the VSM that are relevant to specific organisational needs may provide assistance based upon strong foundations. The idea of combining the VSM with other tools is considered as an avenue for further research in Chapter 10.

The discussion on viability cannot, however, be left there. We saw above that viability is defined as the ability to survive. The continued survival of a company seems intuitively a desirable aspiration and appears to give rise to the wide range of applications to companies in the literature, as discussed in Chapter 2. However, there is an interesting paradox in the notion of project team viability and it may explain why there appears to be a gap in the literature on using VSM in project environments. Projects, by their definition are discrete entities with delineated start and end points (Cleland, 1999). Therefore, can project teams really be thought of in terms of viable systems when, right from their inception, they deliberately plan for their own extinction? Turner and Müller (2003) state that project teams need structures in place and information and communication systems to monitor the delivery of the project, which the VSM modelled as S3 in Project Teams A, B and C. Furthermore, the findings from the research extensively supported the project management literature. For example, the importance of setting goals at S3 in the VSM is highlighted in Project Team C who failed to do so, resulting in a 6 month delay, which supports Lynn et al. (1999) who state that the identification of clear goals is an important enabler of project team performance. Further examples of the similarities between the VSM and project literature, and the implications of this research for project management, are highlighted when discussion focuses on the research questions in the sections below.

It would appear then that the VSM is relevant to project teams. The only difference appears to be the temporal nature of project teams compared to companies, departments, etc. Therefore, perhaps viability for project teams simply needs to be redefined as the ability to survive and maintain a separate existence for the duration of the project. This definition does not tell the complete story though, with some project teams working together on projects on a continuous basis, taking up a new project after each project they complete. Furthermore, the differences between project teams and other types of organisation may potentially cause differences in terms of information in the VSM. One difference is that

tight schedules are often more inherent in projects – as was the case in all of the project teams in this research. The literature suggests that these timeframes in projects often leave team members so occupied with completing their tasks that they may not have the time to engage in sharing information (Purvis and McCray, 1999; Kasvi et al., 2003; Carrillo et al., 2004). Furthermore, Fernie et al. (2003) suggest that building trust with people over long periods of time enhances information sharing, with Nicholas (2001) highlighting that it is difficult for people to build up trust over a short period of time. Given that project teams are often characterised by short timeframes, it may lead to little trust being built up, even by the time a project has been completed (Koskinen et al., 2003; Bresnen et al., 2003; Pretorius and Steyn, 2005). This appeared to be less of a problem in the project teams in this research, as Project Team A members had already built up experience of working with one another and Project Teams B and C worked on projects that were quite long in duration. Nevertheless, these differences in project teams due to their temporary nature suggest further research may be necessary to further understand the paradox of project team viability.

This research has further implications beyond project management and providing information diagnostic tools for managers. The central question of this research was to explore the role that information plays in sustaining viability in organisational systems. Much more detailed discussion of the contribution that specific types of information had in the case studies is provided in the sections below. However, the findings suggest that the types of information provided in Table 5 were sufficient to enable the case studies to survive. This has implications for the information systems research community, as it could be used to help them to build more effective information systems. When designing information systems, designers could use the model to ensure that the information system being designed captures and shares the information required to sustain viability. It is accepted that each organisational information system will have extensive uniqueness in terms of the information content it generates and shares but, as the VSM and Table 5 is theoretically applicable to all organisations, the model does offer some general guidance for information system development.

However, whilst the VSM and Table 5 can offer guidance, it is important that information system developers do not rely upon them alone. Firstly, the VSM and Table 5 offer no guidance on how to understand the uniqueness of information content for each organisation. Furthermore, an information system should not just be developed according

to a template and be expected to be successful. As stated by Wood-Harper et al. (1985, pp. 9), concentrating on just the information processing and the technical specification aspects is “*not sufficient to ensure successful information systems*”. These authors, along with others (e.g. Walsham, 1993; Checkland and Holwell, 1998), highlight that the ‘soft’ social context side of the information system also needs to be considered in information system development. Symons (1990) identifies that there can often be political dimensions to developing information systems in organisations and Avison and Wood-Harper (1990) suggest that consideration needs to be given to how the information system can fit with the working lives of the people in the organisation. For this reason, it is argued that such social factors need to be considered in conjunction in any information systems development that used the VSM and Table 5 to guide its design. This could be achieved through combining the approach with other methods, which is considered as an avenue for further research in Chapter 10.

This chapter has so far focussed on the high-level implications of the research, which have included providing a tool for organisational information problem diagnosis, project management and information systems design. The following sections provide much more detailed discussion of the findings in this research. This will now be presented in order of the research questions, with discussion given to where the detailed findings fit into the higher-level implications discussed above.

9.2 Information at Level 1 Recursion

The first question posed in Chapter 3 was: *What information is present within viable organisations at one level of recursion?*

The findings showed that most of the information domains present in the Achterbergh and Vriens (2002) model were present within all of the case studies. The exception to this were those information domains that related to oscillation (ID13-14 and ID16-18), where no evidence to support them was found in the dataset for Project Team A and Company A. This could simply be because oscillation did not occur in either case study. For Project Team A this could well be the case, as discussed in Chapter 5, these project team members were very organised and quick to respond to any issues – they had to be, given the extremely tight timeframe to complete the work that they had. This could have led to the

Project Team A members identifying and correcting oscillation problems before they had time to properly manifest and become observable. However, Fong (2003) contradicts this by identifying that time pressures in projects can actually result in teams not sharing information effectively. This suggests that tight timeframes are actually more likely to cause oscillation than resolve it, with tight timeframes in projects often leaving members so occupied with completing their tasks that they may not have the time to engage in information sharing activities (Purvis and McCray, 1999; Carrillo et al., 2004; Kasvi et al., 2003). The findings from Project Team B further suggest that being very organised and quick to respond to issues does not negate oscillation alone, as they still suffered from oscillation problems in terms of scheduling.

This oscillation in Project Team B appears to have been brought about by external factors, such as participant availability, which appears to support the project management literature. Belassi and Tuksel (1996) claim that external environment factors can directly impact upon effective planning and scheduling in projects. Pinto and Slevin (1989) suggest that most external environment factors impact during the planning stages of a project, however this research shows that they can impact during the project too. Pheng and Chuan (2006, pp. 29) highlight this in stating that project members “*can be rendered idle or non-productive due to a lack of materials and tools at the right time*”. Whilst these authors concentrate on construction projects in particular, the ‘materials’ in the project teams in this research were their participants and gaining access to them for data collection. Choo (1996) highlights that there exists critical dependencies between an organisation and its environment and this research has found that S1 dependency on the external environment, in this case dependency on participant availability, can cause oscillation. This implies that S2 should regularly seek information from S1 units about both S1 internal performance but also try to detect any issues in the environment that may cause scheduling issues further down the line. This supports the inclusion of a new communication channel in the VSM, which is represented in Figure 22 and discussed in Section 9.3.

Another potential reason for non-oscillation in Project Team A could be that their project had a much shorter timeframe than Project Teams B and C, so there was less time available for potential causes of oscillation to arise. Less confidence can be given to determining that oscillation did not occur in Company A. Given that data for Company A was captured through single interviews with each member, the data collected was very much based on the here and now, i.e. the participants very much focussed discussion around the work that

was going through the company at the time of the interview. If oscillation was not occurring at that moment within the company, this may explain why evidence of oscillation was not captured.

The findings showed that the other information domains present in the Achterbergh and Vriens (2002) model were present within all of the case studies, supporting their inclusion in the model. Whilst the case studies showed consistency in the *domains* of information present in them, what was interesting were the differences between the *actual* information present within the same domain for different case studies. One difference found was between the modus operandi of the primary activities in S1 (ID2) in the project teams compared to Company A. Whilst some S1 activities in the project teams were guided by accepted research methodology and university-specific codes of conduct, this was very general guidance and project teams could be flexible and adapt their modus operandi according to how they felt was best to carry out the task. For example, Project Team A spent a significant amount of time at the start of the project determining the data collection methods and number and types of people to collect data from. By contrast, it was found that the modus operandi was much more formalised and rigid for Company A, with procedures for S1 fully documented by the company. This, perhaps, is more a reflection of the innate differences between project teams and companies. Projects, by their definition have “*a unique scope of work*” (Turner, 1999, pp. 3) which are undertaken by their members. The unique element of project work implies that project teams have to take a different approach each time they conduct a new project, which is dependant upon the nature of the project. This is supported in the project management literature by Gray and Larson (2008) who argue that projects always have a unique set of routines and procedures, even on construction projects where established building practices have to be tweaked slightly each time. By contrast, Company A was involved in very routine work with, for example, their printing process being fundamentally the same for each job with only the inputs (e.g. paper, inks, etc.) to the process changing dependant upon customer requirements. This appears to support the assertion made by Turner and Müller (2003) that routine work has processes which become stable and unchanged for long periods of time, which are incompatible with the flexible requirements of project work.

These differences in ID2 between the project teams and Company A had a significant bearing on monitoring and control practices (ID4). Slack et al. (2004) highlight a number of formalised monitoring and control practices that companies can undertake to control

their quality, such as statistical process control and Six Sigma. Company A was found to be engaged in regular statistical analysis of customer satisfaction and product non-conformance. Due to Company A having formalised processes, it enabled them to develop specific process controls and standards that were incorporated into particular points in the processes. For example, Design Artists and the Design Director carried out checks at the end of the design process to ensure designs were correct before being printed on the presses. However, the project teams did not formalise their monitoring and control processes and appeared to conduct them as and when was felt appropriate. This raises an interesting question in that, by project teams not having formalised and explicated monitoring and control processes detailed, do they put their viability at risk through potentially forgetting to check something during the course of the project that could potentially lead to project failure? Gray and Larson (2008, pp. 419) argue that large projects “*need some form of formal control*”, although they do also suggest that in smaller projects, members overcome most problems through just being involved. However, the range of project management tools discussed in the literature, from simple Gantt charts to the PRINCE2 methodology, suggest that formal monitoring and control processes can, and do (e.g. Afshari and Jones, 2007; Thompson, 2004; Gist and Langly, 2007), take place in projects. Also, if the project objectives change over time, does it render previous monitoring and control processes redundant? Certainly, much of the project management literature (e.g. Turner, 1999; Gray and Larson, 2008; Koskela and Howell, 2002) appears to show that changes in goals during projects are inevitable. If this is the case, any detailed monitoring and control process will need to be updated each time to reflect how the new/amended goals will be monitored. However, Lynn et al. (1999) advocate keeping goals stable for project teams, as changes can increase the cost and duration of projects dramatically. If project objectives do not change, then perhaps monitoring and control processes may not become redundant. Potential further research on this topic is discussed in Chapter 10.

The link between ID2 and ID4 discussed above shows that the information domains do not work in isolation. This point is powerfully reinforced by the findings from Project Team C. As discussed in Section 7.1.2, whilst the project team set broad objectives (ID3) for the project, they did not create more specific goals for the S1 activities (ID4). This had a profound effect on other information domains within this project team. Through S3 not defining the expected performance of tasks and their deadlines, monitoring practices (ID5) could not be formally set to determine whether tasks had been achieved satisfactorily.

Given this, the project team could also not take actions to rectify them if they had not been done satisfactorily (ID7-9). Without specific goals and milestones, the project team were also unable to identify the needs for S1 (ID19) to determine resource allocation (ID20). This meant that S3 did not know which resources were being used in the current tasks and so could not look at innovation proposals from S4 (ID22) and determine if enough resources were available to implement them (ID23-27). As a result, incomplete innovation proposal reviews were completed by S3 (ID29), causing problems for S5 in determining whether to adapt organisation goals (ID3), such as the problem discussed in Chapter 7 of the team adding an extra research question to their project without having the capacity to research it. Achterbergh and Vriens (2002) highlight that dependency diagrams can be built from their model to provide insight into the relationship between information domains, helping organisations to understand *why* information should be shared. At present, the literature available does not appear to have explored these relationships in detail. Another future direction for research would therefore be to explore the linkages between these different information domains to gain a stronger understanding of information flow in the VSM.

The focus of this discussion so far has been on the information domains within the Achterbergh and Vriens (2002) model. However, as discussed in Chapter 3, through examining the Achterbergh and Vriens (2002) model in comparison to the VSM literature, this research suggested that there were other potential information domains that the Achterbergh and Vriens (2002) model omitted. This section will now consider each of the information domains that were identified from the literature review for potential addition to the Achterbergh and Vriens (2002) model, as presented in the extended theoretical model in Table 5.

The first additional information domain presented in the extended theoretical model was external environment information (ID1). As shown in Chapter 2, the Second Principle of Organisation detailed by Beer (1979) explicitly states that there are channels that carry information between the operation and the environment but the information carried along this channel is not detailed in the model by Achterbergh and Vriens (2002). Yolles (1999) highlights that external environment information can act as both inputs and outputs of a viable system and the findings in this research supported both of these being present. In terms of an input, the project teams were found to collect data from the external environment. In terms of an output, the project teams were found to give feedback to

research participants and disseminate results through various academic channels. In Company A, external environment information was found to be an input through customers producing artwork themselves and providing it to the company. Information was also found to be an output through Company A generating artwork proofs for checking by customers in the external environment, who would then provide their feedback on the proofs back to the company.

Whilst the findings show that external environment information (ID1) is highly relevant to the system, by its very nature this information is generated *outside* the system boundary. This raises an important question in that, if information is generated outside the system boundary, should it be included in the extended theoretical model in Table 5? Achterbergh and Vriens (2002, pp. 223), in producing their model, identified domains of information that an organisation should “*possess*” to maintain viability and this, perhaps, provides the reason for their omission of external environment information. However, the findings suggest that it is necessary to understand the information flowing in and out of a system to gain a full understanding of the information processing conducted in a viable system. For example, the artwork proofs that are sent back and forth between the Design S1 unit in Company A and their customers in the external environment play a significant role within the organisation. If this external environment information is not properly processed by using it to inform necessary changes to the artwork, as was shown in Section 8.2.1, it can cause major financial loss to the company through them having to reprint incorrect work. As a result, the findings suggest it is useful to include this information domain within the extended theoretical model, as otherwise it may be overlooked by analysts using it, leading to the information domains that link to external environment information not being studied in full.

The second additional information domain presented in the extended theoretical model was operational information (ID10). Leonard (1999; 2000) believes this type of information resides within S2, such as patent expiry dates, maintenance records, project reports and personnel records of operational staff. Operational information was found to exist within all of the case studies, with the project teams generating project reports to record their progress at various stages. Company A generated significantly more operational information than the project teams did in the form of records of previous jobs, maintenance records, preferred supplier lists, error reports and personnel records. The difference between the level of operational information in the company compared to the project teams

would appear to stem from the different types of activities that the project teams were conducting compared to Company A. The project team activities were mainly knowledge-based activities that did not really require anything other than the members for their S1 operations. Contrastingly, Company A activities were much more physical resource-based in terms of relying upon machinery and raw materials from suppliers to conduct their S1 activities, resulting in the need for maintenance records, supplier lists, etc. for these physical resources. Therefore, the findings suggest that physical resource-based organisations will have more operational information to manage than knowledge-based organisations and so may need to develop more complex methods of holding this information. For example, Company A used an MIS computer system to manage their operational information on previous jobs.

The third additional information domain presented in the extended theoretical model was resource allocation (ID20). As shown in Chapter 3, the Achterbergh and Vriens (2002) model describes S3 setting goals for S1 units and S1 informing S3 of the resources it needs to meet these goals. As a result of this, their model assumes that resource allocation is based on a process of identifying the resources needed to meet the goals set and then providing them. The findings show that the Achterbergh and Vriens (2002) model approach to resource allocation appears to reflect simple resource allocation processes. For example, as shown in Section 8.4.3 in Company A, if a Print Operative at S1 required some more ink for the presses, they would inform the Production Manager at S3 who would then source the ink and provide it to them. This process suitably fits in to how the Achterbergh and Vriens (2002) model handles resource allocation. However, the findings for both the project teams and Company A show that accounting/funding information plays a role in resource allocation too. For example, the S1 activities in Project Teams B and C were constrained by the small budgets they each had to conduct their projects. Project Team B commented that they had no financial resources to employ an extra temporary member to resolve their falling behind schedule issue described in Section 6.2.1. As discussed in Chapter 8 for Company A, S3 maintained management accounts to help determine resource allocation. The literature demonstrates that economic data has long since been acknowledged to be a crucial element in the resource allocation process (e.g. Pondy and Birnberg, 1969), however, this type of information is not reflected in the Achterbergh and Vriens (2002) model.

The findings also show that the project teams resourced and assigned personnel through understanding the skills of each member, for example in Project Team A the Research Supervisor became the main resource for the Focus Group Data Collection S1 unit due to their extensive previous experience of running focus groups. This shows that resource allocation for knowledge-based activities is not as straight-forward as the Achterbergh and Vriens (2002) model suggests, with the process involving S3 using S2 operational information on personnel skills. Gray and Larson (2008) support this and suggest that project managers should also pick people to work together with compatible work habits and personalities to minimise unnecessary tension; and also with skills that complement one another to mitigate the weaknesses of individual members. This supports the assertion made by Leonard (2000) that information needs to be drawn upon of how people in the operations work together and of the work that they perform to help determine resource allocation in the VSM.

The fourth additional information domain presented in the extended theoretical model was manipulation of external environment (ID21). Jackson (1988) highlighted that S4 can attempt to influence the external environment in order to manipulate it to benefit the system. The findings suggest that manipulation of the external environment is centred to a great extent around the activities of sales and marketing. As discussed in Section 8.2.1, Company A was heavily involved in manipulation of the external environment through engaging with customers and trying to persuade them of the importance of an accreditation that only they could deliver. Project Team B tried to manipulate the external environment to 'sell' their project and get people across the university interested in contributing science engagement learning materials to it. Given the vastness of the external environment, it proved difficult to identify the manipulation of it in Project Teams A or C. Project Team C set out to change culture within the higher education sector – which they may have done through the stakeholders in the environment reading the findings of the research disseminated by Project Team C. Project Team A may have manipulated the environment through conducting focus groups with the carers of disabled children, which may have made the carers think more about care provision, leading them to become more active in lobbying the Government for increased funding. However, the vast nature of the environment meant that the research did not capture data on such events. Nevertheless, this raises an important point about the relationship between the system and its external environment. Activities that the system undertakes could, potentially, manipulate the external environment in ways that had not even been thought about and so organisations

need to pay close attention to this information flow to ensure that they are not accidentally manipulating the environment in a detrimental way. This is supported by Morgan (1982) who believes that, through influencing external environments, cybernetic systems can damage critical relationships they rely upon and need in the environment.

The fifth additional information domain presented in the extended theoretical model was auditing (ID28). As discussed in Chapter 3, the Achterbergh and Vriens (2002) model does not make any specific reference to S3* in the VSM. Whilst these authors argue that auditing comes under their monitoring and control practices (ID5) information domain, given that Beer (1979; 1981; 1985) explicitly makes S3* distinct from S3 in the VSM, it would appear logical to keep them separate in the Achterbergh and Vriens (2002) model. Indeed, Beer (1985) says he kept S3* apart from the S3 command function to highlight the sporadic nature of auditing that is distinct from the routine monitoring and control practices carried out by S3. The findings showed that auditing occurred in Project Team A through time resource and quality audits, in Project Teams B and C through quality audits and in Company A through customer complaint audits. Given the nature of what was being checked in these audits, for example customer complaints do not occur routinely in Company A, it is argued that these should not be classed as being routinely monitored as an S3 activity. As a result, the findings support the distinction made in the extended theoretical model to separate S3 monitoring and control activities from S3* auditing.

The sixth additional information domain presented in the extended theoretical model was cultural knowledge (ID37). Burack (1991) defines organisational culture as the customary ways of carrying out tasks, driven by the philosophies and assumptions inherent in an organisation. In Chapter 2, it was shown that the VSM is criticised for omitting culture (Jackson, 1988) and the Achterbergh and Vriens (2002) model omits it too. In Chapter 3, however, it was argued that this missed the vital link between organisational goals and culture, with goals not just emerging on their own but being bound to the culture of an organisation. Cultural knowledge was therefore suggested to include knowledge of the organisation's past experiences, their level of development, their relationships and the social, business and economic environments in which they exist (Leonard, 1999; Curry and Moore, 2003). Cultural knowledge was found to exist in all of the case studies, with a significant difference between the project teams and the company. The culture in the project teams was relatively informal, compared to a significant level of formal cultural knowledge documented in Company A. Company A made explicit clear procedures that

should be followed throughout the company, whereas project teams were much more relaxed about these and certainly did not have them defined in documentation. The link between culture and organisational goals was evident through the project teams being much more willing to change organisational goals quickly if their data analysis suggested a need for it. In contrast, the organisational goals of Company A were much more fixed with the Managing Director feeling his staff were stuck in their ways and unreceptive to change. This supports the assertion of Sata (1989) that the culture of an organisation significantly impacts upon the extent of its adaptability to change. Given that viable systems need to be able to adapt themselves to manage the variety of the external environment (Yolles, 2000), this suggests that culture has a profound effect on the viability of an organisation and supports its inclusion in the extended theoretical model.

The final additional information domain presented in the extended theoretical model was the algedonic signal (ID38). As discussed in Chapter 3, the Achterbergh and Vriens (2002) model does not include the algedonic signal that Beer (1979) states is present to enable other functions in the VSM to alert S5 to potential danger. The algedonic signal was found to be present in Company A, with the staff notifying heads of departments if any problems were identified with a job. However, there was no evidence found to support the presence of the algedonic signal in the project teams. This finding is interesting, especially given that Pretorius and Steyn (2005) found that members from smaller teams are more likely to get acquainted with each other and share knowledge, suggesting this information was more likely to be shared in the project teams. Perhaps the project teams just did not encounter any dangerous problems, although the size of the project teams provides a different potential reason. Given that there were only 3 members in each project team, it could have been the case that the algedonic signal was generated by the same member that was responsible for S5 in response to a danger they saw. If this was the case, the member may have rectified the problem themselves without making the algedonic signal explicit.

There was also no evidence of any other types of information contributing to viability at one level of recursion that are not present in Table 5, suggesting that Table 5 provided the sufficient information domains for these case studies.

The second question posed in Chapter 3 was: *What information is shared within viable organisations at one level of recursion?*

The findings provide evidence that support each of the information domains being shared as detailed in the extended theoretical model in Table 5. The sharing of the original information domains in the Achterbergh and Vriens (2002) model occurred in all case studies, except for the oscillation gap (ID16) in Project Team A and Company A for the reason of neither of them suffering from oscillation problems as detailed above. In terms of the extended theoretical model in Table 5, as discussed above, the algedonic signal (ID38) in all project teams and the manipulation of external environment (ID21) in Project Teams A and C were not found to be present and, as a result, were also not found to be shared in these case studies either. However, the algedonic signal was found to be shared in Company A through staff going directly to heads of department to notify them of impending problems on jobs. Manipulation of the external environment was found to occur in Company A through the External Salespeople engaging with customers and discussing the benefits of products, such as the environmentally accredited printwork, that only their company could offer.

The findings show that information was shared between S1 units within the VSM and this highlights the omission in the Achterbergh and Vriens (2002) model that it does not model information flows between S1 units, as discussed in Chapter 3. Beer (1985) made this link explicit as communication channel (iii) in Figure 8. Leonard (1999) suggests that learning is shared between S1 units and the findings showed this occurred at the higher levels of recursion. For example, Project Team C were shown in Section 7.3.1 to be sharing information with other project teams within their university and learning from these other project team S1 units.

The findings showed further information types were also shared between S1 units, in the form of input/output information. For example, artwork from the Design S1 unit was shared with, and then used, in the Print Production S1 unit of Company A. However, this was only a one-way flow of information between S1 units which was significantly different to the S1 unit to S1 unit information sharing in the project teams. In each of the project teams, the data collected flowed from the Data Collection S1 units to the Data Analysis S1 units for analysis to be conducted. However, the data analysis was found to then inform future data collection activities in each of the project teams. For example, as discussed in Section 5.4.1, Project Team A generated new questions for subsequent data collection interviews based upon their prior analysis. This shows a two-way communication process between the S1 units in the project teams. This difference between

one-way and two-way communication appears to stem from the level of dependency between S1 units in each of the case studies, with the project team S1 activities working iteratively and closely together in order to meet the overall project goal. By contrast, the Print Production S1 unit was able to work independently of the other S1 units, providing the customer supplied their own artwork, and only needed to interact with the Design S1 unit when artwork was needed to be designed for customers.

This leads to an important issue to consider as the Achterbergh and Vriens (2002) model does not model S1 unit to S1 unit information sharing, as it represents S1 as being one 'system', rather than breaking it down into its constituent units. As discussed in Chapter 3, the reason for doing this appears to be that it makes analysis simpler by grouping the information domains for all of the separate S1 units. However, the discussion above suggests that, whilst this may be acceptable for systems with a low degree of dependency between S1 units, the model will omit a significant amount of information sharing that goes on in the system if there is a high degree of dependency between S1 units. This could potentially cause analysts to fail to diagnose threats to system viability caused by problems with S1 unit to S1 unit information sharing. As a result, the findings suggest that, when analysts face systems that show high levels of dependency between S1 units, they should not treat the S1 units as being one system in the way that Achterbergh and Vriens (2002) suggest. Instead, in these situations analysts should explicitly examine the sharing of information between S1 units.

With the exception of the S1 unit to S1 unit information sharing discussed above, there was no evidence of any other types of information being shared that contributed to viability at one level of recursion that are not present in Table 5, suggesting that Table 5 provided the sufficient information domain sharing details for these case studies.

The third question posed in Chapter 3 was: *How does information sharing occur within viable organisations at one level of recursion?*

The findings supported all of the communication channels being present in the VSM as shown in Figure 13. The biggest difference between the case studies was in the use of the S3 corporate intervention channel, which appears to have been determined by the management style within the system. For example, Company A had quite autocratic management, which in turn appeared to cause them to make much stronger use of the

corporate intervention channel (communication channel D) than the project teams. An example of this autocratic style was shown in the extent to how involved the Managing Director was in every aspect of the organisation. As discussed in Section 8.1.2, the Managing Director would walk regularly around the factory to check on staff and intervene if he felt it necessary. By contrast, the project teams gave much more autonomy to their S1 units with, for example, Project Team B giving the Research Fellow most of the responsibility for the Data Collection S1 unit with only a light level of supervision being exercised over them.

This difference may have been due to a number of potential factors. One factor may have been time, with the project team members all working to tight deadlines and working on a series of other projects at the same time, they may not have had enough time to make extensive use of the corporate intervention channel in the same way that Company A could. However, the findings do not necessarily support this as the Managing Director appeared to also be significantly busy during the time data was collected in Company A and he was often out of the office at times when the researcher was there. Another potential factor arises from the claim by Espejo and Gill (1997) that stronger links between S1 units reduce the requirement for S3 to impose control from above, creating greater autonomy and empowerment to S1 units. These authors believe that this higher dependency causes more communication to occur between S1 units, providing S1 units with more opportunity to become aware of problems and solve them together, without S3 intervention. The findings support this, as it has already been shown above that the S1 units in the project teams had a significantly higher dependency upon each other compared to the S1 units in Company A. As a result, perhaps the higher level of communication between S1 units led project teams to not require the corporate intervention channel to be employed as heavily as in Company A. Another potential factor may have been the cultural differences in Company A, with the Managing Director commenting that their staff were not very self-motivated. This may have led to the Managing Director feeling the need to constantly monitor their staff to get them motivated through fear of being caught not working. In comparison, for example, Project Team A members displayed a very high level of self-motivation and perhaps did not need that level of monitoring, as S3 was more confident that the members would carry out the work required.

9.3 Information Sharing between Recursion Levels

The fourth question posed in Chapter 3 was: *What information is shared between different levels of recursion in viable organisations?*

The findings showed that, at the higher level of recursion, there was a significant amount of information sharing between project teams and their funding organisation in the initial stages. This intense period of information sharing occurred where each project team and the funder of the project worked together to define the scope of the project. This supports Gray and Larson (2008) who state that the project manager and customer of the project should work closely together to develop the project scope. The information domains shared in this process were proposed goals (ID22) and the misalignment (ID27) between the required capacity (ID25) and actual capacity (ID26) to implement them. This process was iterative until an agreement on the goals (ID3) could be reached. This process is described fully in Section 5.3.2 and was found to be applicable to all project teams in the research. The process was not identified in Company A, possibly as a result of the research not collecting data from the inception of the company and so the data collected was during a period when the goals of the company had already been established.

After the initial scoping process had been conducted in the project teams, the information sharing between recursion levels was significantly reduced. Project progress (ID2) was shared by all project teams with the higher recursion level. Project Team A shared the most information on this and, as discussed in Section 5.3.2, they sought as many opportunities as they could to provide feedback to the council. These updates included a presentation on emerging findings, which the project team were particularly keen to conduct to ensure they were meeting the objectives of the council. Whilst, project progress was also shared between Project Teams B and C with their higher recursion levels, they were unable to use this information sharing in the same way as Project Team A were to ensure they were meeting the objectives of the funding organisation. This may be important as Fong (2005) highlights that client requirements often evolve during projects. Due to much less detailed information being shared between Project Teams B and C and their funder, as the funder had lost interest, these teams were fearful that they may deliver their projects and then the funding organisation saying they had not met their objectives at the end. This suggests that organisations should seek to send progress reports to their higher recursion levels to gain confidence that they are on track. However, this was not the case for Company A, which

needed to send progress reports to their customers in the external environment (in the form of proofs) to ensure they were on track. This appears to suggest there are differences between the information domains that are shared between recursion levels for different types of system.

Slack et al. (2004) highlight that customers sometimes decide to change the project specification after it has been formally agreed. In this respect, information on potential scope increases to the project (ID22) were found to be shared between the higher recursion level and a project team. As discussed in Section 5.3.2, Project Team A were found to receive suggestions for potential scope increases from the council after the scope had been agreed. Gray and Larson (2008) state that that scope creep is a common problem in projects, although this was not found to happen after the initial project scoping process for Project Teams B and C. The most likely explanation for the lack of this being that the funder was no longer interested in the projects. Potential new projects were also identified through information (ID22) sharing between the project teams and their higher recursion levels. Project Team A, for example, identified a gap in that the council had not included a highly relevant group of participants in their consultation and so the project team proposed to carry out this work for the council. Project Team B identified a project that they planned to discuss with the university to develop their computer system further and provide it for use university-wide. Identifying proposals for innovation (ID22) also occurred in Company A from their industry at the higher level of recursion, such as merger and acquisition opportunities and new technologies to deliver products that filled a gap in the current market.

Operational information (ID10) was found to be shared between Project Team C and the university at the higher level of recursion in terms of what that the university science engagement department had learnt through other projects conducted prior to Project Team C's project. Project Team C were shown in Section 7.3.1 to comment on how this learning shaped their own project. This information was not found to be present in the other project teams and this appears to be due to their universities at the higher-level of recursion not having a dedicated facility to co-ordinate information sharing between similar projects. As a result, the other project teams may not have accessed useful learning that was occurring/had occurred in other projects at their university. The findings suggest that this would have been useful, with Project Team B saying they were keen for their university to

develop a structure to help them access relevant learning from previous/concurrent projects in their university to realise perceived synergistic benefits.

Information on funding (ID20) was shared between all of the project teams and their funding organisation at the beginning of their projects, which ensured project teams knew how much money they had allocated. Project Team B were shown in Section 6.3.2 to have to update their funding organisation at set intervals before they would be provided with the next stage of funding. Project Team A also generated quotes and sent them to the council to be paid.

Anti-oscillatory measures (ID11) were also shared between the higher recursion levels and all of the case studies. The project teams all received regulations and criteria from their universities in the form of university-specific codes of practice and standards. Company A had regulations and criteria for achieving certain standards and accreditations from the industry. This information helped reduce the variety, and therefore potential for oscillation, within level 1 recursion S1 activities by providing guidance on what S1 units should and should not be doing. For example, the Print Production S1 unit in Company A could only use certain types of paper for work that was covered by its environmental accreditation.

At the lower level of recursion, goals, performance and modus operandi for S1 units (ID2) were shared between all of the case studies and their lower recursion levels. The project teams generated project specification documents that contained details of objectives and milestones, which were used by the S1 units to guide their activities in terms of scheduling and monitoring and control. Company A also shared this information with lower recursion levels in the form of the Job Information Sheet and quote documents it generated being sent to S1 units so they knew the requirements and timeframes of the job that they needed to produce.

Operational information (ID10) was also shared between Company A and its lower recursion levels. For example, the Print Production S1 unit updated the maintenance records held within Company A. Operational information was not found to be shared by the project teams with their lower recursion levels, perhaps again reflecting the implications that the differences between resourced-based and knowledge-based S1 activities have on this information domain, as discussed in Section 9.2.

The fifth and final question posed in Chapter 3 was: *How does information sharing occur between different levels of recursion in viable organisations?*

It was through the analysis of this question in conjunction with the VSM model in Figure 11 that led to, perhaps, some of the most interesting findings from the research. As highlighted in Chapter 2, Schwaninger (2004) claims that the VSM has never been falsified. This research certainly supports this in that, as shown in Sections 5.1.3, 6.1.3, 7.1.3 and 8.1.3, for *one level of recursion* the VSM appeared to effectively model all of the case studies in this research. However, as stated in Chapter 3, the VSM literature is limited in describing how information at one level of recursion in the VSM relates to other levels of recursion. The project scoping process described in Section 5.3.2 demonstrated that the relationship between S3 and S4 at different recursion levels is very strong, showing that the context of the situation cannot be fully explored by just looking at one level of recursion. Beer (1984) does explicate the communication channels that link two consecutive levels of recursion together, as shown in Figure 11, but he does not demonstrate how information is shared between *three or more levels of recursion*.

It could be argued that the reason for this is encapsulated by Espejo et al. (1999) who suggest that the interactions between *successive* recursion levels are at the core of the VSM in order to achieve cohesion. Leonard (1999) also states that the recursion level directly above and directly below the system-in-focus should be studied when carrying out VSM investigations. Given this, it could be understood that only information sharing between *two* levels is as far as VSM investigations need to consider at any one time. However, even here the findings suggested that the VSM is deficient. It was found, in Section 7.3.2, in Project Team C that there was operational information (ID10) shared between S4 of the Project Team Level 1 VSM and S2 of the University Level 0 VSM in terms of what the science engagement department had learnt previous to the project team beginning their project. However, whilst communication channel C in Figure 13 of the VSM provides a link between S1 units and S2, it does not provide a detailed structure for this information sharing to be carried out. For example, the VSM does not provide an explicit link between S4 of Level 1 and S2 of Level 0 for this to directly happen. These missing communication channels are shown in Figure 22:

VSM Diagram with Level 1 S4-Level 0 S2 Communication Channels

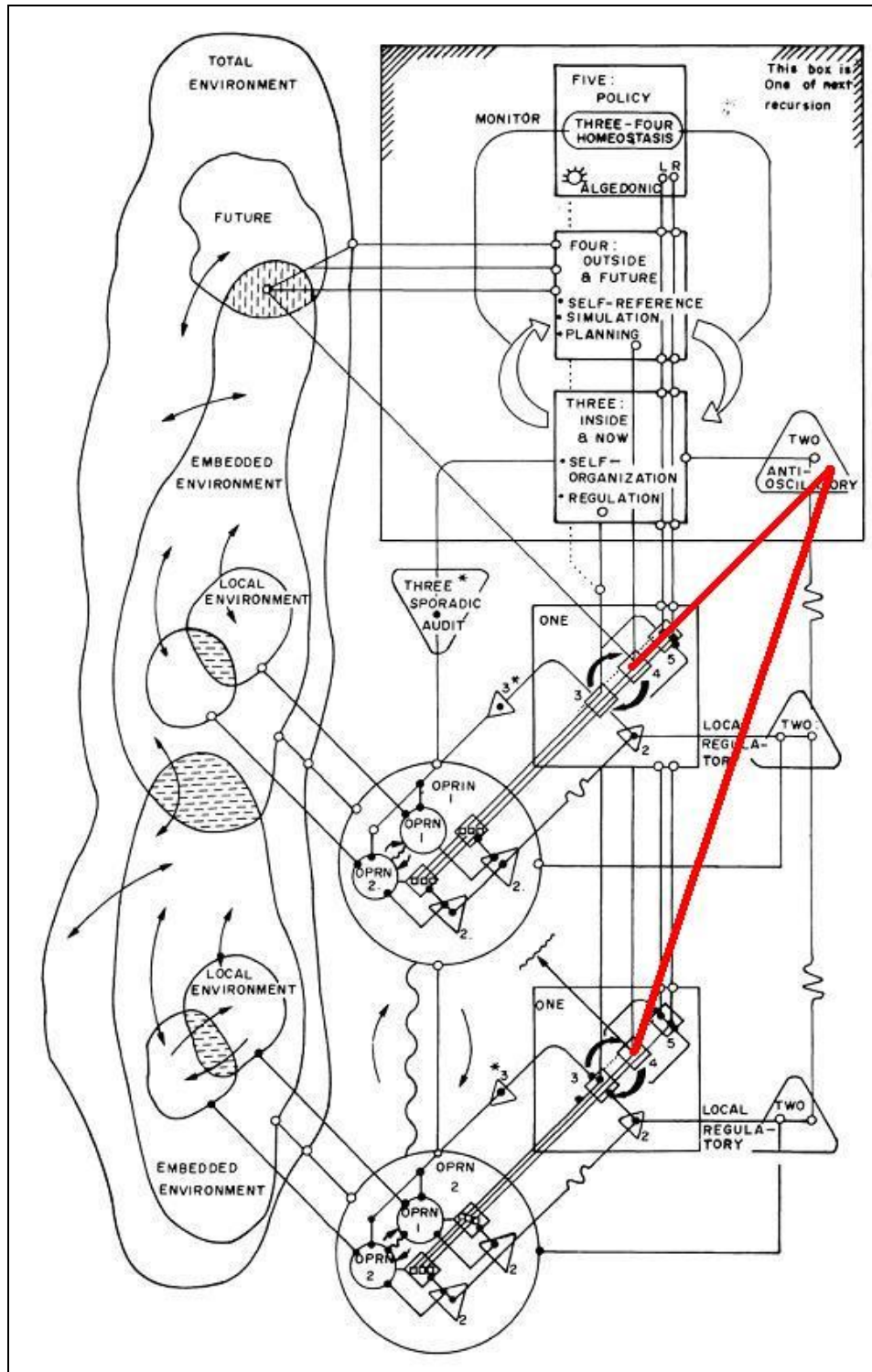


Figure 22 (Adapted from: Beer, 1984, pp. 15)

However, if we take the stance of Schwanger (2009, pp. 91) who writes that “for a given [VSM] unit, information about units at recursion levels other than those in the immediate neighbourhood can also be of relevance”, it suggests we should also consider how information is shared between *three or more levels of recursion*, which is not covered by the VSM diagram in Figure 11 by Beer (1984). The findings, in Section 5.3.2, showed that

information did indeed flow between three levels of recursion in Project Team A in the form of the S1 Focus Group unit feedback documents from the Data Collection Level 2 VSM being shared with S3 of the Level 0 Council VSM. However, the VSM diagrams in Figure 11 and 13 do not provide a structure for information to move between Level 2 and Level 0 for this to directly happen and there was no evidence to suggest that this information was first sent to the VSM at Level 1 prior to Level 0. This missing communication channel is shown in Figure 23:

VSM Diagram with Level 2 S1-Level 0 S4 Communication Channels

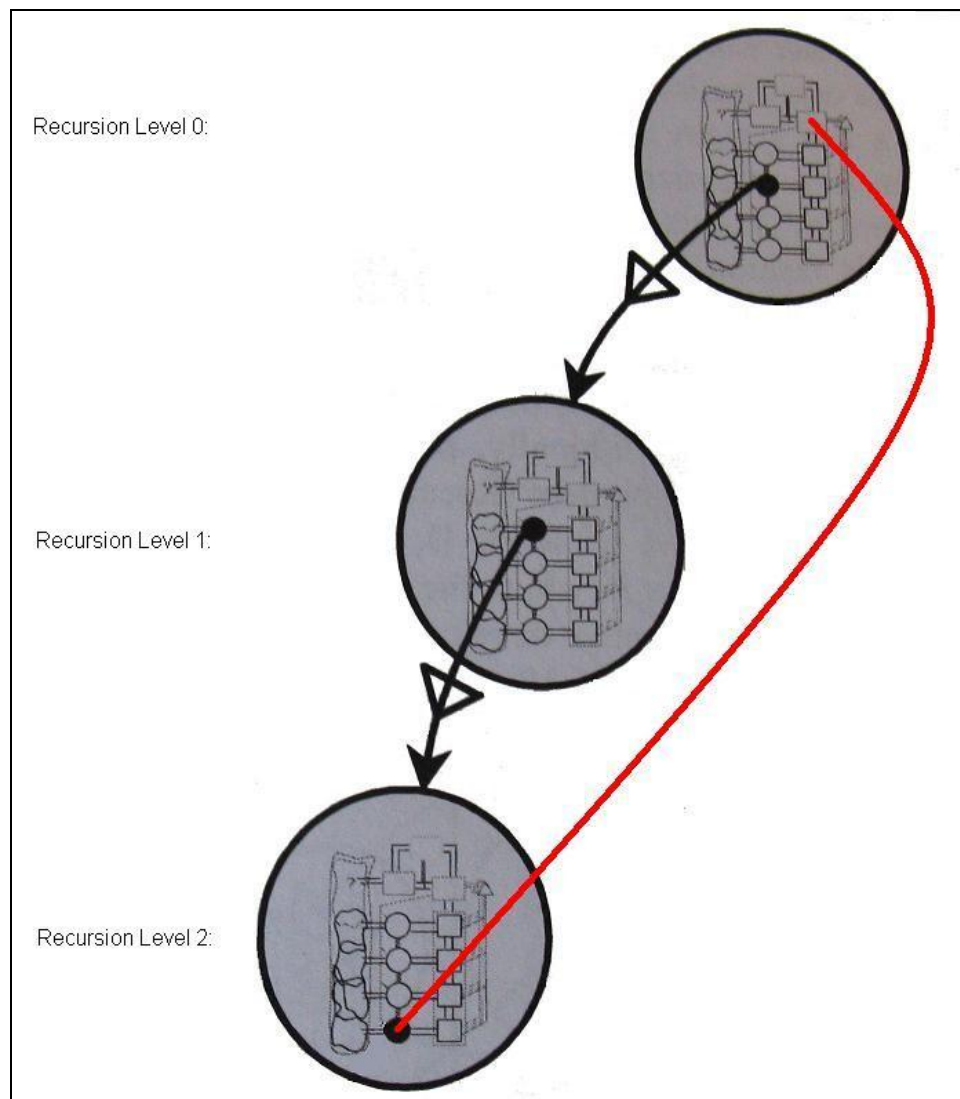


Figure 23 (Adapted from: Schwaninger, 2009, pp. 87)

In Section 9.2, it has already been shown that Achterbergh and Vriens (2002) do not incorporate communication channel B into their model. However, whilst Beer (1984) provides communication channel B in the VSM in Figure 11, this research showed another deficiency of the VSM is that it does not provide a detailed structure for this information

sharing to be carried out. Figure 11 represents communication channel B as a fuzzy line but does not demonstrate the direct link found, for example, between the Focus Group Analysis S1 unit of the Data Analysis Level 2 VSM to S4 of the Computer System Production Level 2 VSM in Project Team B. This information sharing, discussed in Section 6.4.6, was found through Project Team B carrying out the designing the computer system and developing its architecture S1 units at the same time the Data Analysis S1 units at Level 2 were being carried out. This meant that S4 of the Computer System Production Level 2 VSM could be identifying new findings from the S1 units of the Data Analysis Level 2 VSM to be included/revised in the design and development of the computer system. However, the VSM diagram in Figure 11 does not allow this to be shown. The missing communication channel is shown in Figure 24:

VSM Diagram with Level 2 S1-Level 2 S4 Communication Channels

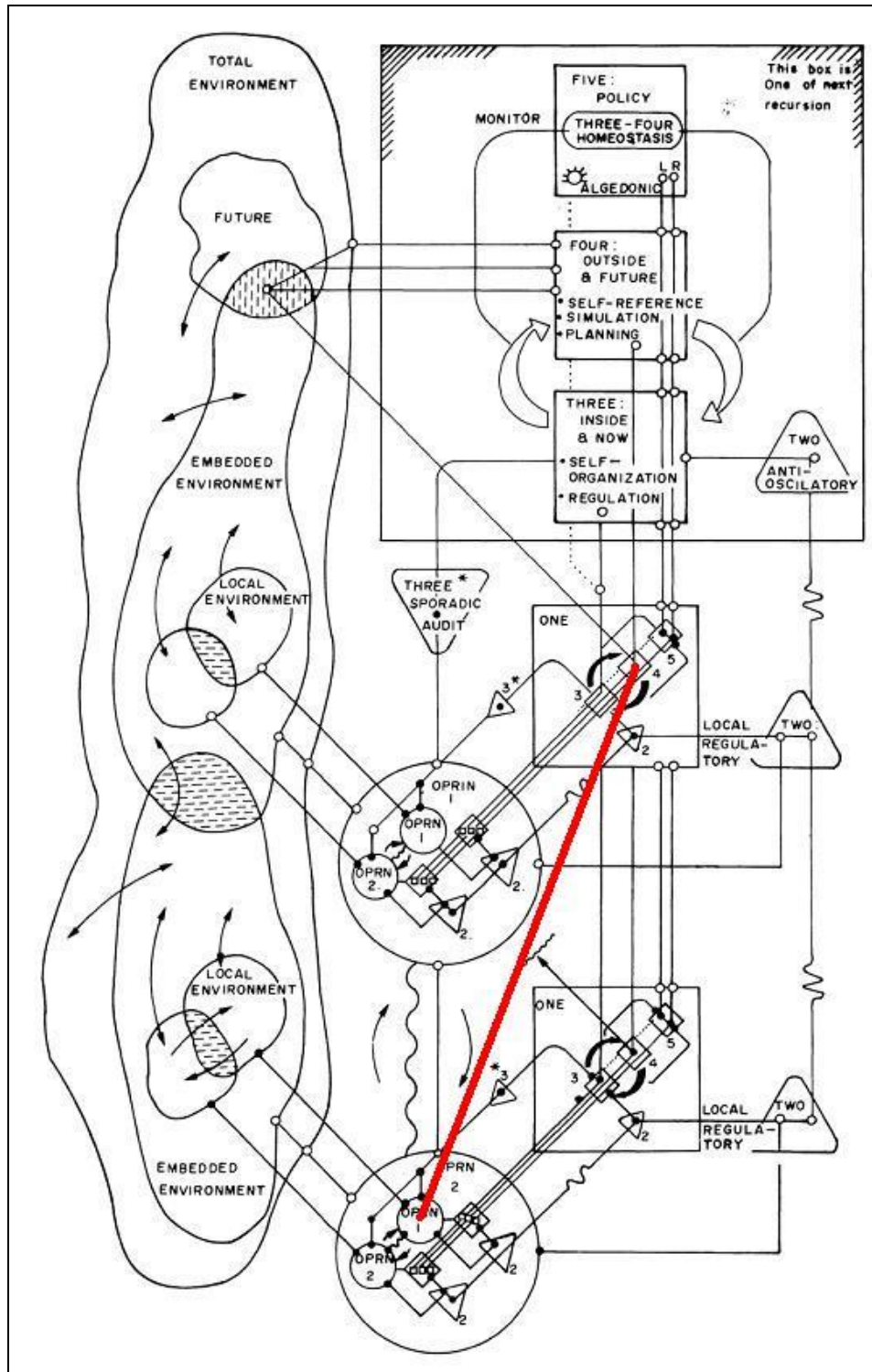


Figure 24 (Adapted from: Beer, 1984, pp. 15)

In contrast to the project teams, the analysis of Company A did not suffer from the deficiencies identified above in the VSM's ability to model information sharing between recursion levels. The first deficiency, identified in Project Team C, of failing to provide a detailed link between S1 units and S2 did not occur as S1 units did not appear to use learning at the higher level of recursion from previous jobs to shape new jobs in Company

A. The second deficiency, identified in Project Team A, that the VSM does not provide a structure for information to move directly between recursion levels that are two levels apart, did not occur as there was no information found that fed directly between the lower recursion levels and the higher recursion level in Company A. The third deficiency, identified in Project Teams A, B and C, of failing to provide a detailed link between different S1 units of the same recursion level did not occur as there was only a simple one-way flow of information between the Design Level 2 VSM and the Print Production Level 2 VSM of the finalised artwork. This deeply contrasted, for example, to the heavy two-way communication process in the project teams between their Data Analysis and Findings VSMs at Level 2. The lack of these issues in the Company A findings suggests that these communication channels may only be present/used in certain systems. This could potentially lead to analysts missing these communication channels between recursion levels that are only present in certain types of system, as they may assume they may be irrelevant for the system they are studying. This could lead analysts to fail to diagnose problems by not analysing these communication channels. Given that only project teams and a company have been used to identify these missing communication channels, further research is called for in Chapter 10 to identify if there are other missing communication channels between recursion levels in other types of systems.

Although these findings do not falsify the model, whilst Beer (1979, pp. 115) set out to deliver “*a statement of conditions that are necessary and sufficient*”, the findings concur with the assertion of Brocklesby et al. (1995) that a two-dimensional diagrammatic representation of phenomena can never fully capture the multidimensional complexity of reality. As a result of this, whilst the use of the VSM and Table 5 provides a powerful lens with which to guide inquiry into information management in systems, as with any modelling technique, analysts should be mindful that they could still potentially miss something by relying upon it solely for their analysis. Through combining this method with another modelling technique, it may help to mitigate this potential problem, as is discussed in Chapter 10.

9.4 Limitations

There are certain limitations to the extensions of the VSM that this research has developed. These limitations, along with the other limitations of this research, are discussed in this section.

The Achterbergh and Vriens (2002) model and the theoretical extensions made to it in this research are based upon literature on information management in the VSM, of which Chapter 3 showed is currently limited. Furthermore, this research only focused on four case studies. As such, it is recognised that the extended theoretical model in Table 5 may not be complete in terms of the information generated and applied within a viable system and Table 5 could undergo further empirical testing to establish its completeness. As stated in Chapter 3, the Achterbergh and Vriens (2002) model is also presented as being at the level of the company, which may lead to different information being present at different levels of recursion. Theoretically, this should not be an issue as the VSM is applicable in exactly the same way to every level of recursion. This research has explored the project team level as well as the company level but further research is suggested to determine if Table 5 offers a comprehensive view of information generation and application for other recursion levels too.

There are also some methodological limitations that are present in this research. These have been discussed in detail in Chapter 4, with one of the main areas where this research could potentially be criticised being that the use of microanalysis leads to findings inevitably being shaped to some degree by the assumptions and experiences of the researcher (Thomas, 2006). However, as shown in Chapter 4, Ryan (2006c) notes that this is just a feature of postpositivism in that all of the data is filtered through the researcher and the researcher has to decide how to use it. This research therefore argues that it was actually an advantage that the researcher used their combination of experience, reading of the literature and theoretical knowledge to provide a deep level of insight that the research would not have achieved if an approach had been taken to try to keep the researcher and 'object' of study independent. Other methodological limitations included the Research Fellow in Project Team B and an Artwork Designer in Company A being unable to participate, leading to the research not capturing the complete views of all of the primary actors involved. As discussed in Chapter 4, the research used triangulation and cross-case comparison to mitigate the effects of this.

There is also a limitation in terms of the generalisability of this study. This research aimed to provide an in-depth analysis of the role that information plays in viable systems. As a result, only a small number of case studies were analysed, as increasing the number of cases would have reduced the depth they could be studied in. However, Lee (1989) remarks that each case study features unique and non-replicable events, leaving studies with a small number of cases susceptible to criticism that their findings may not be applicable in other settings. As a result of this, this research calls for further research to be carried out as discussed in the next chapter.

9.5 Summary

This chapter discussed the findings made from this research. It was shown that this research has highlighted some wide ranging issues that extend far beyond the inner-workings of the VSM. Issues relating to information management, systems thinking, project management and information systems were all discussed to show the wider context of the research findings. The chapter also showed that Table 5 can be used as a coding structure for qualitative data analysis to extend the VSD process. The chapter then went on to answer the 5 questions posed in Chapter 3. The chapter showed that Table 5 appears to provide a comprehensive view of the information that is generated and shared in a viable organisation. The chapter also demonstrated that the research has contributed to our understanding of the information that is shared between recursion levels in viable organisations and highlighted some of the deficiencies found in the VSM to accurately model this. The chapter then concluded with a discussion concerning the limitations of this research, which included those arising from limitations in the VSM itself, methodological limitations and limitations in the generalisability of the findings.

Chapter 10

Conclusions

10.0 Introduction

This chapter highlights the contributions that this research has made and the future directions that research in this area could take.

10.1 Contributions

This research set out to increase understanding about the role that information plays in sustaining viability in organisational systems. This was found to be an area where there was limited literature available and presented a gap that this research sought to fill. The research built upon the domains of information management and systems thinking to extend our understanding of the VSM and to provide assistance on how organisations can manage their information to sustain viability. This has led to a number of contributions to knowledge and practice. These contributions will now be considered in this section.

10.1.1 Information Management

There are 5 contributions that this research makes to information management. These are: demonstrating the way real-world information management fits with the Achterbergh and Vriens (2002) model, identifying seven new information domains that Achterbergh and Vriens (2002) omitted and finding other weaknesses in their model, developing an empirically tested extended version of the model to show the information generation and sharing required to ensure organisational viability, demonstrating the linkages and impact that different types of information have on one another in organisational systems and identifying the information that organisations share with different recursion levels. Each of these contributions to knowledge will be discussed below.

1. *Demonstrating the way real-world information management fits with the Achterbergh and Vriens (2002) model:* The thrust of this research was to explore information in viable organisations. The VSM was shown in Chapter 2 to provide a useful lens with which to explore viability in organisations but, as shown in Chapter 3, there is currently limited literature available that explores information management in the VSM for viable organisations (Paucar-Caceres and Pagano, 2009). The lack of knowledge available in this area has led to Schwaninger and Ríos (2008) calling for new theories to help explore information management in the VSM. To date, Achterbergh and Vriens (2002) have led the way in this research area by developing a model that identified a number of theoretical information domains that they believe are generated and applied in viable organisations. The model produced by these authors provided the platform for this research.

However, as identified through the InterScience citation tracking analysis described in Chapter 3 that was carried out as part of this research, there is currently no literature available that demonstrates the empirical testing of the Achterbergh and Vriens (2002) model. This research has therefore contributed to the literature by empirically testing the Achterbergh and Vriens (2002) model through analysing the four case studies presented in Chapters 5-8. As a result, this research has contributed to knowledge through demonstrating the way real-world information management fits with the Achterbergh and Vriens (2002) model. This provides the information management academic community with confidence that the Achterbergh and Vriens (2002) model relates to the real-world. Furthermore, the empirical testing of the model shows the ways in which different organisations manage information domains – for example, Chapter 9 highlighted the differences in monitoring and control practices between the company compared to the project teams. This contribution helps information management researchers understand how different organisations use the same types of information.

2. *Identifying seven new information domains that Achterbergh and Vriens (2002) omitted and finding other weaknesses in their model:* As discussed in Chapter 3, through examining the Achterbergh and Vriens (2002) model in comparison to the VSM literature, this research suggested that there were seven information domains that the Achterbergh and Vriens (2002) model omitted. These were:

- external environment information
- operational information
- resource allocation
- manipulation of external environment
- auditing
- cultural knowledge
- algedonic signal.

Descriptions of each of these are given in Chapter 3. Through highlighting these omissions, this research has identified previously unknown weaknesses of the Achterbergh and Vriens (2002) model. This has highlighted to information management researchers that they should not rely solely on the Achterbergh and Vriens (2002) information domains if they are using the model to conduct information management research.

A further weakness that this research identified in the Achterbergh and Vriens (2002) model was that it failed to model S1-S1 units sharing information. This could potentially cause analysts using the model to fail to diagnose threats to system viability caused by problems with S1 unit to S1 unit information sharing. As a result, this research suggests that, when analysts face systems that show high levels of dependency between S1 units, they should not treat the S1 units as being one system in the way that Achterbergh and Vriens (2002) suggest. Instead, in these situations analysts should explicitly examine the sharing of information between S1 units.

3. *Developing an empirically tested extended version of the model to show the information generation and sharing required to ensure organisational viability:* The seven new information domains above were developed into the extended theoretical model in Table 5 and then empirically tested as part of the analysis in the four case studies presented in Chapters 5-8. Through this empirical testing, the research concludes that Table 5 provided the sufficient information domains for the four case studies. Whilst it was found that most of the information domains applied to all of the case studies, some information domains were only found to be relevant to certain case studies. These were oscillation (ID13-14 and ID16-18), manipulation of external environment (ID21) and algedonic signal (ID38). As described in Section 10.2, further empirical research will help us to understand why some information domains only

appear in certain systems. In the case of oscillation and the algedonic signal, however, these are information domains that are used to react to a threat to viability. This suggests that, if a threat is not present, then viable organisations do not need to utilise these information domains. This finding further contributes to our understanding of the Achterbergh and Vriens (2002) model as these authors do not highlight how these information domains function when organisations are performing effectively.

The development of the extended theoretical model and the empirical testing of it, leads to the development of Table 15. This table brings together the findings from this research and contributes to knowledge by providing an empirically tested model that shows the necessary information domains required to be managed for organisational viability. The information domains marked in Table 15 by an asterisk are those that were found to be only applicable to certain viable systems:

Empirically Tested Model

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
1	External environment information	G, A	A				A	
2	Goals set by performance and modus operandi of the primary activities in S1		G, A	A	A	A	A	
3	Organisational goals		A		A		A	G, A
4	Expected performance of the primary activity (goals for S1 activity)		A		G, A			
5	Monitoring and control practices by S3		A		G, A			
6	Goal and performance misalignment		A		G, A			
7	Causes and consequences of goal and performance misalignment		G, A		G, A			
8	Actions to counter goal and performance misalignment by S1		G, A					
9	Heuristics to implement counteractions		G, A					
10	Operational information		A	G, A				
11	Anti-oscillatory measures		A	G, A				
12	Interdependencies between S1 activities			G, A				
13*	Actual oscillations			G, A				
14*	Actual performance loss due to oscillations			G, A				
15	Norms for admitted performance loss due to oscillations (goals for S2)			A	G, A			
16*	Gap between norm for admitted and actual performance loss due to oscillations			A	G, A			
17*	Causes of the gap between admitted and actual performance loss due to oscillations			G, A				
18*	Experiences with anti-oscillatory measures			G, A				
19	Problems and needs of the management of S1 activities		G, A		G, A			
20	Resource allocation		A	G, A	G, A			
21*	Manipulation of external environment	A					G, A	
22	Proposals for innovation made by S4						G, A	A
23	Desired goals for S1 based on proposals for innovation				G, A			
24	Gap between desired and current goals of S1				G, A			
25	Required capacity for reorganisation of S1 activities				G, A			
26	Actual capacity for reorganisation of S1 activities				G, A			
27	Gap between required and actual capacity for reorganisation of S1 activities				G, A			
28	Auditing				A	G, A		
29	Reviews by S3 of proposals for innovation				G, A		A	A
30	Finalised plans for adaptation of organisational goals (a joint S3 and S4 product)				G, A		G, A	A
31	Regulatory measures to counter the imbalance between S3 and S4				A		A	G, A
32	Developments in the relevant environment of the organisation						G, A	
33	Norms for balance between S3 and S4							G, A
34	Actual imbalance between S3 and S4							G, A
35	Causes of imbalance between S3 and S4							G, A
36	Experiences with regulatory measures to counter the imbalance between S3 and S4							G, A
37	Cultural knowledge	A	A	A	A	A	A	G, A
38*	Algedonic signal	G, A	G, A	G, A	G, A	G, A	G, A	A

Table 15

4. *Demonstrating the linkages and impact that different types of information have on one another in organisational systems:* Another contribution to knowledge has been to demonstrate the linkages between information domains in the extended theoretical

model. Achterbergh and Vriens (2002) hint at such linkages in their work but this research has shown how certain information domains impact upon other information domains. For example, in the Project Team C analysis it was demonstrated how through the project team not defining the expected performance of tasks and their deadlines (ID4), monitoring practices (ID5) could not be formally set to determine whether tasks had been achieved satisfactorily. This also meant that the project team could not take actions to rectify tasks if they had not been done satisfactorily (ID7-9). Without specific goals and milestones, the project team were also unable to identify requirements and allocate resources (ID19-20). This meant that the project team did not know which resources were being used and so could not look properly at innovation proposals (ID22) to determine if enough resources were available for their implementation (ID23-27). Therefore, incomplete innovation proposal reviews were completed (ID29), causing problems in determining whether to adapt organisation goals (ID3) for the project team. This contribution to knowledge of demonstrating the impact that information domains have on one another will help information management researchers to understand the importance of certain types of information being managed. For instance, the above example shows the impact that not defining expected performance of tasks and their deadlines has on an organisation as a whole. Whilst authors such as Lynn et al. (1999) stress the importance of setting such goals, this research goes much further in mapping out the organisation-wide impact that setting such goals have on the other information that an organisation manages. Through the better understanding of the linkages between different types of information this research provides, it helps information management researchers to understand the consequences of failing to manage particular types of information effectively.

5. *Identifying the information that organisations share with different recursion levels:* Chapter 3 highlighted that the literature did not really explore the information that was shared between recursion levels in the VSM. However, Espejo et al. (1999) argue that the interactions between two successive recursion levels are at the core of the VSM in order to achieve cohesion. Furthermore, Leonard (1999) states that the recursion level directly above and directly below the system-in-focus should be studied when carrying out VSM investigations. Given the importance that authors such as these stress on the relationship between recursion levels in the VSM, Chapter 3 exposed quite a gap in the literature when, through the literature review, it found no literature on how information at one level of recursion in the VSM relates to other recursion levels. In order to help

fill this gap, this research looked explicitly at information sharing between recursion levels and Section 9.3 showed that the following information domains were shared between recursion levels in the case studies:

- Goals set by, performance and modus operandi of the primary activities in S1 (ID2)
- Organisational goals (ID3)
- Operational information (ID10)
- Anti-oscillatory measures (ID11)
- Resource allocation (ID20)
- Proposals for innovation made by S4 (ID22)
- Required capacity for reorganisation of S1 activities (ID25)
- Actual capacity for reorganisation of S1 activities (ID26)
- Gap between required and actual capacity for reorganisation of S1 activities (ID27)

The nature of these information domains being shared was given in Section 9.3. However, these findings demonstrate the importance of information sharing between an organisation and other levels of recursion. For example, Section 5.3.2 identified how the project scoping process was an interactive process between the project team being studied and the recursion level above. The research shows that information management researchers should include other recursion levels in their analysis or risk missing important information flows in organisational information management.

However, as shown in Chapter 9, the scoping process was not identified in Company A, which suggests that the information domains shared between recursion levels given above may only be relevant to certain contexts. Whilst this research shows that information management researchers need to pay attention to information flowing between recursion levels, further empirical research needs to be conducted to help us understand why some of the information domains shared between recursion levels only appear in certain systems.

10.1.2 Business School

There are 2 contributions that this research makes to business school communities. These are: increasing understanding of the VSM approach and developing a new approach to qualitative coding. Each of these contributions to knowledge will be discussed below.

1. *Increasing understanding of the VSM approach:* A contribution of this research to the business school community is to increase understanding of the VSM approach. As discussed in Section 2.1.3, authors such as Munro and Mingers (2002) and Mingers and Rosenhead (2004) have shown that the VSM receives less attention than other systems thinking approaches, such as SSM. One of the reasons for this appears to be that, as stated by Espejo, Bowling and Hoverstadt (1999), the VSM is often regarded as a difficult to tool to use. As will be shown in Section 10.1.6, this stems from the complex nature of the VSM which is compounded by the often difficult to read literature that describes the VSM.

One of the ways in which this research has contributed to business school communities is to enable them to understand the VSM more easily through the condensed theory description provided in Chapter 2. The salient points needed to understand the VSM have been brought together in a much more easy to read format in Chapter 2 than authors such as Beer (1979; 1981; 1985) have provided. This enables business school communities to more easily grasp the principles of VSM which are needed to understand how to successfully apply it. This will hopefully open up the VSM approach to the business school community who may currently find it difficult to access.

Through undertaking this research and developing the VSM, the research sought to renew relevance and interest in the model. The business school communities are unlikely to be interested in teaching or researching with obscure, out-of-date theories. As a result, it is important for the VSM to be given new life. It is hoped that this research has done this through developing it and, perhaps, will spark new debates within the academic community, raising its profile.

2. *Developing a new approach to qualitative coding:* The research has contributed to knowledge through applying a standardised methodological approach – microanalysis

by Strauss and Corbin (1998) – in a different way. It was shown in Chapter 4 that there are two approaches to data coding. One approach is top-down, where a structure is *placed upon* the data. Content analysis takes this approach where codes are identified prior to analysis and form a coding schedule (Bryman and Bell, 2007). This coding schedule is then used to analyse the data, with data that fits into the codes being assigned to the relevant codes (Bryman, 2000). The other approach is to use a bottom-up approach, where codes are generated *from* the data. Microanalysis, based upon grounded theory, takes this approach, which has at its core theory generation in research being “*grounded in data and built up from the bottom*” (Miller and Brewer, 2003, pp. 132). As a result, analysis of the data enables codes to emerge from the data (Strauss and Corbin, 1998).

It was shown in Chapter 3 that part of this research involved the empirical testing of the extended theoretical model developed in Table 5. One approach to doing this would have been to use the information domains in Table 5 to create a coding schedule, similar to that used in content analysis. However, to empirically test the model fully this research wanted to determine if there were any information domains that were missing from Table 5 that were present within the organisations being studied. If Table 5 had been used to structure the analysis initially, it may have constrained the researcher to just looking for those information domains within the analysis. As a result, a truly top-down coding approach was identified as one that could not be used.

Therefore, Chapter 4 showed that the more bottom-up approach to coding of microanalysis was needed to identify any information domains that Table 5 did not capture. However, microanalysis is about building theory from the data (Strauss and Corbin, 1998), where the data is traditionally used to build a theoretical framework. In this research, however, rather than use the data to build new models, it wanted to empirically test a pre-existing model – the extended theoretical model in Table 5. Strauss and Corbin (1998) do highlight that, in some instances, the use of theoretical frameworks in the coding process can be useful. These authors stress that, if a theoretical framework is used in coding, the research must “*remain open to new ideas and concepts and be willing to let go if he or she discovers that certain “imported” concepts do not fit the data*” (Strauss and Corbin, 1998, pp. 40). However, the literature was found to not provide an explicit strategy on how to test theoretical frameworks using microanalysis.

As a result, a new approach to microanalysis was developed in Chapter 4 through using open coding to take an initial bottom-up approach to the data analysis but then impose a top-down approach to data analysis for the axial coding and selective coding stages of microanalysis. The bottom-up approach taken to the first stage of microanalysis enabled the researcher to be free from an imposed structure to enable all relevant data to be coded. This meant that once the top-down approach of using the extended theoretical model as a coding structure was used in the analysis, it was possible to identify any data that had previously been coded in the open coding stage of the microanalysis that did not fit with the information domains in Table 5. This process therefore allowed the extended theoretical model to be checked for omissions and extended through any additional information domains identified in the data.

Through taking the bottom-up and then top-down approach to microanalysis described above, this research has provided an explicit strategy on how to test theoretical frameworks in microanalysis, which was found to be lacking in the literature. This has contributed to knowledge for business school communities by providing a modification to the microanalysis approach to enable empirical testing of theoretical models. As a result, future research conducted in business schools seeking to empirically test a theoretical model through qualitative research can adapt the Strauss and Corbin (1998) approach in the same way as undertaken in this research, i.e. through conducting open coding in the traditional manner prior to structuring axial coding and selective coding through a theoretical model.

10.1.3 Information Systems

There are 2 contributions that this research makes to information systems research. These are: providing researchers with a VSM approach to analyse information systems and providing researchers with a VSM approach to design information systems. Each of these contributions to knowledge will be discussed below.

1. *Providing researchers with a VSM approach to analyse information systems:* As discussed in Chapter 1, the information systems literature provides a range of approaches to help develop information systems. This research considered approaches

such as SSADM, MERISE and Information Engineering from the information systems literature but highlighted that a criticism of these types of approaches is that they concentrate too heavily on the data processing aspect and fail to provide in-depth exploration of the people and processes which the information system needs to support (Avison and Fitzgerald, 2006; Checkland and Howell, 1998). As a result, it was identified in Chapter 1 that a systems thinking approach could be used to provide a wider and more complete picture of the organisation in information systems research.

It was shown in Section 2.1.3, that the use of systems thinking approaches for information systems is not, in itself, novel. Indeed, it was shown that authors such as Wood-Harper et al. (1985) and Checkland and Holwell (1998) have already used systems thinking within the information systems domain. However, what was found was that SSM was by far the most common systems thinking approach used. The contribution of this research to the information systems community has been to link a different systems thinking approach from SSM to information systems – the VSM.

Schwaninger and Ríos (2008) had criticised the VSM for being unable to provide much help with detailed information and communication structures and had called for new theories to be explored about the way people interact and what information they need in the VSM. This appeared to be one of the reasons identified in Chapter 2 why VSM had not been significantly used by information systems researchers previously. This research has responded to the Schwaninger and Ríos (2008) call, developing the VSM into a methodology that can be used by information systems researchers to structure their analytical approaches.

Chapters 2 and 3 demonstrated that the VSM was previously limited as an approach for use by information systems researchers because there has been no methodological approach available to carry out the final stage of the VSD process, i.e. “*check that all information channels, transducers and control loops are properly designed*” (Flood and Jackson, 1991, pp. 95). This research has therefore provided information systems researchers with an approach for carrying out this stage through developing a qualitative framework that they can use to conduct the final stage of the VSD process. Through using Table 15 as a structure for qualitative data coding of information domains in an organisational system, information systems researchers can analyse what information is generated in an organisation and compare it to the information domains

required to achieve viability (indicated by a “G” in Table 15). Once this coding has taken place, Table 15 can then be used to further analyse information sharing in the organisation through comparing where information should be applied (indicated by an “A” in Table 15) in the VSM, compared to where that information is presently being shared in the organisation. This contribution to knowledge has significantly increased the utility of the VSM for information systems researchers, enabling them to now use the approach to conduct rigorous analysis on the requirements and use of information systems in organisations.

2. *Providing researchers with a VSM approach to design information systems:* Related to the contribution above, given that the findings suggest that the types of information provided in Table 15 are sufficient for viability, the model can be used by information systems researchers to help organisations build more effective information systems. In Chapter 2, it was shown that the VSM has two modes of use, one is diagnosis and the other is design (Brocklesby et al., 1995; Espejo, 1989b). Whilst the contribution above relates to the former use, this research also enables information systems researchers to use the VSM in its design mode. When designing information systems, information systems researchers can use the model to ensure that the information system being designed captures and shares the information required to sustain viability. Information systems researchers can take each information domain provided in Table 15 and ensure it is included in the design of the information system. Information systems researchers can then use the table to ensure processes are developed within the information system that handle the management of each information domain as required by Table 15. For example, this research has highlighted that monitoring and control practices by S3 (ID5) require performance indicators (ID2) from S1. This is shown through Table 15 by ID2 being generated at S1 and then applied to S3. As a result, an information system process being developed for monitoring and control purposes needs to enable an input of performance indicators from those responsible for S1 in an organisation and for this information to be shared with those responsible at S3 of an organisation. It is accepted that each organisational information system will have extensive uniqueness in terms of the information content it generates and shares but, as the VSM and Table 15 are theoretically applicable to all organisations, the model does offer general guidance for information system development.

10.1.4 Viable Systems Modelling

There are 5 contributions that this research makes to VSM research. These are: demonstrating the VSM in action with project teams, adding to the discussion on viability, providing understanding of the information that needs to be managed within the VSM, understanding of the role that communication channels play in the VSM and adding new communication channels to help VSM effectively model the relationship between recursion levels. Each of these contributions to knowledge will be discussed below.

1. *Demonstrating the VSM in action with project teams:* The simplest contribution is that the research has provided the literature with more case studies demonstrating the VSM approach in action. Whilst the VSM literature already shows that the VSM has been successfully applied to a wide range of situations (as shown in Chapter 2), this research provides further evidence to support the method being a useful lens through which to identify problems in organisations. In particular, through the case study selection, this research has provided the literature with new knowledge about using the VSM to model project teams. Chapter 2 demonstrates that the VSM has been applied to mainly companies and that there is little currently in the literature about applying the VSM to project teams. Through the analysis of Project Teams A, B and C in Chapters 5-7, this research has shown that the VSM can be applied to project teams in the same way as with the more traditional company analyses to diagnose and design viable project teams.
2. *Adding to the discussion on viability:* Through using project teams as case studies, this research has also contributed to an important discussion within the VSM literature – the notion of viability. Viability has traditionally been defined as a system’s ability to maintain a separate existence and survive on its own (Beer, 1979). In Section 9.1, it was observed that this ‘viability’ – which is the key aspiration for VSM interventions – is actually a paradox for project teams which, by definition, are characterised by delineated start and end points (Cleland, 1999). Given that project teams deliberately plan for their own extinction right from their inception, this research questioned the appropriateness of the VSM for project team analysis. In Section 9.1, it was posited that, perhaps, viability for project teams could just be seen as survival *for the duration of their projects*. Due to project teams not receiving interest from VSM researchers, project team viability appears to be an undefined concept. However, the concept is

relevant because, as shown in Section 10.1.5, the VSM can be used as a tool for project management. As a result, this research contributes to knowledge by offering a working definition of project team viability:

project team ‘viability’ is the ability of a project team to survive and maintain a separate existence *for the duration of their projects*

This is classified as a working definition as Section 9.1 shows there are significant differences that arise in project teams due to their temporary nature compared to other organisations – with our current understanding of their impact on viability being limited. As a result, it is suggested that further research is necessary to strengthen our understanding of the paradox of project team viability.

Whilst the research posited that viability for project teams could be defined as above, this research identified another issue debated in the literature about viability in the VSM. It was shown in Section 2.1.4 that Jackson (1988) and Sutton (1995) have noted that social systems can still exist when not adhering to logical structures, including the VSM. As a result, there is an argument within the literature that viability is more about effectiveness and efficiency rather than survival (Yolles, 2005; Sutton, 1995). This research has added weight to this view through showing that Project Team C did not adhere to the VSM structure initially but still managed to survive – just not efficiently. Whilst this finding from Project Team C may not be strong enough to generalise out as a single case study, it does suggest that the viability debate needs to be returned to in order to examine what the VSM aspires to achieve and what it actually delivers.

3. *Providing understanding of the information that needs to be managed within the VSM:*
A major contribution of this research to the VSM research community has been to provide them with understanding of the information that needs to be managed within the VSM and where it should be managed. Achterbergh and Vriens (2002) had begun to help VSM researchers understand this, however, this research has developed their work further to increase our understanding of how the VSM manages information in real-world organisations. This contribution to knowledge has already been discussed in detail in the contributions to information management section (Section 10.1.1) above. However, this contribution is also relevant to VSM researchers and has shown VSM researchers how they can use the model to examine the role that information is playing

in organisations when conducting VSM analyses. This increases the powerful diagnostic and design capabilities of the VSM that were shown in Chapter 2.

4. *Understanding of the role that communication channels play in the VSM:* Since its creation by Beer (1979; 1981; 1985), literature on the specific communication structures present within the VSM is very limited. Through the literature review in Chapters 2 and 3, it was noted that applications of the VSM seem only to provide, at best, cursory discussion about the communication channels in their analysis, focusing much more on the problems within S1-5 than with the channels between them. As part of the analysis presented in Chapters 5-8, this research looked specifically at the communication channels in the four case studies. As discussed in Chapter 9, this research provides the literature with empirical evidence of the detailed information flows that communication channels handle to sustain viability in real-world organisations.

One finding made by this research was that the corporate intervention channel (communication channel D) is used differently in different VSMs. As discussed in detail in Section 9.2, project teams appeared to make much less use of this communication channel than the company did in this research. This is important as it shows that different systems use the communication channels in different ways. However, through many of the VSM analyses presented in the literature ignoring the communication channels in their analyses, these differences in communication channels are not being picked up. This could lead to a VSM analysis failing to identify a system using communication channels in a way that is acceptable for another system but not acceptable for that system. As a result of this research highlighting the importance of communication channels in VSM analyses, VSM researchers need to incorporate this element into their research if they are to fully understand the complex relationships between S1-5 in the VSM. The contribution to knowledge in this respect then has been to highlight to VSM researchers the importance of communication channels and the need for researchers to examine them in VSM analyses.

5. *Adding new communication channels to help VSM effectively model the relationship between recursion levels:* As highlighted in Chapter 2, Schwaninger (2004) claims that the VSM has never been falsified and this research certainly supports this for *one level of recursion*. However, as stated in Chapter 3, the VSM literature is limited in describing how information at one level of recursion in the VSM relates to other levels

of recursion. This research has contributed to knowledge in this respect through showing how the different recursion levels related to one another in the case studies presented in this research. Through doing so, this research has contributed to knowledge by highlighting deficiencies in the VSM in this respect and provided practical examples through the case studies of communication it fails to accurately model. The first deficiency identified in this research is that the VSM does not provide an explicit link between S4 of Level 1 and S2 of Level 0. This was identified in the Project Team C case study as being necessary for operational information to flow between the higher recursion level to the system-in-focus in terms of prior learning. These missing communication channels were described in greater detail in Section 9.3 and were shown in Figure 22. The second deficiency identified in this research is that the VSM fails to model how information is shared between *three or more levels of recursion*. This was identified in the Project Team A case study as being necessary for S1 unit feedback at recursion level 2 to be shared with S3 of recursion level 0. These missing communication channels were described in greater detail in Section 9.3 and were shown in Figure 23. The third deficiency identified in this research is that the VSM does not provide a detailed structure for information sharing to be carried out across communication channel B. This was identified in the Project Team B case study as being necessary for S1 units to share information with S4 units of different VSM models of the same level of recursion. These missing communication channels were described in greater detail in Section 9.3 and were shown in Figure 24. This research therefore extends the VSM and contributes to knowledge by providing the missing communication channels that this research has identified, as summarised in Figure 25:

Extended Communication Channels in the VSM

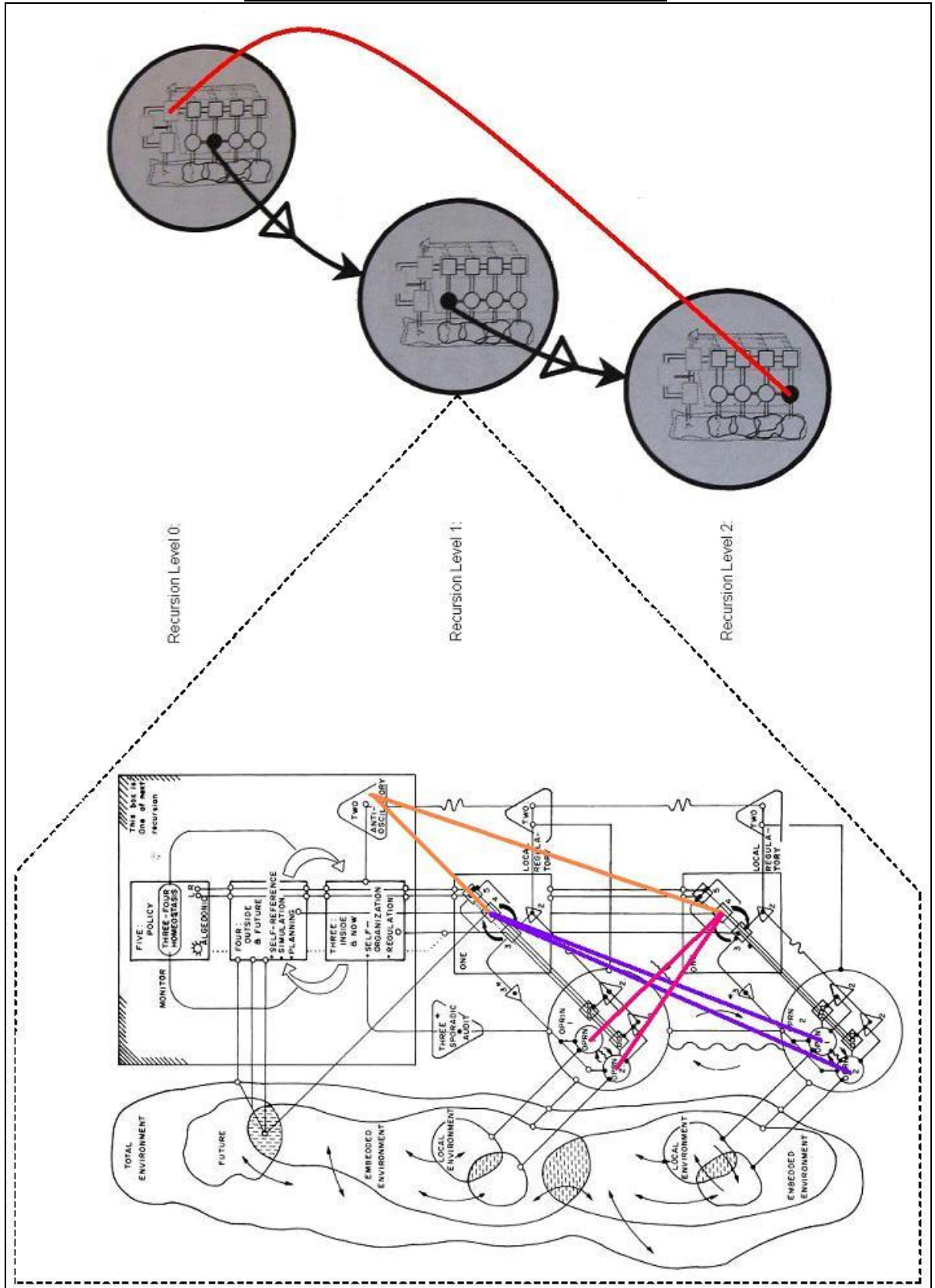


Figure 25 (Adapted from: Schwaninger, 2009, pp. 87; Beer, 1984, pp. 15)

10.1.5 Project Management

There is 1 contribution that this research makes to project management research. This is: providing researchers with a VSM approach to manage project teams. This contribution to knowledge will be discussed below.

1. *Providing researchers with a VSM approach to manage project teams:* As highlighted through the literature review in Chapter 2, the literature is very limited in terms of applying the VSM to project teams. As discussed in Section 9.1, this may be due to the narrow definition of viability which creates a paradox in project environments – i.e. that viability is seen as continued survival when project teams are characterised by delineated start and end points. However, this research has contributed to knowledge through finding significant similarities between the project management literature and the findings from the VSM analysis of the case studies. For example, the use of goals in project teams, the explanation of the project scoping process, the scheduling of activities, anti-oscillatory measures, etc. were all shown in Chapter 9 as commonalities between the project management literature and the VSM/extended theoretical model. As a result, this research has identified that the VSM, VSD process and the extended theoretical model approach is just as applicable to project teams as it is to any other type of organisation. The only difference between creating viability in project teams to that in other systems is that viability is only needed *for the duration of the project* (or *projects* if the project teams are engaged in multiple/subsequent projects). This research therefore contributes to knowledge through concluding that the VSM/VSD/extended theoretical model can be used by project managers to help build successful project teams through adherence to the model.

10.1.6 Practical Contribution

Before discussing the practical implications of the research, practitioners should be made aware that they may need to spend some time learning about the VSM before they can use it – it is quite difficult to just pick up the VSM and use. As stated by Espejo, Bowling and Hoverstadt (1999), the VSM is often regarded as a powerful tool but one that is difficult to use in practice. Certainly this has become apparent through the course of this research,

with the researcher often having to go back to the VSM literature to clarify aspects of the theory. However, it is the complexity of the model that gives it its very strong explanatory capabilities – to reduce its complexity would reduce its utility. However, this puts the approach at a disadvantage with time-constrained practitioners when compared to other approaches that are more intuitive, for example SSM with its rich pictures. However, the argument needs to be made that whilst practitioners may have to put more time in initially, they will ultimately benefit from the strong explanatory capabilities of the approach provided in this research.

In terms of practitioners actually learning the VSM, the different elements of the VSM are, perhaps, not too difficult to get to grips with. However, the issue for practitioners is that there are numerous subtleties in the VSM theory that means it can take a long time to feel confident in using it. Indeed, Beer (1979; 1981) wrote two large volumes providing the theory to VSM. Whilst many practitioners may struggle to find enough time to read these large volumes, it is further complicated by the fact that the books are written in a very academic and philosophical way. It would appear that Beer (1985) recognised this when he produced a book that describes itself as a handbook or managers guide to teach practitioners how to use the VSM. However, even this book struggles to shed the academic feel.

One of the ways in which this research has contributed to practitioners is to enable them to understand the VSM more easily. It has done this through Chapter 2 condensing the relevant theory needed to gain a strong understanding of the VSM. Whilst it is accepted that Chapter 2 does not go in to anywhere near as much detail as Beer (1979; 1981) does in his large volumes – the salient points needed to understand the VSM have been brought together in a much more easy to read format than Beer (1979; 1981; 1985) provided. This allows practitioners to more easily grasp the principles of VSM which are needed to understand how to successfully apply it.

Once the principles of VSM are understood, the VSD process by Flood and Jackson (1991) described in Section 2.2.4 provides a step-by-step process that turns the VSM from a model into an approach that can be followed by practitioners. However, these authors left practitioners with little guidance on how to “*check that all information channels, transducers and control loops are properly designed*” (Flood and Jackson, 1991, pp. 95). This research has aided practitioners by providing a structured approach to carrying out

this stage of the VSD process.

As a result, the core contribution to practice of the research is that it enables practitioners to diagnose information-related problems and design effective information management processes. In order to do this, practitioners should first carry out the VSD process described in Section 2.2.4 to build and analyse VSM models of the organisation they are seeking to diagnose information related problems and design their solutions in. Once this is done, the practitioner can then compare the information being managed in the organisation with how Table 15 suggests information should be managed. Through examining each information domain and where it is generated and shared in the organisation compared to the model, practitioners can identify where organisations are failing to manage their information effectively. Practitioners can then use Table 15 to design solutions that enable the organisation to manage information in the way the model suggests is necessary to maintain viability. Whilst the focus of this research was to empirically test the extended theoretical model in Table 5 to gain a stronger understanding of information management in the VSM, as part of the agreement for participants being involved in this research they were provided with a report detailing the results of the analysis undertaken on their project team/company. The reports provided to participants highlight the relevance to practice of the approach. For example, for Company A, at ID22 it was found that External Salespeople at S4 were supposed to fill out a Job Information Sheet for potential new jobs, which was a structured document to ensure that all the requirements of a job were captured as detailed in Section 8.2.1. This Job Information Sheet was then shared with S3 to work out whether to take the work on and to generate a quote. However, when reviewing ID22 it was found that not all External Salespeople would fill out a Job Information Sheet and instead would just write potential customers' requirements down on scrap pieces of paper – potentially missing required information through not having the structured approach of the Job Information Sheet. Company A were advised in their report that this may lead to extra conversations having to be held with customers to ascertain the required information or result in quotes being wrong through lack of necessary information. It was therefore highlighted to Company A that this could strain their dependability and so it was recommended they should tighten up this process. Additionally, as highlighted in Section 8.4.3, at ID11 the Production Manager would input scheduling information into tables in Microsoft Word on his computer to create production schedules. However, when reviewing ID11 it was found that the Production Manager did not always maintain the production schedule on the computer, instead keeping the information in his head.

Company A were advised in their report that this could lead to jobs being forgotten and it was therefore recommended that this process also be tightened up. For Project Team C, at ID4 it was found that the project team had not clearly defined what was expected in terms of the activities needed to be undertaken in the project. This was shown in Section 7.2.1 to impact upon a range of areas, such as allocating resources, considering innovation proposals, carrying out quality checks and undertaking measures to counter any deviance from project goals. Project Team C were therefore advised in their report that clear interim goals should be set at the start of projects.

These examples highlight the practical contribution of the approach developed in this research. The practical element of the research could also be taken further through undertaking future action research projects utilising the approach, as discussed along with other future directions this research could take in the next section.

10.2 Future Directions

Through conducting this research, the work has highlighted a number of potential areas for future research. These will now be considered in this section.

1. *Further research on the linkages between different information domains*

Chapter 9 highlighted that the findings showed high levels of dependency between different information domains in the case studies. A future direction for research would therefore be to explore the linkages between these different information domains to gain a stronger understanding of information flow in the VSM. This could then help managers to understand the impact that problems in one information domain could have on the rest of their organisation.

2. *Further research into combining the VSM and Table 15 with other systems thinking tools*

As identified in Chapter 9, the VSD and qualitative framework is limited only to situations where the purpose of the system can be agreed upon. As a result, further research may explore if combining the approach with another relevant tool, such as Soft Systems Methodology, can help overcome this and facilitate initial agreement on the purpose of the system before it is then analysed.

Chapter 9 also highlighted that a two-dimensional diagrammatic representation of phenomena, such as the VSM, can never fully capture the multidimensional complexity of reality (Brocklesby et al., 1995). As a result, combining the VSM and Table 15 with other systems thinking tools may help to mitigate this potential problem, through enabling the strengths of different systems thinking tools to compensate for the weaknesses of the VSM. This ‘total systems intervention’ approach of combining the strengths of systems thinking tools together has been advocated by Flood and Jackson (1991) and their work could provide the foundation for conducting this future research.

3. *Further research in to using the VSM and Table 15 to **prevent** information sharing*

If the VSM and Table 15 are assumed to provide the sufficient conditions for complete viable information management, future research may wish to examine how it could be reengineered to provide conditions that deliberately distort effective information flow. An example of this would be to increase information security in a military organisation, where the approach could be used to show which communication channels in the VSM need to be shut down to protect secret information from being shared to unauthorised areas.

4. *Further research on VSM communication channels*

A contribution of this research has been to extend our understanding of the role that communication channels play in sustaining viability in organisations. It was identified in Chapter 9 that this research highlighted a series of communication channels between recursion levels that are omitted in the VSM. Whilst these findings have begun to help us to understand how communication channels are used to sustain viability, it is based upon findings from only four case studies. Therefore, further research using different case studies may further increase our understanding of communication channels in the VSM.

5. *Further empirical research on Table 15*

As highlighted in Chapter 9, given the limited literature and empirical testing on information management in the VSM, Table 15 may be strengthened through further empirical research to establish its completeness. Through using case studies *similar* to those used in this research, and also using case studies that are from *different sectors*,

e.g. from the voluntary sector, this can further increase the confidence in the generalisability of the model.

Furthermore, as discussed in Chapter 3, the extended theoretical model is presented at the company level of recursion. Theoretically, this should not be an issue as the VSM is applicable in exactly the same way to every level of recursion. This was found to be the case in terms of the information domains themselves for both the company and project team recursion levels explored in this research. However, whilst the information domains themselves were found to be the same for the company and project team recursion levels in this research, there were differences found in the application of the information domains. For example, in Chapter 9 it was discussed that, whereas the company had formalised and explicated monitoring and control processes, the project teams did not. As a result, there may be differences between other recursion levels too and so to further increase the confidence in the generalisability of Table 15, further empirical research could be carried out using case studies from *other recursion levels*.

10.3 Summary

This chapter has highlighted the contributions made by the research, which include extending our understanding of the VSM, developing an empirically tested model to increase the diagnostic and design capabilities of the VSD process and increasing our understanding of the role that information plays in organisations. This chapter then highlighted some possible future directions that research in this area could take, including further empirical testing of Table 15, further research on combining the approach with other tools and also reengineering the VSM and Table 15 to increase information security.

The findings in this research offer useful insight into the role that information plays in viable systems. It is hoped that researchers can use these findings to structure future research on information in organisations. It is also hoped that these insights can be used by organisations to assist in their management of information, in order to make them more effective in the future.

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Appendix 1

Introduction

The purpose of this appendix is to show in detail each stage that was carried out for the analysis process described in Section 4.3. This appendix uses examples from actual data in this research to provide a richer description of the process than was possible to provide in Section 4.3. The examples provided here are taken from the Company A case study detailed in Chapter 8 but the same stages of analysis were also carried out in the same way for Project Teams A, B and C in this research.

Example Analysis

The first stage of microanalysis was to conduct open coding, involving the researcher going through each transcript and audio line-by-line to identify concepts and properties within the data (Strauss and Corbin, 1998) which were then segmented into common categories within the NVivo 8.0 software application. The concepts and properties that were relevant to this research were primarily those about information but also those about how the organisation was being run, for example the responsibilities, structure and processes within the business. As a result, data that related to the overall theme of the research being conducted was coded during this phase. For example, “*all the jobs [and] all the quotes are all on the [computer] system and there are various methods and ways of finding them*” from the Internal Salesperson 1 Interview data implies information was being stored and so was coded in NVivo 8.0. In this example, during the open coding phase this data was coded under the heading ‘sales information’.

Once open coding had taken place, the VSD process was undertaken as laid out in Table 3. The VSD process was initially used to build the VSM models by following the step-by-step process to firstly identify each system, establish its purpose and determine its wider context. The VSD process was then used to analyse each system in terms of S1 to S5 of the VSM by following each of the remaining steps detailed in Table 3. The VSD process for Company A has been summarised in Table 16:

VSD Process for Company A

System Identification:

- The system was identified as: a system to **provide print solutions** to customers.
- The system to achieve the purpose of providing print solutions was the Company A organisation and, as a result, the organisation system became the system-in-focus for this case study.
- S1 - the organisation defined their purpose as a *“supplier of design, print and associated services”*. In terms of print, the Design Studio Director stated that their customers were *“predominately they are people who are print customers”* who would *“supply their artwork on disk”* which the organisation would then print on their presses. In terms of design, the organisation had a design studio where the Design Artists would create artwork for clients as Company A *“also have a reasonable pot of, what I describe as end-users, who are actually coming to us for the origination, for the artwork as well as the print”*. In terms of associated services, the organisation had a small number of customers that they provided with *“technical support, consultancy, large format graphics, print management or general facilities management”* and also provided some *“training to individual staff members or groups”* in organisations. Therefore, for the organisation system to achieve its purpose of providing print solutions, it needed to undertake three main activities: design, print production and associated services and it is these activities that make up the S1 units of the VSM.
- S2 - there was a particularly high level of dependency between the Design and Print Production S1 units, as the designs that were created by Company A were used for the printwork. This dependency meant that it was important that S2 performed effectively to ensure the finalised artwork was received by the Print Production S1 unit on time. This S2 function took the form of *“production planning is conducted upon a day to day basis, making certain that all orders received for design/printing are placed into the system correctly to ensure that the customer’s delivery requirements are met”*. This role was carried out by the Production Co-ordinator who, upon receipt of an order, would *“book them in, get delivery dates, take them down into either the [Print Production] department if they’ve supplied a disk or down into the [Design] studio if they need artwork”*. This booking is then used to schedule the Design S1 unit to ensure that Design provides the work to the Print Production S1 unit on time, as *“the documentation that’s supplied with it has got all the deadlines for when the proof is required for, etc. – so basically that’s [the Design] running sheet then”*. The Production Co-ordinator would then ensure the Production Manager got *“a copy of [the order] and he’ll put it on to his schedule so I make sure he’s got that”*.
- S3 - the Managing Director took a very hands-on role in monitoring the Design and Print Production activities. The Managing Director said that they liked to walk around the factory very often to ask people what they were doing and where they had been, etc. The Managing Director said that *“people who work hard have no problem with it... [whilst] people who don’t work hard will try to avoid me”*. In one example, the Managing Director walked around the factory and had a discussion with an employee about a job and found out that he was just about to print the job on to the wrong type of paper. The Managing Director was also keen to use these walks around the factory to monitor that staff were working effectively and, in one example, said he noticed that one employee had been on a personal telephone call for a *“long time”* and that he was going to talk to the employee about it later on that day. In another example, the Managing Director walked around the factory and noticed some staff were absent, at which point he made a point of asking colleagues where these staff members were. The Production Co-ordinator also played an active role in S3 activities in terms of checking the schedules to ensure jobs were being delivered on time, *“I check them off against my delivery schedule, if there are any there that haven’t been delivered and I’ve still got them on schedule... then I’ll go and question them with [the Distribution Workers] – why haven’t they gone out?”*. The Accountant also produced *“management accounts at the end of the month”* to monitor the financial performance of the organisation. S3* also conducted audits for S3 in that if a customer complained about a job, the Production Co-ordinator would conduct an audit of what happened *“if a customer’s got a problem with a job, they’ll ring through [and] speak to me, I’ll go down and find out what’s happening with it or why it’s gone wrong”*.
- S4 - this activity can be broken down into two particular activities for Company A – sales and strategy. In terms of sales, the salespeople were responsible for generating sales through existing clients by *“try[ing] and develop[ing] them, look[ing] at a client and what we do for them at the moment, look[ing] at what we can offer them now that we couldn’t before and then try[ing] and get[ting] the client aware of that”*. Salespeople would also attempt *“making new contacts – cold calls”*. The Managing Director was also involved in generating new business

from larger organisations, “we do it very professionally, we can go out to them, put everything up on screen – [provide] half a dozen copies of a presentation, we tell them... all about us... on the bigger accounts [the Managing Director] does 70-80% of the presentations on the bigger companies that we’re going out to”. In terms of strategy, the Managing Director was the sole person responsible and was always looking to “implement the things so that we just continuously improve”. An example of the Managing Director carrying out S4 strategy activities was him “looking at a business at the moment to acquire” to extend the current production capabilities of Company A.

- S5 - the Managing Director was the sole person responsible for S5 activities. The other senior staff in their interviews showed that they really only concentrated on the day-to-day issues of running their departments. The Managing Director said that “we have done quite a lot of things [in the past year] – it is all totally driven by me” and he felt that other “people here struggle to take on management responsibilities”.

System Diagnosis:

- Study S1 of the system-in-focus:
 - Design - *Environment*: customers, suppliers, design technology, industry standards
Operations: elicit customer requirements, produce artwork design, seek customer approval and make amendments as necessary
Localised Management: Design Director
Constraints: design artwork must (approximately) meet time quoted for, design must meet customer requirements
Accountability: Design Director
Performance Indicators: customers accepting design artwork, design artwork completed on time, number of design errors going through to print
 - Print Production - *Environment*: customers, suppliers, print technology, industry standards
Operations: produce reprographic template, print artwork, conduct finishing to printwork (e.g. binding, cutting, folding, etc.) as required by customer
Localised Management: Production Manager, Production Co-ordinator
Constraints: printwork must use materials quoted for, printwork must meet customer requirements
Accountability: Production Manager
Performance Indicators: customers accepting printwork, printwork completed on time, number of jobs with print errors
 - Associated Services - *Environment*: customers, suppliers, technology, industry standards
Operations: technical support, consultancy, large format graphics, print management, general facilities management, training
Localised Management: Salespeople/Design Director/Production Manager
Constraints: associated services must meet time/cost quoted for, associated services must meet customer requirements
Accountability: Salespeople/Design Director/Production Manager
Performance Indicators: customer satisfaction
 - *model of S1 according to the VSM diagram*: see VSM diagram in Figure 21
- Study S2 of the system-in-focus:
 - *possible conflict*: design artwork not sent to print production in time
 - *harmonising elements*: Production Co-ordinator ensuring scheduling between Design S1 unit and Print Production S1 unit
 - *perception*: facilitating (Design Director and Production Manager rely on Production Co-ordinator for scheduling)
- Study S3 of the system-in-focus:
 - *control elements*: Managing Director, Production Co-ordinator, Accountant
 - *exercising authority*: Managing Director (has power to hire/fire) walks around organisation asking staff questions, Production Co-ordinator (has respect from other employees) checks schedules and questions anomalies, Accountant (reporting to Managing Director who has power) checks financial performance
 - *resource bargaining*: S1 units permitted to make small purchases or any materials approved needed for a job written in the quote without the need for a sign-off, large new purchases discussed by employees with Managing Director

- *responsibility for performance*: Managing Director
- *audit enquiries*: Production Co-ordinator investigates customer complaints
- *relationship between S3 and S1 units*: mainly autocratic
- Study S4 of the system-in-focus:
 - *S4 activities*: sales - email, telephone, cold calling, presentations, media, meetings with current clients
strategy - Managing Director attending conferences, networking, reading industry press
 - *how far ahead activities consider*: sales - short-term (mostly seeking current work customers require)
strategy - medium-term/long-term (technology/acquisitions)
 - *guarantee adaptation to the future*: yes, although need to address margins continuing to be squeezed
 - *monitoring environment and assessing trends*: sales - not good at developing new customers and limited success at developing current customers further
strategy - good at identifying technological innovation, less strong at reconciling that with customer desires (e.g. the research shows Company A did not identify that many of their customers do not want FTP, online ordering, etc.), good at identifying potential acquisitions/mergers
 - *open to novelty*: sales - no, routine work
strategy - yes, Managing Director very keen on innovative new ways of working
 - *environment for decision*: sales - salespeople, estimators and Managing Director (all in same two-room small office)
strategy - Managing Director only
 - *can S4 alert S5 urgently*: sales - yes, all in same small two-room office
strategy - yes, both are Managing Director
- Study S5 of the system-in-focus:
 - *who is involved*: Managing Director
 - *how they act*: very innovation driven, keen to expand, feels current staff are stuck in their ways
 - *does S5 provides a suitable identity*: yes, print-related services
 - *ethos of S5 affecting S4 perception*: as S5 is very innovation driven, S4 is held in very high regard
 - *ethos of S5 affecting S3/S4 relationship*: as S5 is very innovation driven, organisation is thinking more about the future than the present (S4 stronger)
 - *S5 sharing an identity with S1*: yes, although S5 is keen to extend capabilities beyond current S1 operations

Table 16

This VSD analysis was compared to the open coding by going through each coded piece of data to check if any processes that had been described in the data were present that the VSM had failed to model. In the case of Company A, the data did not show any other processes in the organisation that the VSM had failed to model. As a result, the VSM presented in Figure 21 was produced. This same VSD process as above was then repeated to create VSM models for the relevant recursion levels directly above and directly below the system-in-focus.

Axial coding was the second stage of the microanalysis, where categories identified in the first stage were related to higher-level categories (Strauss and Corbin, 1998). This stage was conducted using the extended theoretical model in Table 5, with the different information domains in Table 5 becoming these higher-level categories. The categories from the open coding phase were then assigned to the relevant information domains that described that type of information (according to the description of each information domain given in Chapter 3). Using the previous example of “*all the jobs [and] all the quotes are all on the [computer] system and there are various methods and ways of finding them*” from the Internal Salesperson 1 Interview data, ‘sales information’ became associated with the ‘operational information (ID10)’ category as the quote above referred to storing information that was used by the organisation in its operations.

However, during the open coding phase, data such as “*pop round and see people, perhaps have a cup of tea with them and say “oh, what have you got coming up?”*” from External Sales Person 2, discussing how they would generate sales leads, was also coded under the ‘sales information’ category. As a result, ‘sales information’ also became associated with the ‘developments in the relevant environment of the organisation (ID32)’ category as the quote above referred to how the organisation was scanning the environment looking for opportunities. For this reason, selective coding is the final stage of microanalysis, which is a stage where all of the levels of categories are integrated and refined (Strauss and Corbin, 1998) by the researcher refining all of the categories and removing any duplication. It was during this stage all of the data coded was refined to be categorised under one (or more) information domain codes from the extended theoretical table. Any data that had previously been coded in the open coding stage of the microanalysis that did not fit under one of these information domains represented a type of information that the extended theoretical model was unable to model – implying that the extended theoretical model required further extensions to be made to it. In the case of Company A this did not happen and so the extended theoretical model appeared to capture the information management aspects of the organisation. This same process was done for all of the VSM models built at different recursion levels that had been identified during the VSD process.

Once the microanalysis was completed, each information domain category in the extended theoretical model had quotes coded under it, as shown from the sample of quotes presented in the example in Table 17 **from recursion level 1** of Company A:

Sample of Quotes for ID32 for Company A Recursion Level 1

Code	Data
ID32: Developments in the relevant environment of the organisation	<ul style="list-style-type: none"> • “[initiating] a campaign on new business... we’re going to start cold calling... physically knocking on the door, sending mailers out and looking at databases” • “if I’m driving past somewhere and I think “oh, I’ve never called in there”, I will call in and leave a card and try and get somebody’s name to approach” • “you look in the newspapers or the yellow pages or the internet [or] just word of mouth” • “pop round and see people, perhaps have a cup of tea with them and say “oh, what have you got coming up?”” • “I try and pick two or three [clients] a week, where I try and develop them... [I] look at what we can offer them now that we couldn’t before and then try and get the client aware of that and thinking down those lines. Then every so often go back to the client and chase them up and say “have you had any thoughts on it, is it something we can take forward?” and that’s the way you grow the business really – keep going back to people and drum it into them that we can do more for them”

Table 17

As can be seen from Table 17, the categorisation process enabled the data to be structured according to the information domains the data represented. This was then used for the subsequent analysis which involved using the extended theoretical model presented in Table 5 to identify whether the information it states should be generated was actually generated at level 1 recursion. In the example of ‘developments in the relevant environment of the organisation (ID32)’, the extended theoretical model shows that this information should be developed at S4, as highlighted in Table 18:

ID32 in the Extended Theoretical Model

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
32	Developments in the relevant environment of the organisation						G, A	

Table 18

Through comparing the category of S4 from the VSD process detailed in Table 16, it can be seen that one of the activities S4 was responsible for was conducting sales through the approaches shown in Table 19:

S4 Activities in the VSD Process for Company A

<ul style="list-style-type: none"> • Study S4 of the system-in-focus: <ul style="list-style-type: none"> ○ S4 activities: sales - email, telephone, cold calling, presentations, media, meetings with current clients strategy - Managing Director attending conferences, networking, reading industry press
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Table 19

These activities mirror the quotes shown in Table 17 and so represent information from ID32 being generated at S4 in the VSM. This process was completed for all information domains to determine whether the extended theoretical model actually provided an adequate representation of the information present at level 1 recursion in order to address the first research question posed in Chapter 3: *What information is present within viable organisations at one level of recursion?*

Once this had been completed, the data coded under each information domain category was gone through again to identify any data that showed that the information was being shared. An example of data coded under an information domain concerning the sharing of information is provided in Table 20:

Sample of Quotes for ID11 for Company A Recursion Level 1

Code	Data
ID11: Anti-oscillatory measures	<ul style="list-style-type: none"> • <i>“production planning is conducted upon a day to day basis, making certain that all orders received for design/printing are placed into the system correctly to ensure that the customer’s delivery requirements are met”</i> • <i>“book them in, get delivery dates, take them down into either the [Print Production] department if they’ve supplied a disk or down into the [Design] studio if they need artwork”</i> • <i>“the documentation that’s supplied with it has got all the deadlines for when the proof is required for, etc. – so basically that’s [the Design] running sheet then”</i>

Table 20

The analysis then involved using the extended theoretical model presented in Table 5 to identify whether the information it states should be shared was actually shared at level 1 recursion in accordance with the model. In the example of ‘anti-oscillatory measures (ID11)’, the extended theoretical model shows that this information should be developed at S2 and shared with S1, as highlighted in Table 21:

ID11 in the Extended Theoretical Model

Identifier (ID)	Information Domains	Env	S1	S2	S3	S3*	S4	S5
11	Anti-oscillatory measures		A	G, A				

Table 21

Through examining the category of S2 from the VSD process detailed in Table 16, it had already been identified that anti-oscillation in the form of scheduling was being conducted at S2. As can be seen from the quotes in Table 20, this oscillation process involved

information flowing to Print Production and Design – which were both highlighted to be S1 units in the VSD process detailed in Table 16 – and so represented this information sharing between S2 and S1 taking place. This process was completed for all information domains to determine whether the extended theoretical model actually provided an adequate representation of the information shared at level 1 recursion in order to address the second research question posed in Chapter 3: *What information is shared within viable organisations at one level of recursion?*

As stated in Section 4.3.2, the information sharing found to occur at this stage was then checked against the communication channels at level 1 recursion in the VSM as detailed in Figure 13. To do this, the data representing information sharing in each information domain was compared to how the communication channels in the VSM were defined. For example, the anti-oscillatory measure (ID11) data in Table 20 shows that information flows directly from the person responsible for scheduling at S2 (in this case the Production Co-ordinator) and is taken directly “*down into either the [Print Production] department if they’ve supplied a disk or down into the [Design] studio if they need artwork*” – which were shown to be S1 units above. This direct flow of information is represented by communication channel C in Figure 13. This comparison was carried out for all of the information found to be shared in order to address the third research question posed in Chapter 3: *How does information sharing occur within viable organisations at one level of recursion?*

As detailed above, the VSD and microanalysis process were conducted for each of the other relevant recursion levels directly above and below the system-in-focus. Where evidence for information flowing between recursion levels was found in the data, it went through the same process as being open coded initially and then refined in comparison to the extended theoretical model information domains, as detailed previously. An example of a quote representing information sharing between recursion levels is presented in Table 22 from recursion level 2 (Design) of Company A:

Sample of Quotes for ID11 for Company A Recursion Level 2

Code	Data
ID11: Anti-oscillatory measures	“ <i>obviously the documentation [quote and job information sheet] that’s supplied with it has got all the deadlines when the proof’s required for, etc. – so basically that’s their running sheet then</i> ”

Table 22

As can be seen from the data in Table 22, the quote and job information sheet, previously identified as being generated at S2 of the level 1 VSM, were being used by ID11 at the level 2 VSM for scheduling design activities.

As before, any data that did not fit in to the information domains would be highlighted to show that the information domains in the extended theoretical model did not capture the information being shared between recursion levels. In the case of Company A this did not happen and so information domains in the extended theoretical model appeared to represent the types of information flowing between recursion levels. This process was completed for all information domains for all relevant models at different levels of recursion in order to address the fourth research question posed in Chapter 3: *What information is shared between different levels of recursion in viable organisations?*

The data coded in each of these information domains to represent information sharing between recursion levels was then examined to determine how this information sharing was taking place between recursion levels. For example, the data coded in Table 22 was shown to represent an information flow between S2 of the level 1 VSM and S2 at the level 2 VSM for scheduling design activities. This is represented on the VSM diagram in Figure 11 as the communication channels between S2 at level 1 and the two S2 units at level 2 on the diagram. This process was completed for all information domains for all relevant models at different levels of recursion in order to address the fifth and final research question posed in Chapter 3: *How does information sharing occur between different levels of recursion in viable organisations?*

Summary

Through the use of examples to provide richer descriptions than were possible in Section 4.3, this appendix has detailed each stage that was carried out for the analysis process described in Section 4.3. Whilst the examples provided here are taken from the Company A case study detailed in Chapter 8, it should be noted that the same stages of analysis were also carried out in the same way for Project Teams A, B and C in this research.