RHODES UNIVERSITY

Investigating the Problems Experienced by Virtual Team Members Engaged in Requirements Elicitation

THESIS

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DECLARATION

I acknowledge that all references are accurately recorded and that unless otherwise stated, all work herein is my own.

Upuli de Abrew

Abstract

The constant acceleration in the rate of technological innovation, and the ever growing emphasis on the importance of information for competition has seen organisations around the world strive for the technologies that give them global customer reach. One of the most pervasive technological innovations developed is the internet, and its unique quality of being able to draw people from across the world together in one virtual space has given birth to the concept of virtual teams. Organisations have seized the advantages of such virtual teams to give them the cost and time reductions they need to stay competitive in the global marketplace.

In the software industry, where product and service development is always a race against time, forward thinking software companies in the developed world have taken full advantage of the cost and time saving benefits that virtual teams have to offer. In addition, the rate of expansion of technology and software to support such teams is also growing exponentially, offering increasingly faster ways of virtual working.

Despite the immense advantages offered by such teams, South African software development companies do not seem to engage in distributed work to any great degree. The importance of this research rests on the belief that South African software development companies will be unable to avoid engaging in distributed software development if they are to achieve and maintain competitiveness in the global marketplace.

This research focuses on a sub-section of the software development process with a specific reference to South African software development. The requirements elicitation phase of software development is one of the initial stages of any software project. It is here that developers work with the users in order to identify requirements for the system to be built. It is acknowledged that other phases of distributed development also bring to bear their own problems, however, in the interests of scoping this research, only the requirements elicitation process is focused on.

The research shows that most techniques of requirements elicitation can be adapted for use within the virtual environment, although each technique has its share of advantages and disadvantages. In addition, virtual team members experience problems during their general, day-to-day interactions, many of these arising from the dependence on technology for communication and task performance.

The research identifies the problems in both categories, and develops a holistic model of virtual requirements elicitation to prevent or solve the problems experienced by virtual teams engaged in distributed requirements elicitation. The model is made up of three key frameworks, each of which prescribes actions to be taken to ensure the success of the virtual team within the requirements elicitation process. The model is verified through the testing of its critical success factors.

Certain aspects of the model were adapted based on the findings of the study, but it was confirmed that the rationale behind the model is sound, indicating that it has the potential to solve the problems of virtual RE when implemented.

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Glossary of Terms and Abbreviations

Glossary of Terms

Collaborative Technology: The communication hardware and software that supports communication and task performance between virtual team members.

Requirements Elicitation Technique: The framework to be used to elicit requirements from the stakeholders of the system to be developed.

Virtual: Jarvenpaa and Leidner (1998) note that the concept of virtual implies permeable interfaces and boundaries. Stead (1998:viii) quotes the University of Missouri web page (1996) as defining virtual as "being of, relating to or possessing a power of acting without the agency of matter. Being functionally or effectively but not formally of its kind." Stead (1998:viiii) further states that of where a team is virtual, the agency of matter is the team.

Virtual Team: Lipnack and Stamps (2000) and Aranda and Aranda (1997:23) contribute to the definition of a virtual team as being a group of people who work on a common project across space, time and organisational boundaries, with links strengthened by webs of communications technologies."

Virtual/Distributed Requirements Elicitation: The process of requirements elicitation implemented across a virtual interface.

Virtual/Distributed Requirements Elicitation Techniques: The implementation of frameworks for requirements elicitation across a virtual interface.

Abbreviations

CASE:	Computer Aided Software Engineering
DVC:	Desktop Videoconferencing
GSS:	Group Support Systems
JAD:	Joint Application Development
RAD:	Rapid Application Development
RE:	Requirements Elicitation
SDLC:	Systems Development Lifecycle
SRS:	Software Requirements Specification

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PART I

Introduction

Part I of this research introduces the research problem. This is accomplished by describing the research area, and showing how the research area relates to the research problem on a general level. This section also presents a summary of the results of the research, and explains the organisation of this thesis.

Chapter 1

Introduction

1.1 The Problem and its Setting

For centuries, change has been integral to human society. As technology advances, society adjusts, and today more than ever technology has become the catalyst for change everywhere. Advances in telecommunications technologies have changed the way in which people interact with each other. Hand-written letters that take days to reach their destination have been surpassed by electronic mail, which reaches the intended receiver in seconds. Pagers and cellular phones are becoming the norm rather than the exception. People can be contacted almost anywhere, at almost anytime; location is irrelevant.

Changes in technology also enable changes in the way in which business is conducted. Gates (1995:135) asserts that because the most efficient businesses have an advantage over their competitors, companies have an incentive to embrace technologies that make them more productive. Nowhere is this more pronounced than in the way in which the Internet has revolutionalised thousands of businesses across the globe.

The Internet is one of the most pervasive technologies ever developed, and has penetrated societies around the world at an astounding rate. Its size, complexity and pervasive nature, has ushered in a new era for telecommunications; making information available to anyone, anywhere in the world, quickly and efficiently. Organisations have seized the advantages of the Internet and other telecommunications technologies to conduct business faster, with more efficiency and with better service levels, by exchanging relevant information with their customers and partners. Information has become the basis for competition in the 21st century.

First developed for military use, the Internet has evolved from being a tool for the exchange of information to one for the exchange of ideas, and most recently, as a tool for collaborating on product and service development. Kimball and Carmichael (1997) explain that the most powerful quality of the Internet lies in its capacity to provide a place where groups of people can go to be together to engage in conversation. Within the last ten years or so, many organisations have tried to harness this unique quality in order to allow employees in different locations to work together as a team in developing products and services for company customers.

Teams are an ancient concept; for centuries, human society has been based on the operation of small groups, comprising members who work together for the collective benefit of the group, and society at large. Lipnack and Stamps (2000) describe the evolution of teams from the Nomadic Age of human society to the present Information Age.

In the Nomadic Age, the world's population was comprised mostly of hunter-gatherers who roamed the earth in small groups. History records that 10 to 12 thousand years ago, humans moved from hunting and gathering to herding and farming in the Agricultural Age. Hierarchical groups were first formed during the Agricultural Age. The Industrial Revolution brought the Industrial Age in the 18^{th} century, where factories replaced farms, and there was a mass exodus of people moving out of the rural areas and into the cities where the factories were located. Organisational groups were first formed here, although they were very different to the present day concept of teams.

The building of factories and the resulting growth in the importance of business lead to competition between companies involved in the same manufacturing industry. Competition was based around providing a new or improved product, manufactured at high quality and at a low cost. In the twentieth century, it became apparent that all competitive companies possessed the technology to provide the quality and low cost that consumers were looking for. It was obvious that a new competition strategy was required. In the mid-twentieth century, service became the key criteria for competition. High levels of service depended on the availability of information - about the customer, and for the customer. It also depended on the exchange of information with partners outside the organisation. The growing importance of information gave birth to the Information Age.

Lipnack *et al* (2000) describe the Information Age as being the newest era of small groups, which has brought with it the "turbulence of transition." They further explain that human society is now deep into the age of information based, electronically enhanced groups connected through boundary spanning networks.

The emphasis on information for competition has lead to an exponential growth in the demand for the technology that can make this information available to those inside and outside the organisation. This technology takes the form of hardware, software, operating systems and networks. The technology and the people in an organisation are combined together in an organisation to form an information system. More formally, O'Brien (1999:9) defines an information system as an organized collection of people, hardware, software, communications networks and data resources that collects, transforms and disseminates information in an organisation. Laudon and Laudon (1998:4) add that this information is used for the purpose of facilitating planning, controlling, coordination, analysis and decision making in businesses and other organisations. Information systems are therefore an important aspect of businesses, and as a result there is a great need for organisations to acquire information systems that are uniquely tailored to their specific information needs.

In order to acquire uniquely tailored information systems, companies must define the systems development projects that will lead to the construction of the information system. Fertuck (1995:5) states that the process of developing a system is divided into seven stages, which together constitute the systems development lifecycle (SDLC). These stages are illustrated in Figure 1.1.

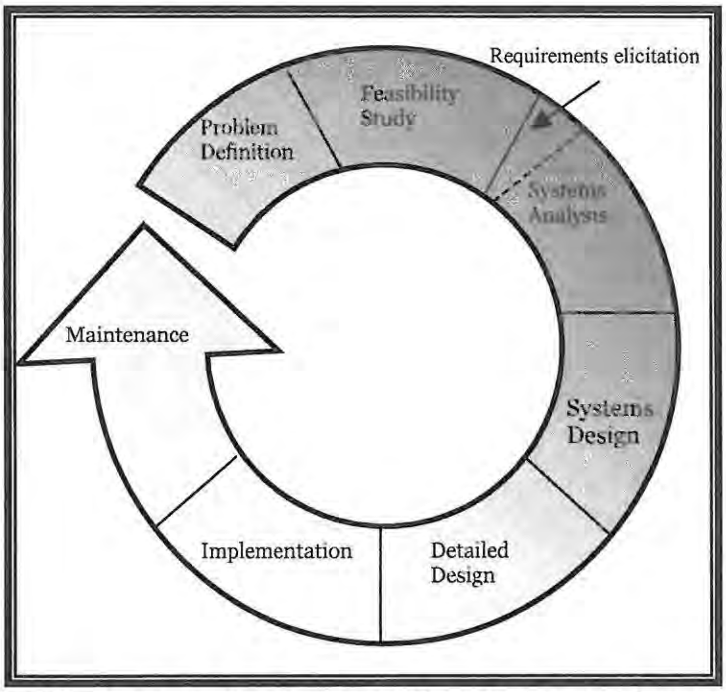

Figure 1.1: Stages of the Systems Development Lifecycle *[Adapted from O'Brien (1999:91)]*

Once it has been decided that the system is feasible, the software developers must engage in systems analysis in order to elicit the unique requirements of the people who will be using the system. Consequently, as shown in Figure 1.1, the Requirements Elicitation (RE) process is an integral sub-stage of the systems analysis stage of the SDLC.

O'Brien (1999:96) suggests that RE is one of the most difficult stages of the lifecycle. This is well supported by Sommerville (1997:80) who states that the acceptability of the system after it has been delivered depends on how well it meets the customer's needs and supports the work to be automated. If the analyst does not discover the customer's real requirements, the delivered system is unlikely to meet their expectations. It is generally accepted by most authors that RE involves the system developers working with the end users as a group to elicit the necessary requirements for the information system to be developed.

As described previously, organisational groups have changed significantly over the last 20 years because of changes in organisations and the nature of the work they do. Today's organisations are widely distributed across geographical distances and industries. The birth of the Information Age means that people, (both inside and outside the organisation) and the knowledge and information accumulated by their formal and informal learning experiences, are seen as major organisational assets, sometimes *the* major organisational asset. Kimball (1997) asserts that there is a new emphasis on knowledge management, which prescribes harvesting the learning of members of the organisation so that knowledge is available to the whole organisation. Windsor (2000) adds that organisations have moved to knowledge management as a basis for competitive advantage.

The importance of information within the Information Age, and the free availability of such information has led to increased global competition and collaboration, or globalisation., Newell, Pan, Galliers and Huang (2001:75) articulate globalisation as being a key issue for many businesses in the 21st century, as firms are increasingly addressing the multifaceted challenges of global competition, global market and global co-ordinations. In a bid to address these challenges, Newell *et al* (2001:75) rationalize that many firms are turning to technology to "enable new organisational forms in a bid to overcome the twin tyrannies of spatial and temporal dislocation that impede global reach."

Kimball (1997) affirms that the challenges of globalisation and the perceived impact of technology in addressing the challenges has changed how teams are formed and how they operate, in particular, with respect to the location of the team members. Teams have evolved beyond geographical constraints to possessing organizationally and geographically distributed membership, supported by technology as the primary means for task performance and communication.

Such teams are known as distributed teams or virtual teams. According to Lipnack *et al* (2000), a virtual (distributed) team can be defined as a team that works across space, time and organisational boundaries, with links strengthened by webs of communications technologies.

The software industry is uniquely positioned to take advantage of the opportunities offered by such a method of dispersed work. The systems development lifecycle prescribes the use of teams for software development. More so, the ability to build a team consisting of members from all over the country, continent or world offers many advantages. These advantages have inspired the software industry in the first world to embrace the idea of virtual teams, and many large software companies (Lotus, Microsoft and Sun Microsystems) have established virtual teams for software development projects. However, very few South African software development companies use dispersed development, although virtual teams are used in other areas, such as policy formulation. The importance of this paper rests on the belief that South Africans will be unable to avoid engaging in distributed development in the future because numerous, unchallengeable reasons exist for using dispersed software development. Mclaughlin (1995) and Carmel (2000) mention several reasons for engaging in dispersed development using virtual teams as listed below:

1. Companies are able to employ the best developers in the world, regardless of their geographic location.
2. Companies can take advantage of cheaper development (labour cost) in the third world
3. Parts of a project can easily be sub-contracted or outsourced.
4. A dispersed project can be worked on around the clock, thus collapsing time to market.
5. Certain team members (such as working mothers) are able to work from home.
6. One physical location may not be enough to contain all staff required for the project.
7. It might be prohibitively expensive to relocate staff.

Although these reasons (amongst others) are a great motivating factor in the move to dispersed software development, virtual teams often experience several problems both with the *process* of moving from traditional to distributed software development and with the virtual environment itself once the move has been achieved. The problems caused by the process of moving to the new environment are those that are common to most situations where people have to change over from old ways of working with which they are comfortable, to new and foreign ways of working.

There are also problems specific to working in the distributed environment, and these will be experienced once the move to the distributed environment has already taken place. Kimball (1997b) and Carmel (1999) state that the most common problems are communication problems, cultural differences, establishing a team culture, time zone differences, identifying and playing out roles, management and co-ordination of the team, the difficulty of instilling a sense of belonging in all team members, and lack of project visibility. Finally, there are problems specific to each phase of the SDLC, resulting from the techniques used or implemented within each phase, which may be experienced by the virtual team members as they move through the project's lifecycle. Problems in this final category, it is believed should be most concentrated in the phases of the SDLC where the most human interaction traditionally takes place. A great deal of interaction between team members and between team members and users occurs in the RE phase of development, as it is here that users and developers work together to discover requirements for the new system.

Therefore, this research aims to examine how RE can be performed in a virtual environment and the problems may be experienced by virtual teams engaged in RE in order to develop solutions to these problems to form the foundation of a model of virtual RE.

The value of this work lies in the many advantages offered by the use of virtual teams (mentioned previously) when they are used optimally. There is a vast quantity of literature on the subject of virtual teams and the challenges and problems they must face as a result of their virtual nature, as well as several solutions to these challenges and problems. However, most of the literature surrounding the subject concentrates on certain aspects of the virtual team rather than viewing it holistically. In addition, there is little literature on the subject of virtual RE and the specific problems experienced in this area.

This research aims to develop a holistic model of virtual RE, by identifying problems and developing solutions specific to the implementation of RE techniques as well as those that are general to any virtual team. It is believed that such a holistic model can provide great opportunities for the South African software development industry if implemented properly, and alongside models for other phases of distributed development. Certain aspects of the model can be applied not only to RE but also to other areas of work where people work as members of virtual teams.

1.2 The Statement of the Problem

This study investigates the problems experienced by selected South African information systems professionals engaged in distributed requirements elicitation and other areas of virtual work in order to develop a holistic model of virtual requirements elicitation to solve these problems.

1.2.1 The Statement of the Sub-problems

1. Identify and examine how the RE phase (and the RE techniques) of software development can be adapted for use within the virtual environment.
2. Identify and examine the problems experienced by virtual team members engaged in distributed RE.
3. Identify and examine solutions to the problems experienced by virtual software development team members engaged in distributed RE.
4. Develop a model of distributed RE based on the solutions to the problems experienced by virtual teams engaged in distributed RE.
5. Verify critical aspects of the model of distributed RE by the use of an empirical study.
6. Modify the theoretical model of RE to reflect practical application according to the information gathered from the survey.

1.3 Scope of Research

1.3.1 Hypotheses

The hypotheses to be tested within the research are derived from the theoretical model of RE which is developed in the course of the research. Therefore, the hypotheses are identified and described in Chapter 8 of this thesis.

1.3.2 Delimitations

In order to intensify the scope of this study, it was found necessary to focus on a specific aspect of software development. In this case, the author chose the RE phase of software development, as it is one of the first phases of any SDLC, and is also the phase where developers and users interact the most, and would therefore be the most challenging for a team where most members are geographically distributed. Therefore, virtual team activities and problems within other phases of software development are not discussed in this research.

To further scope the study, it was decided that process problems (that is, those problems regarding the initial move to the virtual environment) would not be examined. Therefore, the two categories of "problems" referred to in this study are firstly, the general problems experienced by any virtual team, and secondly, those specific to the implementation of RE techniques in the virtual environment.

Finally, further scoping occurred by examining only three major techniques of RE (Joint Application Development, interviews and questionnaires) in detail in this study. Other RE techniques are discussed, but these three are considered to be the most frequently used and therefore the most important techniques of RE.

1.3.3 Assumptions

"Virtual Team" in the context of this research refers to the members of the development organisation who are involved in the RE process. Although it is acknowledged that the process of RE necessitates the participation of the developers and the users, developer-user interaction occurs mainly during the implementation of the RE techniques. Conversely, the members of the development organisation interact on a day-to-day basis in order to develop an SRS.

Some or all of the users involved in the RE techniques are geographically distributed.

The three major techniques of RE are JAD, interviews and questionnaires.

RE is always performed for any software development project.

Cost is not considered to be a major issue in terms of the implementation of the technology.

1.4 Summary of Results

The main contribution of this work lies in the development of a holistic model of virtual RE aimed at overcoming the problems experienced by software development teams engaged in distributed RE. In order to develop such a model, a literature review was conducted to examine the traditional techniques of RE, their adaptation into the virtual environment, virtual teams, and the problems experienced by virtual teams engaged in RE. Solutions to these problems were also proposed.

It was found that most RE techniques can be adapted for use in the virtual environment, although there are several disadvantages associated with such an adaptation. Similarly, an analysis of the literature reveals that although virtual teams provide many benefits, they are also prone to several problems as a result of their dependence on technology for intra-team interaction, These problems were classified as general interaction problems of virtual teams, and were further divided into two categories: problems within the social dimension, and problems within the task dimension.

The literature review also revealed solutions or partial solutions to many of these problems, and these solutions were incorporated into the holistic model of virtual RE. The model is composed of three major frameworks or framework sets:

1. Initial interactions framework: addresses all the activities at the initial, set up phase of the team.
2. Ongoing interactions framework: addresses all the interactions of the team throughout the lifecycle of the team.
3. RE frameworks: consists of frameworks for the implementation of JAD, interviews and questionnaires.

An outline of the principal aspects of each framework revealed that there were several factors that were most important to the success of the component to which the framework relates. These factors were collectively defined as critical success factors (CSFs) for a virtual team engaged in RE. The importance of the CSFs was tested through the use of an empirical study, which confirmed the majority of the CSFs, sometimes subject to modification. The confirmation of these CSFs represent the results of the empirical study, and they are listed below:

1. Place a development team representative at the user site to promote trust, clarity and commitment from user and development sides.

2. Hold an initial face-to-face team building session in order to lay strong foundations for trust and bonding within the virtual team.
3. Hold frequent team building sessions in order to reinforce trust and relationships within the team.
4. Standardise communication and task performance technology in order to minimise co-ordination and integration problems.
5. Ensure informal interaction takes place between team members in order to promote trust, social bonding, a sense of belonging to the team, social satisfaction regarding relationships within the team, motivation and responsibility.
6. Ensure that team members suggest and implement team forums for informal interaction that will encourage all team members to participate in such informal interactions.
7. Address the following issues in detail only at the initial team building session in order to ensure the success of the virtual team: definition of roles and responsibilities and clarity of processes for task performance and communication. Also lay the foundation for social bonding and relationship building and open an ongoing discussion of reward and recognition structures in order to ensure the success of the team.
8. Address the following issues in more detail at the ongoing team building sessions than the initial team building session in order to ensure the success of the virtual team: social bonding and relationship building and reward and recognition structures.
9. Address the following issues in detail at both the initial and ongoing team building sessions in order to ensure the success of the virtual team: clarity of participation, trust, co-ordination of work logistics and leadership issues.
10. Implement a formal process for dealing with technological problems in order to minimise the problems of frustration and general misunderstandings and to ensure a seamless environment for virtual communications and task performance over which team members are able to work transparently, and with a focus on the content of their work and communications rather than the technology.
11. Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings.
12. Provide training in communications styles in a virtual environment in order to minimise frustration, delays in task co-ordination, delays in task performance and problems caused by general message misunderstandings.
13. Ensure that the following are maintained in a videoconferencing JAD session in order to assure the success of the JAD sessions: three or fewer individual sites, an explicit form of

non verbal communication, a different emphasis on facilitation skills, maintenance of effective group dynamics and an explicit back channel of communications

The confirmation of the CSFs, with or without modification, indicates that the rationale behind the development of the holistic model of RE is sound, although the model itself can only be validated through implementation and empirical testing in the virtual RE environment.

1.5 Thesis Organisation

This thesis is organised into four main sections. Part I (Chapter 1) describes the research by introducing the area under study and the research problem and sub-problems. Part II (Chapters 2 to 5) is concerned with the identification of the problems experienced by virtual teams engaged in RE, and Part III (Chapters 6 and 7) propose solutions to these problems, culminating in a holistic model of virtual requirements elicitation. Part IV (Chapters 8 and 9) describes the empirical study focused on the testing of various critical success factors derived from the model. Part V (Chapter 10) discusses the findings of the empirical study with respect to the model. Part VI (Chapter 11) concludes the research and introduces the appendices.

Chapter 1: Introduction

The research area and the specific problem under investigation are introduced by providing contextual background information, and the rationale for conducting the research. The specific areas to be examined are illustrated by the division of the research problem into several sub-problems. The assumptions under which the research is conducted, the delimitations of the research, a summary of results and a discussion of the thesis organization are also contained within this chapter.

Chapter 2: Introduction to RE

The RE process is defined and described in terms of its place within the Systems Development Lifecycle, and its constituent parts. The importance of collecting collect requirements, the participants in the RE process, the output of the RE process and critical success factors for the execution of this process are examined in this chapter.

Chapter 3: Traditional Techniques of RE

Various techniques of RE are introduced and discussed in terms of a comprehensive framework, which illustrates how to plan, design and implement each technique. The focus of this chapter is on three principal techniques of RE, namely, Joint Application Development, interviews and questionnaires. Other techniques are also discussed in less detail.

Chapter 4: Virtual Teams

The concept of virtual teams is discussed in terms of their evolution, their use in the software industry, their use of collaborative technology and their advantages. Subsequently, the chapter articulates and assesses the general problems experienced by virtual teams. These problems are divided into problems with respect to social and task interactions of virtual team members.

Chapter 5: Virtual RE

This chapter demonstrates the adaptation of the three principal techniques of RE for use in the virtual environment. Once again, the techniques are evaluated in terms of a comprehensive framework, which illustrates the collaborative technology to be used for each technique, the preparation for and implementation of the technique, and various problems that virtual team members may experience when using these techniques.

Chapter 6: The Problems and their Solutions

The problems experienced by virtual teams engaged in RE are reviewed. The problems are categorized as general problems experienced by virtual team members, and problems specific to the implementation of the RE techniques. Solutions to the problems in both categories are discussed and analysed in detail.

Chapter 7: A Holistic Model of RE

A model of virtual RE is developed to overcome the problems experienced by virtual teams engaged in RE. The model is represented diagrammatically and each component of the model is discussed in detail. Critical success factors derived from the model are detailed.

Chapter 8: Description of the Empirical Study

The purpose of the empirical study is explained, and the process that was undertaken to achieve this purpose is detailed in this chapter. The hypotheses to be tested within the study are portrayed here, and their relationship to the critical success factors is discussed. The focus of the study, the design of the study and the research methodology used are described and the rationale for their selection is discussed. The research instrument (questionnaire) is described and discussed, and the statistical techniques to be used on the data gathered are explained.

Chapter 9: Research Findings

The data gathered in the empirical study is described, and the results of the tests applied to the data are highlighted. The results of the tests are applied to the hypotheses, and the acceptance or rejection of each null hypothesis is expressed.

Chapter 10: Discussion of Findings and Recommendations

The results of the hypothesis tests are used to validate or adapt the critical success factors. Recommendations based on the validation and adaptation of the critical success factors and results of other tests performed on the data are expressed.

Chapter 11: Conclusion

The research undertaken is summarised, and the contributions of the research are indicated. Finally, areas of future research are examined briefly.

Appendices

Various supporting documentation is contained within the appendices.

PART II

The Problems Experienced by Virtual Team Members Engaged in RE

The aim of this section is to identify a comprehensive list of problems experienced by virtual teams engaged in requirements elicitation.

The process of RE is examined briefly, followed by an in depth analysis of the techniques of requirements elicitation. Several techniques are discussed, although the principal focus is on the three most widely used techniques of RE, namely, JAD, interviews and questionnaires.

The adaptation of these techniques into the virtual environment is discussed in detail, with a specific focus on the technology required and the developer-user interactions which occur during the implementation of the techniques. The technology dependent nature of the techniques, and the new paradigm of interaction styles required means that participants experience several problems within the technique implementations. The problems are discussed in terms of the virtual RE techniques to which they relate.

The concept of virtual teams is introduced, and the advantages of using such teams are discussed in detail. Despite these advantages, however, it is revealed that there are several problems to which virtual teams are prone, many of them arising from the dependence on technology for task performance and communication. These problems are identified and discussed within the realms of the task and social dimensions of virtual team interactions.

Chapter 2

Introduction to Requirements Elicitation

2.1 Introduction

In the previous chapter, it was noted that RE is a sub-stage of the systems analysis phase of the SDLC. It was also emphasised that RE necessitates the equal participation of both system users and systems analysts in order to ensure that a correct and complete set of system requirements are defined. This section aims to expand on the initial definition of RE offered in the previous chapter, in order to provide the reader with a high level view of the elements of the process.

2.2 Definition of a Requirement

According to Shelly, Cashman and Rosenblatt (1998:3), a system requirement is a characteristic or feature that must be included in an information system in order for the system to be acceptable to end-users. Jordon and Machesky (1990:21) add to this definition by stating that requirements are the features of the system components necessary to achieve the system objectives within the constraints. Requirements are statements about data, procedures and people. Kotonya and Sommerville (1998:7) describe five different classes of requirements:

1. A user level facility (for example, a word processor must include a spell checking and correction command).
2. A very general system property (for example, the system must ensure that personal information is never made available without authorization).

3. A specific constraint on the system (for example, the sensor must be polled ten times per second).
4. How to carry out some computation (for example, the overall mark is calculated by adding the student examination, project and coursework marks based on the following formula….).
5. A constraint on the development of the system (for example, the system must be developed using Visual Basic).

Satzinger, Jackson and Burd (2000:98) also state that requirements can be either functional requirements or technical requirements. They go on to say that functional requirements are the activities that the system must perform – that is, the business uses to which the system will be put. These requirements are based on the procedures and business rules that the organisation uses to run its business. Shelly *et al* (1998:3.6) define five classes of functional requirements, most of which fall under Kotonya *et al*'s (1998:87) user level facility category. The reason for this is that user level facilities are the system's functional requirements, as these are the activities that the user requires the system to carry out. Therefore, Shelly *et al* (1998:3.6) declare that functional requirements can be about outputs, inputs, processes, timing and controls. Satzinger *et al* (2000:99) report that technical requirements are all the operational objectives related to the environment, hardware, and software of the organisation.

2.3 The Importance of Correct Requirements

Kotonya *et al* (1998:8) explain that there are a number of consequences that can arise when the system requirements are wrong.

1. The system may be delivered late and cost more than originally expected.
2. The customer and end-users are not satisfied with the system. They may not use its facilities or may even decide to abandon it altogether.
3. The system may be unreliable in use, with regular system errors and crashes disrupting normal operation.
4. If the erroneous system is employed, the costs of maintaining and evolving the system are usually very high.
5. Hawryszkiewycz (1998:82) adds that wrong requirements could impact heavily on critical systems such as medical systems (e.g. life support systems). A malfunction due to incorrect requirements could conceivably lead to the loss of lives.

6. Boehm (1981) as cited by Vat (2000:26) in a survey of 63 software development projects, determined the ranges in cost for errors created by false assumptions in the requirements phase but not detected until later phases. It was found that the cost of fixing errors at later stages could be up to 1000 times more than the cost of fixing the same errors at the RE phase, had they been detected earlier.

These points highlight the critical importance of identifying a correct and complete set of requirements for the proposed system.

2.4 The Process of Requirements Elicitation

Kotonya *et al* (1998:53) record that Requirements Elicitation (RE) is the usual name given to activities involved in discovering the requirements of the system. Whitten and Bentley (1999:623) also refer to the RE process as the fact-finding phase of systems development. During this phase, system developers and engineers work with customers and end-users to find out about the problem to be solved, the services that the system must provide, the required performance of the system, hardware and software constraints and environmental factors which may impact the system. Kotonya *et al* (1998:53) go on to say that there are four dimensions to RE, as shown in Figure 2.1.

Application domain knowledge is knowledge of the general area in which the system is to be implemented. O'Brien (1999:96) refers to this as an organisational analysis. He further elucidates that one cannot produce a new or improved system for the business if one is not aware of the organisational environment. This component of requirements elicitation is concerned with learning about the organisation, the management structures, the people, the business activities and the environmental systems.

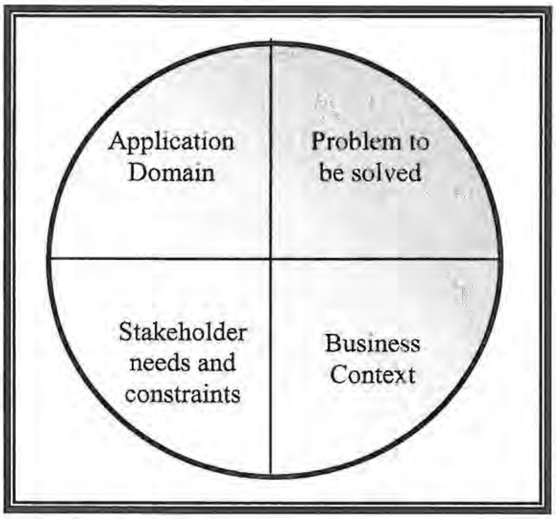

Figure 2.1: Components of Requirements Elicitation *[Adapted from Kotonya et al (1998:55)]*

Kotonya *et al* (2000:55) assert that the details of the specific customer problem where the system will be applied must be understood in the second component of RE. They further state that during problem understanding, the development team specialises and extends general domain knowledge. During this component, Dennis and Wixom (2000:92) and O'Brien (1999:96) recommend that the present system (if any) should also be analysed. The present system may be computerised or non-computerised. Whichever the case, it is important to study the existing system in order to understand its strengths and weaknesses. O'Brien (1999:96) cautions that there is often a temptation to focus only on what the users want in the new system rather than understanding the present system, but he warns that this can be dangerous. Without an understanding of the present system, it is difficult to really understand users' requirements.

Kotonya *et al* (2000:55) contend that systems are generally intended to contribute in some way to the development of a business or organisation. The third component of RE, business understanding, requires developers to understand how such systems interact and affect the different parts of the business and how they can contribute to overall business goals.

There is also a need to understand the needs and constraints of the system stakeholders. Stakeholders are the people who are affected in some way by the system. In this final component of RE, the functional requirements for the system will be identified. Kotonya *et al* (2000:55) explain that developers must understand users' specific needs for system support in their work. O'Brien (1999:97) declares that user interface requirements, processing requirements, storage requirements and control requirements are defined here.

2.5 Participants in the Requirements Elicitation Process

Satzinger *et al* (2000:99) sustain that the primary source of information for functional requirements is the stakeholders of the new system. Stakeholders are all those people who have an interest in the successful implementation of the system. According to Satzinger *et al* (2000:99), stakeholders can be categorized into one of three groups:

1. Users who use the system on a daily basis
2. Clients who pay for and own the system
3. Technical staff who must ensure that the system operates in the computing environment of the organisation.

The author feels that it is necessary to include a fourth group, namely, managers, as these people may not use the system directly, but will have a vested interest in the performance of the system as it will affect tactical and strategic planning.

In addition, Information Systems staff from the systems development organisation are also involved in the RE process. The systems staff fall into the following categories:

1. Analysts
2. Designers
3. Programmers

The analyst is the key member of the development team at this phase of the project, as it is his/her job to glean the requirements from the users and to represent them correctly, completely and unambiguously in the SRS.

Finally, most RE meetings also require facilitators, who often come from the systems development organisation, but should ideally be from an outside entity (e.g. a consulting company) in order to ensure neutrality.

2.6 The Requirements Specification

The RE process should result in a complete, comprehensive and accurate set of functional and technical requirements that define what the features of the new system will be. These requirements are noted in a Software Requirements Specification (SRS) document, which is then signed off by the client, thus signaling the end of the analysis phase of the SDLC. This SRS document serves as the input to the next phase (design) of the SDLC.

The SRS must be a clear and unambiguous blueprint for the system, as the system designers may not be the same people who were involved in the RE process. Another important reason for a non-ambiguous requirements specification is that the system may eventually need to be modified by people who were not involved in its development in any way. A clear SRS will ensure that the people who modify the system will be aware of the original user requirements, thereby ascertaining that they do not delete or unknowingly edit an important part of the system.

Sommerville (1989:58) and Davis (1990:184) as cited by Vat (2000:25) describe the important characteristics of an SRS as being:

- correct – every requirement stated in the SRS represents something required of the system to be built;
- unambiguous – every requirement stated in the SRS has only one interpretation;
- complete – everything the software is supposed to do is defined, the definitions of the responses of the software to all input data is defined, and all word processing is complete;
- verifiable – there is a means by which the software can be checked to determine whether or not every requirement is met;
- consistent – no subsets of individual requirements conflict;
- valid – requirements are stated in such a way that the design may be validated;
- understandable by non-computer specialists.

These facts highlight the need for clear and precise communication through the SRS. The specification is produced for the use of the client, system users and system developers, and therefore it is important that a common language is used within the document.

2.6.1 Modelling Requirements

Hawryszkiewycz (1998:84) explains that people use a language that suits their world. Users talk about their problem domain (e.g. how to manage bank transactions and make decisions). Hawryskiewycz (1998:84) calls this the usage world. Conversely, developers talk about the development world, which includes computer systems and how to go about building them. During the RE process, it is imperative that these two worlds be brought together in order to ensure that the correct requirements are identified. In order to do this, the language of one world must be translated to that of the other in a clear and unambiguous way.

The requirements for the system must be represented in a lucid fashion that everyone involved in the systems development process can understand. There are various means of representing requirements, one of the most widely used being data modeling techniques. Satzinger *et al* (2000:128) assert that the requirements for an information system can best be described by using a collection of models. In the context of information systems, a model can be defined as a representation of some aspect of the system being built (Satzinger *et al* (2000:128)).

Analysts use data flow diagrams to model business processes, entity relationship diagrams to model the objects (tangible or abstract) about which the users wish to store information, activity hierarchies to explain the activities that users go through when performing their business functions, and even system prototypes to show users what their system will look like. Detailed descriptions and explanations of each modeling technique are outside the scope of this research, however, it is important to note that model building is an integral part of the RE process.

2.7 Critical Success Factors for Requirements Elicitation

The preceding sections provided background information regarding the RE process. It is important to remember that successful RE does not simply "happen." Several important factors must be taken into account when implementing a successful RE process. Vat (2000:29) identifies some key factors that need attention during the RE phase of a systems development project in order to ensure that an accurate SRS is produced and that various stakeholders are committed to the rest of the development efforts. These are mentioned briefly below.

- Communication – the systems analyst must have excellent communication skills and be able to apply these skills in various situations. Communication from all participants is key to the entire RE process.
- Preparation – training in communication, problem solving, decision making and the use of enabling technology should be provided to the systems analyst, and to a lesser degree to all other participants. Preparation also includes such issues as venue organisation, timetables, and other enabling factors for the RE process.
- Dealing with ambiguity – ensure that communication is clear and lucid, as ambiguity can lead to misunderstandings which can erode the quality of the SRS.
- Interpersonal interaction – social bonding and relationship building amongst participants is important. Relationships and work must be founded on honesty and trust, and the notion of working together towards a common goal.
- Awareness of the complexity and size of the organisation – affects the choice of RE technique(s) used (discussed in later sections).
- Respect for the organisation – Politically sensitive issues are an aspect of any organisation that the analyst should be aware of. Respect all members of the organisation (not only those involved in the RE process).

- Respect for the end-user – the development team should work closely with the users during the RE process, thus building trust and increasing user confidence.
- Participant selection – Participants from various levels in the organisation must be selected for the RE process in order to ensure that a well rounded set of requirements is gathered.
- Participant scheduling – meeting times should be planned carefully, and participants should be kept abreast of changes in schedules.
- Participant training – for all participants regarding the specific RE techniques to be used, and the enabling technology to be used.
- Resource sourcing and scheduling – must be performed in advance.
- Use of enabling technology – training must be provided to all participants.
- Problem solving – checking and cross checking of facts using problem solving techniques in order to ensure that they are correct and complete.
- Decision making – participants should possess appropriate decision making skills, and should possess the necessary authority to employ specialised decision making techniques when appropriate.
- Goal setting and definition – clearly defined goals and objectives are important in order to ensure commitment and enthusiasm from participants.
- Expectations clarification and management – participant expectations must be clearly discussed and understood in order to ensure that they are realistic.
- Documentation – should be detailed and an accurate reflection of the requirements as discussed, understood and agreed upon by participants. It should be presented in a manner that can be understood by all participants and should be distributed timeously.
- User satisfaction – should be measured along the way and responded to appropriately.
- Stakeholder commitment – the development team must foster the trust, loyalty and confidence of the users.

These critical success factors show that the RE process is to a great extent dependent on the nature, depth and intensity of interactions between the users and the developers. Trust, honesty, unambiguous communication and commitment from all RE participants assures that the correct requirements are gathered and that a complete and accurate SRS is produced timeously. A breakdown in the human interaction aspect of the RE process, on the other hand, can lead to the production of an incomplete and ambiguous SRS, ultimately resulting in a costly system that is of little use to the user organisation, as it does not meet the intended requirements.

Much of the human interaction that is so important to the production of a sucessful SRS occurs through the implementation of various RE techniques. These techniques are the fact finding techniques that are used to gather requirements from the users, and they include interviews, questionnaires and structured workshops such as Joint Application Development sessions. These techniques are examined in detail in the following chapter.

2.8 Conclusion

This chapter provides some background information on the subject of the RE process. The discussion moved from defining a requirement, to showing why correct requirements are important, to who is involved in the RE process to how requirements are represented in an SRS. Several critical success factors for an RE process were mentioned briefly, showing the importance of intensive contact between system users and system developers during the RE process. The process of determining requirements is concerned with interactions between these two parties, and an important aspect of this research focuses on such interactions. These interactions may be structured or unstructured, formal or informal. The interactions mainly occur through the implementation of the techniques of RE. There are various techniques of RE that have been developed by academics and practitioners over the years, and these are discussed in greater detail in the following chapter.

Chapter 3

Traditional Techniques of Requirements Elicitation

3.1 Introduction

This chapter analyses the techniques used to gather requirements within the RE process. Sommerville and Sawyer (1997:63) explain that RE is the process of discovering requirements for a system by communication with customers, system users and others who have a stake in the system development. According to Kotonya *et al* (1998:61), RE involves discovering information about the application domain of the system, the specific problem to be solved, the business which is buying the system and the specific needs of the system stakeholders. They agree with Sommerville *et al* (1997:63) that RE requires application domain and organisational knowledge as well as specific problem knowledge.

There are a variety of different techniques that exist to aid system developers in discovering this information. Most authors and practitioners seem to agree that it is often not enough to use only one technique to determine requirements, as each technique has different characteristics in terms of the degree of interaction, the type of information that can be uncovered and the time taken to implement that particular approach. Therefore, the techniques described below can be used to complement each other in order to gain a complete and accurate set of requirements.

Each technique is described in terms of the following framework

1. Introduction to the technique
2. Kind of information sought by the technique
3. Selecting participants for the implementation of the technique
4. Preparing for the implementation of the technique

5. Implementing the technique
6. Following up the implementation
7. Points of Caution

3.2 Interviews

Kendall and Kendall (1999:111) define an interview as a directed conversation with a specific purpose that uses a question and answer format to gain information. Hoffer, George and Valacich (1999:243) explain that during interviews, interviewers gather facts, opinions and speculation, and observe body language, emotions and other signs of what people want and how they assess their current situations. Dennis and Wixom (2000:113) affirm that interviews are the most commonly used information gathering technique. This is well supported by most authors, and Hawryszkiewycz (1998:89) explains that interviewing is one information gathering technique that is almost always used in RE, as interviews must precede any other method for gathering information about system requirements. The reason for this is that it is always necessary first to approach someone and ask them what their problems and priorities are, before any analysis of these problems and priorities can take place.

Satzinger *et al* (2000:108) insist that interviewing stakeholders is by far the most effective way to understand business functions and business rules. However, they also add that it is the most time consuming and resource expensive technique of RE. This is because interviews are generally conducted one-on-one, although Dennis *et al* (2000:113) do indicate that due to time constraints, several people may be interviewed at once.

Kotonya *et al* (2000:63) describe two types of interviews:

1. Closed (structured) interviews, where the analyst looks for answers to a pre-defined set of questions;
2. Open (unstructured) interviews where there is no pre-defined agenda and the analyst discusses, in an open-ended way, what stakeholders want from the system.

In reality, the boundary between these types of interviews is often blurred, as for example, an interview that begins with a pre-defined set of questions may lead to a more unstructured interview format as new issues arise and are discussed by the interviewer and the interviewee.

3.2.1 Information sought by Interviews

Kendall *et al* (1999:111) explain that the interview is used to obtain the opinions of the interviewee and his or her feelings about the current state of the system, organisational and personal goals, and informal procedures. Similarly, Kotonya *et al* (2000:63) aver that interviews can be very effective for developing an understanding of the problem at hand, and for eliciting very general system requirements. Fertuck (1995:231) asserts that interviews are particularly useful in determining what problems exist with the present system or are anticipated with the future system. Interviews are therefore an excellent way of gaining background information, and this explains why they are often the very first technique used in eliciting requirements from system users.

With this in mind, Kendall *et al* (1999:111) recommend that interviewers seek the opinions of the people being interviewed, and they assert that in many cases, opinions may be more important and more revealing than facts. For example, the current system may get the job done; however it may be difficult and unwieldy to use. An observation of the results produced by the system would show that the system works very well, however, an interview with a dissatisfied user would yield very different information.

Kendall *et al* (1999:111) also advise that the interviewer should aim to capture the feelings of the interviewee as a result of the fact that the interviewee knows a great deal more about the organisation than the analyst, and understanding an employee's feelings could contribute a great deal to the interviewer's understanding of the organisation and its culture.

3.2.2 Selection of Participants for Interviews

Dennis *et al* (2000:113) and Shelly *et al* (1998:3.8) propose that the interviewer should draw up an interview schedule that lists all the people who should be interviewed, when and for what purpose. The people who appear on the interview schedule are selected on the basis of the analyst's information needs. Kendall *et al* (1999:113) counsel that key people at all levels in the organisation who will be affected by the system in some manner should be interviewed. It is extremely important to select a balanced and representative sample of organisational members in order to elicit as many of the correct requirements as possible. Often the organisation is far too large to interview every single individual who will be affected by the system, so the interviewer must be careful to select an adequate sample size, and an appropriate sample content.

Hawryszkiewycz (1998:106) suggests using an organisational chart to identify potential interviewees. An organisational chart describes the organisation's units, the positions in these units and each position's occupant. According to Hawryszkiewycz (1998:106), the analyst can select those units that fall within the boundary of the system study and that are likely to be affected by the system. Persons in these units then become candidates for interviewing.

Dennis *et al* (2000:114) explain that people at different levels of the organisation have different perspectives on the system, so it is important to include both managers and staff who actually perform the business processes, in order to gain both high-level and low-level perspectives on an issue. Hawryszkiewycz (1998:106) is of the opinion that it is wise to begin interviewing at the top levels of the organisational areas in order to gain support and co-operation from management before beginning to look into particular organisational activities or suggesting new solutions. Also, Dennis *et al* (2000:114) note that top management will provide the analyst with a strategic view of the business and the problem(s) to be solved. Mid-level managers can provide broad, overarching information about the business processes and the expected role of the system being developed and finally, lower level managers and staff members can fill in the exact details of how the process works.

Shelly *et al* (1998:3.8) recommend that the interviewer should consider informal organisational structures as well. Informal structures are based on interpersonal relationships and can develop from previous work assignments, physical proximity, unofficial procedures or personal relationships. Shelly *et al* (1998:3.8) maintain that in an informal structure, some people may have more knowledge or influence than appears on an organisational chart, and thus knowledge of a company's formal and informal structures will help an interviewer to determine which people to interview during the RE phase.

Hawryszkiewycz (1998:106), Dennis *et al* (2000:114) and Kotonya *et al* (2000:62) fully agree that interviewing to acquire requirements is an iterative process. As more people are interviewed, more issues will be identified for which more information is needed. As a result, additional people who can provide this information are called in. Also, it may be necessary to interview each user more than once in order to glean all the necessary information from that user.

3.2.3 Preparation for the Interview

Kendall *et al* (1999:112) and Flynn (1998:138) discuss five major steps that are involved in preparing for a RE interview:

1. Read background material.
2. Establish interview objectives.
3. Decide whom to interview.
4. Prepare the interviewee.
5. Decide on question types and structure.

Satzinger *et al* (2000:109) add two further points:

6. Determine project team members who will participate in the interview.
7. Set the location and time for the interview.

1. Read background material

Kendall *et al* (1999:112) propose that an interviewer should read and understand as much background information about the interviewees and their organisation as possible. They further advise that the interviewer should be particularly sensitive to the language that the organisational members use in describing themselves and their organisation, as this will help him to build up a common vocabulary that will eventually enable him to phrase interview questions in a way that is understandable to the interviewee. Use of this common vocabulary which is familiar to the interviewee, will also help to set the interviewee at ease.

2. Establish interviewing objectives

Satzinger *et al* (2000:109) believe that this step involves determining precisely what the interviewer hopes to accomplish with the interview. Kendall *et al* (1999:113) suggest that the background information gathered in the previous step and the interviewer's personal experiences should help to establish interview objectives. They further discuss six key areas concerning information processing and decision-making behaviour about which the interviewer may want to ask questions. These areas include: information sources, information formats, decision-making frequency, qualities of information and decision-making style.

3. Decide whom to interview

This step was discussed in detail in section 3.2.2 and it is closely intertwined with the foregoing step number 2. Satzinger *et al* (2000:109) note that as a result of this close relationship, both steps may be carried out in tandem. They also point out that these two are the most important steps in interview preparation, as objectives and participants drive everything else in the interview.

4. Determine project team members to participate

Interview participants can include one or more project team members (interviewers) and one or more users (interviewees). Satzinger *et al* (2000:109) are of the opinion that at least two project team members should be involved in each interview, as this will enable them to help each other during the interview, and also to compare notes afterward to ensure accuracy. They further suggest that the number of interviewees should be limited to one. Although other writers reviewed are silent on this point, the current author believes that an interview may be less effective if the interviewee does not feel at ease in the interview and with the interviewer, and will be less willing to answer honestly about feelings and opinions if he or she feels uncomfortable as a result of being "outnumbered." The author further believes that a one-on-one interview would be far more effective when questioning users about their personal goals, beliefs, feelings and opinions.

5. Set time and location for the interview

Flynn (1998:138) counsels that the interview be conducted at a quiet location with minimal intrusions and interruptions. If the interviews are conducted off-site, organisational employees may feel more comfortable revealing their true expectations and opinions. Times should be discussed with users beforehand in order to ensure that the users are prepared to fully commit to the interview and to answering all questions to the best of their abilities.

6. Prepare the interviewee

Satzinger *et al* (2000:110) advocate that each interviewee should be advised of the objectives of the interview and should, if possible, also be provided with a list of questions that will be asked in the interview. They reason that interviews consume a substantial amount of time, and they can be made more efficient if each participant knows beforehand what is to be accomplished. Flynn (1998:138) advises that the interview should be scheduled well in advance in order to ensure that the interviewee has had plenty of time to adjust his work schedule and to thus provide his undivided attention to the interview.

7. Decide on question types and interview structure

Kendall *et al* (1999:113) state that the interviewer should write questions to cover the key areas of decision making that were discovered when the interview objectives were ascertained. There are two basic forms of questions that may be used, namely: open ended questions and closed questions. Dennis *et al* (2000:114) also mention a third question type – the probe. Each question type looks for different types of information and each has its drawbacks and benefits.

Hawryszkiewycz (1998:109) defines an open question as one that requires the respondent to express a viewpoint. Dennis *et al* (2000:115) expand on this definition by stating that open questions are those that leave room for elaboration on the part of the interviewee, for example, "What do you think of the introduction of a computer system to determine sales forecasts?"

Closed questions are defined by Hawryszkiewycz (1998:109) as those questions that require a direct answer. Dennis *et al* (2000:115) state that such questions are used when the interviewer is looking for specific, precise information, for example, "How many sales transactions do you process per day?" as opposed to the more open ended "Do you process many sales transactions?" Kendall *et al* (1999:115) further elaborate that closed questions limit the responses available to an interviewee as, for example in a multiple choice exam.

Kendall *et al* (1999:116) show the characteristics of open and closed questions on a basic scaled diagram. This diagram has been adapted according to other characteristics of both types of questions mentioned by Dennis *et al* (2000:115) and Flynn (1998:138) as in Figure 3.1.

Probing questions are used to follow up the interviewee's replies, often when the interviewer is unclear about the answer. Dennis *et al* (2000:115) relate the benefits of probing questions to be that they encourage the interviewee to expand on or confirm information from a previous response, and they are a signal that the interviewer is listening and interested in the topic under discussion.

In general, Dennis *et al* (2000:115) assert that the interviewer should not ask questions about information that is readily available from other sources such as document reviews, (which are discussed later in this chapter). This saves time, and focuses the interview on the issues at hand. Dennis *et al* (2000:115) and Satzinger *et al* (2000:111) also state that usually a combination of the above question types are used during any interview. The dominant question type used depends on how far the RE process has progressed. For example, at the initial stages, the development team is trying to gain general background information, and as the process continues, the information required becomes more and more detailed.

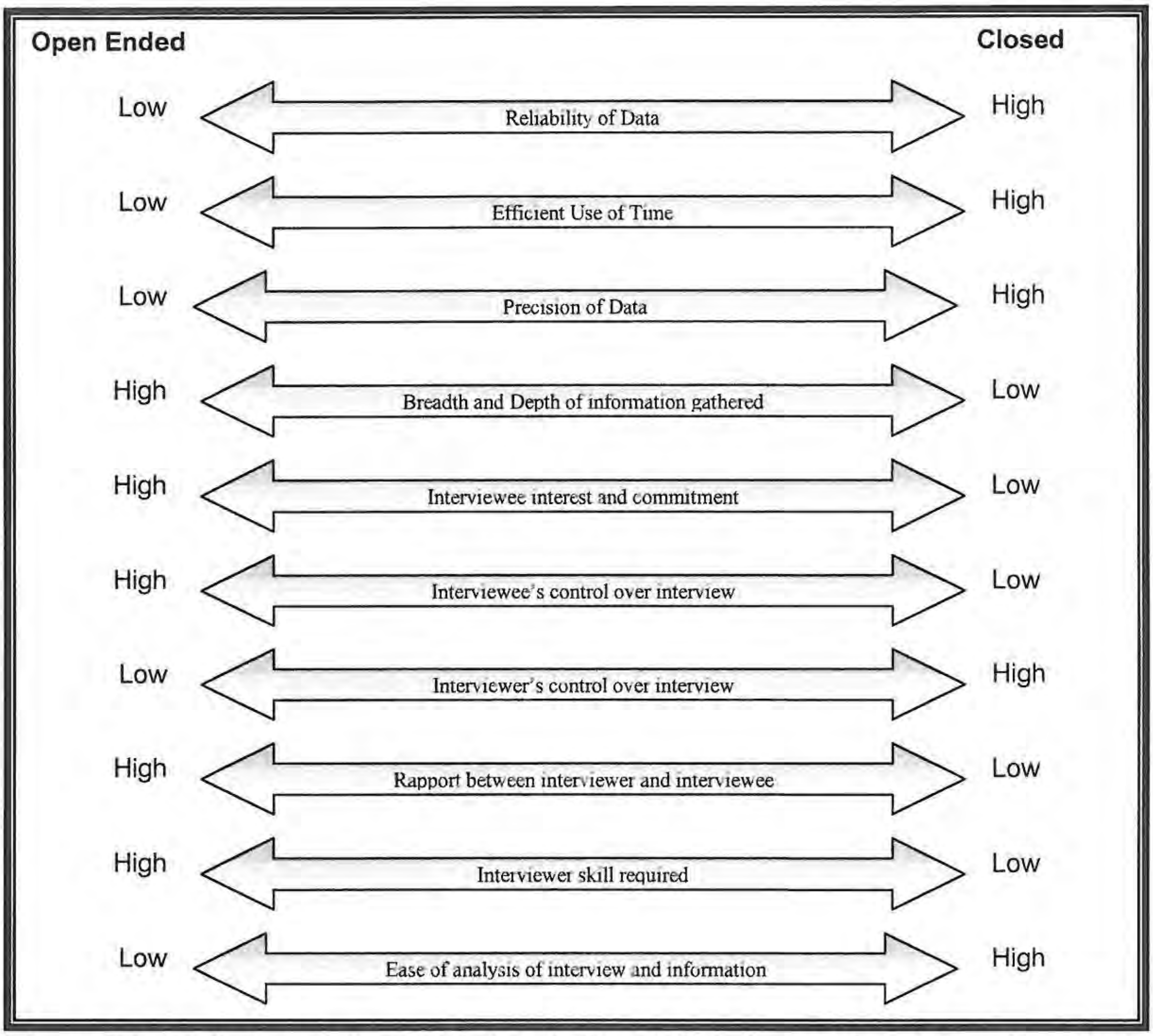

Figure 3.1: Attributes of Open-ended and Closed Questions *[Adapted from Kendall et al (1999:116)]*

All authors reviewed recommend that the interview preparation phase also includes determining the interview structure – i.e. how the interview questions are organized. Kendall *et al* (1999:119), Dennis *et al* (2000:117) and Hawryskiewycz (1998:106) define three different interview structures:

1. Funnel Structure : This is a top-down approach where the interviewer begins with open ended questions regarding broad, general issues, and works his way down toward more specific ones. Dennis *et al* (2000:117) affirm that this is one of the most common approaches to interviews, as it enables the interviewer to understand the issues before moving to the details, because the interviewer may not have sufficient information at the start of the interview to ask very specific questions.

2. Pyramid Structure: Here, the interviewer begins with specific questions, and moves on to broader issues as the interview progresses. Kendall *et al* (1999:119) recommend that this structure be used if the interviewer believes that the interviewee needs to warm up to the topic under consideration. This is an easy, non-threatening way of beginning the interview, and it may elicit so much detailed information that long sequences of closed questions and probes are unnecessary.
3. Diamond Structure: Most interviewers use a combination of both funnel and pyramid structures, thus resulting in a diamond shaped structure. Kendall *et al* (1999:119) explains that the interviewer begins with easy, closed questions that provide a warm-up to the interview process, moving on to broad topics, and back again to specifics, thus providing closure for both the interviewee and the interviewer. Such a structure combines the advantages of the other two structures, but also possesses the disadvantage that it may take longer.

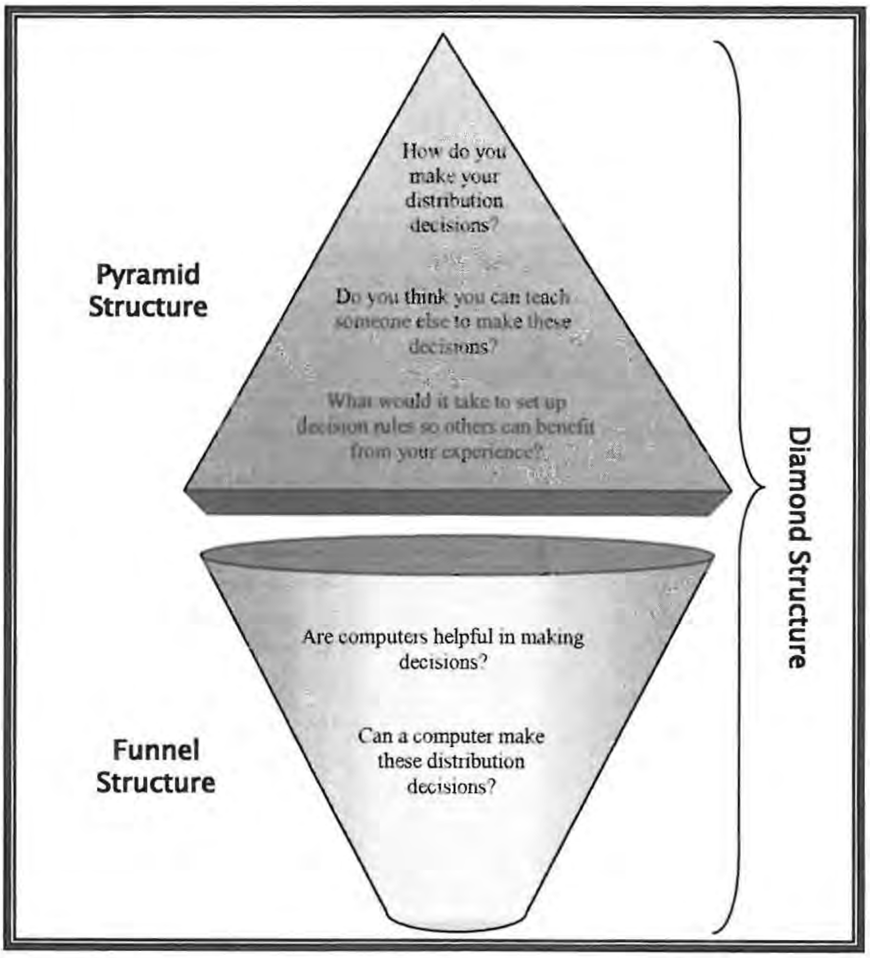

Figure 3.2: Interview Structures *[Adapted from Kendall et al (1999:118 to 120)]*

The pyramid structure and the funnel structure are shown in Figure 3.2, which also shows how the two structures fit together to form a diamond structure.

3.2.4 Implementation of the Interview

Satzinger *et al* (2000:110), Kendall *et al* (1999:124), Hoffer *et al* (1999:244) and Dennis *et al* (2000:117) provide interviewers with several guidelines for conducting successful interviews. These are summarised below along with several of the author's own guidelines.

Phase 1: Introduce the Interview

1. Dress appropriately in order to project competence and professionalism without intimidating the user.
2. Arrive on time.
3. Firmly shake the interviewee's hand. Kendall *et al* (1999:124) believe that this establishes credibility and trustworthiness.
4. Build rapport with the interviewee by explaining the goals of the interview and the reasons for choosing him or her as an interviewee.
5. Record the interview using a cassette recorder and/or a notepad. It is a good idea to ask the interviewee beforehand if he or she minds having the interview recorded on tape. If so, respect his or her wishes, and employ someone to record detailed written notes throughout the interview. Remind the interviewee that the data collected will be treated with confidentiality.

Phase 2: Conduct the Body of the Interview

6. Depending on the structure of the interview (funnel, pyramid or diamond), it is preferable to open with easy, non-threatening open-ended questions that will set the interviewee at ease.
7. Make a concerted effort to pick up and note the jargon used by the interviewee when he or she is describing the organisational, business and application domains.
8. Concentrate on verbal and non verbal cues.
9. Ask follow up information if you do not understand the issues that are being discussed. One method of increasing your understanding is to periodically summarise the key points that the interviewee is communicating.
10. Limit the time of the interview to the allocated period in order to ensure that you are not keeping interviewees from other duties, and also to ensure that you absorb the optimum amount of information.
11. Look for exception and error conditions and probe for details.

Phase 3: Close the Interview

12. At the close of the interview, ask the interviewee if there is anything that has not been touched on during the interview that he or she feels is important.
13. Summarise and provide feedback on your overall impressions.
14. Inform the interviewee about the subsequent steps to take, and what you and the other team members will do next.
15. Finally, set up future appointment times for follow-up interviews and thank the interviewee for his or her time.

3.2.5 Following up the Interview

Satzinger *et al* (2000:111) announce that following up the interview is important in order to absorb, understand and document the information that was obtained from the interview. This is generally done by writing up an interview report. Flynn (1998:138), along with many other authors, recommends that the interview report should be written up as soon as possible after the interview is concluded. Kendall *et al* (1999:125) states that this assures the quality of interview data. The report should contain interview notes, which consist of information collected over the course of the interview which are summarised in a useful format.

Dennis *et al* (2000:119) and Shelly *et al* (1998:3.12) contend that the interview report should be sent to the interviewee with a request to read it and inform the analyst of any clarifications or updates needed. Kendall *et al* (1999:126) recommend that the report should be reviewed with the interviewee at a follow up meeting; however, the author believes that in the interest of saving time, sending the report to the interviewee should suffice. If there are any significant changes broached by the interviewee, a second interview will be required.

Satzinger *et al* (2000:111) suggest that the interview information should be used to construct models of the business processes discussed in the interview. Data modelling techniques such as Entity Relationship Diagrams (ERD) can be used to create these models. If this is done as an iterative process, where the models are updated after every interview, they are an excellent way of improving the project team's understanding of the business and application domain and the system to be constructed.

3.2.6 Points of Caution

Kotonya *et al* (1998:63) assert that interviews should be part of all RE processes. However, they also warn that interviews alone are rarely completely adequate for RE, and they go on to recommend that wherever possible, interviews should be used in conjunction with other RE techniques.

Finally, they caution that application domain knowledge may be difficult to elicit during interviews for two reasons. Firstly, most application domains have their own terminology and users may find it difficult to discuss the domain without using this terminology. Such terminology may lead to interviewers misunderstanding user descriptions. This can be alleviated somewhat by Kendall *et al*'s (1999:112) aforementioned recommendation that an interviewer should read as much background material as possible before the interview, in order to familiarise himself with such user terminology.

Secondly, there are some types of domain knowledge which stakeholders may find very difficult to explain, or are so familiar with that they never think of explaining it, and this can be disastrous for an interviewer who is attempting to gain a comprehensive description of the domain.

Kotonya *et al* (1998:64) also state that organisational knowledge may be difficult to elicit during interviews, primarily because of political and social factors. They further counsel that in all organisations, there are subtle power and influence relationships between the different people in the organisation. User requirements may be influenced by these, but users may be understandably reluctant to discuss these with a stranger from outside the organisation or organisational department.

Although the aforementioned interview guidelines may help to alleviate these problems, an interviewer should be aware of them, and system developers should understand that interviews alone are never in themselves sufficient for gaining a complete description of user requirements. Hoffer *et al* (1999:248) sum up that interviews are very effective ways of communicating with people and obtaining important information from them, however, they are also very expensive and time-consuming to conduct. Therefore, it is important that other elicitation techniques are used to complement the elicitation interviews.

3.3 Questionnaires

Whitten *et al* (1998:630) define a questionnaire as a special purpose document that allows the analyst to collect information and opinions from respondents. Shelly *et al* (1998:3.15) elaborate that a questionnaire contains a number of standard questions that can be sent to many individuals. Whitten *et al* (1998:630) further elucidate that a questionnaire allows the analyst to collect facts from a large number of people while maintaining uniform responses. They assert that when dealing with a large audience, no other fact-finding technique can tabulate the same facts as efficiently.

3.3.1 Information sought by the Questionnaire

Kendall *et al* (1998:149) explain that questionnaires enable systems analysts to study attitudes, beliefs, behaviours and characteristics of several key people in the organisation who may be affected by the current and proposed systems. Attitudes are what people in the organisation say they want, behaviour is what organisational members do and characteristics are properties of people or things. Shelly *et al* (1998:3.15) assert that questionnaires can be used to obtain information about workloads, reports received, volumes of transactions handled, types of job duties, difficulties and opinions of how a job could be performed better or more efficiently.

Further, Kendall *et al* (1998:149) declare that responses gained through questionnaires using closed questions can be quantified, and responses to questionnaires using open-ended questions are analysed and interpreted in other ways. Analysts may use questionnaires to quantify information gathered in interviews, for example to determine how widespread or limited a sentiment expressed in the interview really is. Questionnaires can be used to survey a large sample of system users in order to sense problems or raise important issues before interviews are scheduled. Hawryszkiewycz (1998:90) states that in general, questionnaires are useful when the same kind of information is sought from a number of users. This is especially so if that information is of a quantitative nature.

3.3.2 Selection of Participants for the Questionnaire

According to Dennis *et al* (2000:125) the standard approach to selecting individuals to whom to send questionnaires is to select a sample of people who are representative of the entire group. Sampling guidelines are discussed in most statistics books, and are therefore not be discussed here. However, it is important to note that when selecting a sample, not everyone who receives a questionnaire will complete it. Dennis *et al* (2000:126) estimate that on average only 30% to 50% of paper and email questionnaires are returned and response rates for Web-based questionnaires tend to be significantly lower (often only 5% to 30%)

3.3.3 Preparation (Design) of the Questionnaire

Whitten *et al* (1998:631) define two types of questionnaires: free format and fixed format questionnaires. Free format questionnaires offer the respondent greater latitude in the answer. A question is asked and the respondent records the answer in the space provided after the question. For example: "What reports do you currently receive and how are they used?" Whitten *et al* (1998:631) caution that responses to such questions may be difficult to tabulate and it is also possible that the respondents' answers may not match the questions asked. To ensure usable responses in free-format questionnaires, the analyst should phrase the questions in simple sentences and not use words, such as "good", that can be interpreted differently by different respondents. The analyst should also ask questions that can be answered in three or fewer sentences, otherwise the questionnaire may take up more time than respondents are prepared to sacrifice.

The second type of questionnaire identified by Whitten *et al* (1998:631) is the fixed format questionnaire, which contains questions that require specific responses from individuals. Given any question, the respondent must choose from the available answers, for example, multiple choice questions. This makes the results much easier to tabulate.

In general, questionnaires should be composed of mostly closed ended questions, with a few open ended questions to allow the respondent the opportunity to add insights not anticipated by the designer of the questionnaire. The following is a list of guidelines for questionnaire design gathered from Kendall *et al* (1999:161), Hoffer *et al* (1998:248), Dennis *et al* (2000:126), Whitten *et al* (1998:631), Shelly *et al* (1998:3.15), Curtis (1998:327) and Hawryszkiewycz (1998:91).

1. Keep the questionnaire brief and user friendly.
2. Provide clear instructions that will answer all anticipated questions.
3. Allow ample white space around questions: i.e. no clutter.
4. Allow adequate space for responses.
5. Be consistent in style.
6. Questions must be ordered in a logical sequence (easy to more complex).

   a. Questions of importance to respondents go first.
   b. Cluster items of similar content together.
7. Questions must be unambiguous, simple and unbiased.
8. Try not to lead the response or use questions that give clues to expected answers.
9. Limit the use of open-ended questions that will be difficult to tabulate.
10. Limit the use of questions that can raise concern about job security or other negative issues.
11. Make sure that the questions are aimed at the level of intellect and particular interests of the respondents.
12. Avoid branching, e.g, "If your answer to questions 8 was "yes" then go to question 23, otherwise go to question 19."
13. Test the questionnaire on a small sample of respondents. If your respondents had problems with the questions, or if the answers were not useful, edit the questions, and retest the questionnaire until the answers received from the sample are satisfactory.

3.3.4 Implementation of the Questionnaire

Dennis *et al* (2000:126) maintain that a key issue in administering the questionnaire is getting participants to complete the questionnaire and send it back. Marketing research textbooks suggest various ways to improve response rates, such as clearly explaining why the questionnaire is being conducted and why the respondent has been selected, stating a date by which the questionnaire is to be returned, offering an inducement to complete the questionnaire and offering to supply a summary of the questionnaire responses.

In addition, Kendall *et al* (1999:165) explain that the analyst has several options for administering the questionnaire, and the choice of administration method is often determined by the existing business situation. Kendall *et al* (1999:165) describe the advantages and disadvantages of each method in Table 3.1.

Method	Advantages	Disadvantages
Convening all concerned respondents together at one time	1. No wait time before receiving responses. 2. Everyone receives same instructions. 3. 100 percent of forms will be returned.	1. Not all employees in sample will be free at scheduled time.
Personally distributing and receiving questionnaires	1. Good response rate.	1. Analyst time is a problem when sample is large or widely dispersed. 2. Respondents may be skeptical about anonymity.
Self administering questionnaire	1. Anonymity is assured, therefore answers may be less guarded.	1. Response rates are lower.
Administering questionnaire electronically	1. Quick way of reaching current system users. 2. Costs of duplication are minimized 3. Responses can be made at the convenience of the interviewee. 4. Responses can be collected and stored electronically.	1. Respondents may question the confidentiality of their responses that are given electronically. 2. Analyst could miss potential users who do not currently have access to a computer system.

Table 3.1: Characteristics of Questionnaire Administration Techniques *[Kendall et al (1999:165)]*

3.3.5 Following Up the Questionnaire

Dennis *et al* (2000:127) recommend that the returned questionnaires should be processed and a questionnaire report developed soon after the questionnaire deadline. This ensures that the analysis process proceeds in a timely fashion and that respondents who requested copies of the results receive them promptly.

3.3.6 Points of Caution

Curtis (1998:327) cautions that questionnaires are only of limited use in obtaining information for the purposes of investigating an existing system. This is due to several reasons:

1. It is difficult to avoid misunderstandings on the part of the respondents, as they cannot gain clarification of a question on a questionnaire if it is judged to be vague or confusing.
2. Questionnaires that are simple provide little information whereas those that are more ambitious are likely to be misunderstood.
3. Response rates to questionnaires are generally quite low.
4. To set a good questionnaire, the analyst has to have more information about the system under investigation than the questionnaire could hope to provide in the first place.

Whitten *et al* (1998:631) cite two other disadvantages:

5. There is no guarantee that an individual will answer or expand on all the questions.
6. It is not possible for the systems analyst to observe and analyse the respondent's body language.

Finally, Hoffer *et al* (1998:250) state that questionnaires are most useful in the RE process when used for a very specific purpose rather than for more general information gathering. Hawryszkiewycz (1998:91) concludes that questionnaires should be used to supplement other techniques. They are useful for gathering numerical data or retrieving relatively simple opinions from a number of people, but they are not very effective for in-depth searches or for identifying system problems or solutions.

3.4 Joint Application Development (JAD)

Wood and Silver (1995:3) define JAD as a joint venture between users and software engineers centering around a structured workshop (called a JAD session) where people come together to plan projects, design systems or make business decisions. It involves a detailed agenda, visual aids, a facilitator who moderates the session and a scribe who records the agreed-upon requirements.

Hoffer *et al* (1998:258) state that the primary purpose of JAD is to collect system requirements simultaneously from the key people involved with the system. They explicate that the result is an intense, structured but highly effective process. The JAD participants are made up of software development team members, key users and a facilitator who may or may not be a member of the software development team. JAD participants are discussed in greater detail in Section 3.4.3.

The JAD technique for RE possesses many advantages. Dennis *et al* (2000:120) testify that JAD is often the most useful method for collecting user requirements, because it reduces scope creep by 50%, and it avoids having system requirements that are too specific or too vague, both of which cause trouble during later stages of the SDLC. Secondly, Fertuck (1995:232) points out that an analyst who talks to the people actually doing the work in the organisation may find inconsistencies in what they say, because individuals and groups in the organisation may be unaware of organisational policies, or may interpret procedures in different ways. JAD provides an environment where differences can be identified and resolved. He lists several other advantages of JAD:

1. Top management can show their commitment to the project by freeing up the time to attend the JAD sessions, resulting in the resolution of most issues during the sessions.
2. Users are very much a part of the process, and therefore feel more committed to the JAD sessions and the implementation of the system, thus resulting in higher satisfaction with the final product.
3. Working in a group to define requirements means that there is contagious thinking, as the ideas of one person remind others of their own needs, thus leading to a more complete set of user requirements.
4. People are generally better at recognising a good solution and improving it than they are at developing a good solution independently, and JAD sessions create an environment that is condusive to such a problem solving style.

5. The attendance at group sessions by decision makers provides automatic approval so there are no delays for later approval. The resulting system is more responsive to management goals.

JAD sessions also allow development team members to understand and become familiar with the jargon used by users to describe their organisational environment. Moreover, they allow the development team members and the user groups to resolve conflicts through discussion, or to at least understand why certain conflicts cannot be resolved.

3.4.1 Information sought by JAD

Shelly *et al* (1998:3.23) indicate that the objective of JAD during the RE phase is to analyse the existing system, work on potential solutions and agree on requirements for the new system through team based decision making. Therefore JAD is a very non-specific technique of RE that can be used to gain any type of system requirement or organisational information from users and managers. Unlike interviews, which are used when eliciting very general system requirements, or for developing a general understanding of the problem area, JAD can be used to elicit both general and specific requirements, as well as for gaining organisational background knowledge. The non specificity of JAD is highlighted by the fact that JAD can be used not only in RE, but also in system design and any other phases of the SDLC where it is necessary for a group of people to come together to make decisions.

3.4.2. Selection of Participants for JAD

Wood *et al* (1995:37) believe that the success of a JAD session depends largely on its participants. As mentioned before, JAD participants are development team members, managers, users, facilitators and scribes. Table 3.2 describes the key qualities and responsibilities of the participants in the JAD process as described by Wood *et al* (1995:37 - 49), Hoffer *et al* (1998:260) and Dennis *et al* (2000:122)

Participant	Description
Executive Sponsor	• Controls project funding • Gives vision and direction • Empowers people to make decisions • Promises management commitment (therefore must be high up in the management hierarchy) • Has the most authority to make decisions for the project • Should have a strong personality to champion decisions made during JAD • May or may not attend all the JAD sessions
Facilitator / Session Leader	• Organises and runs the JAD • Expert in group management, facilitation and systems analysis • Impartial – objective, unbiased, neutral • Excellent communicator • Natural leader • Ability to summarise discussions • Ability to steer groups away from tangents and unnecessary details • Sensitivity to group dynamics and company politics
Users	• Those who will actually use the system to perform their duties • Must have a clear understanding of what it means to use the system on a daily basis
Managers	• Represent long range strategic and tactical direction of the business • Provide insight into new organisational directions • Provide motivations for and organisational impacts of systems • Provide support for requirements determined during JAD
On-call participants	• Affected by a project, but only in one particular area • Participate only when their expertise about a particular topic is relevant
Observers	• Could be trainee facilitators, business people wishing to gain overall understanding of project, or IS people who will participate later in the project • They may answer questions, but nothing more.
Systems Analysts	• Learn about organisation and information requirements from users and managers • Must not dominate the process
Other IS Staff	• Programmers, designers, consultants • Provide information on existing systems and technology • Can determine feasibility, estimate costs and suggest other approaches when necessary

Table 3.2: Characteristics of JAD Participants

Clearly, it is not feasible to have every person who will be affected by the system as a participant in every JAD session, and therefore it is necessary to choose a sample group of users and managers based on the information that they can provide, as well as their abilities to discuss and work through problems and organisational issues. Dennis *et al* (2000:122) explain that participants for JAD are selected on the same basis as interview participant selection (see section 3.2.2). Therefore, participants are selected on the basis of the information they can contribute in order to provide a broad mix of organisational levels, and to build political support for the new system. Wood *et al* (1995:47) concur by stating that determining who should attend the session requires a balancing act between full representation and decision-making power in all the areas that will directly be affected by the system.

Further, in order for the session to be successful, Shelly *et al* (1998:3.23) recommend that the number of participants be limited to between 10 and 20 people. A small session group size will ensure greater productivity and participation by all. It is also important to achieve an effective IS staff/users and managers ratio, and Wood *et al* (1995:47) recommends a ratio of five users to two IS people.

3.4.3 Preparation for JAD

In the experiences of Dennis *et al* (2000:122), most JAD sessions last from between 5 to 10 days, spread out over a 3-week period. However, the facilitator may determine the duration of the JAD sessions to be longer or shorter depending on the size and scope of the project. JAD sessions require careful preparation if they are to be successful. According to Dennis *et al* (2000:122), JAD sessions are usually designed and structured using the same principles as interviews. To clarify, most JAD sessions are designed to elicit specific information from users, which requires the development of a set of questions prior to the meeting. A difference between JAD and interviewing is that all JAD sessions are structured, and should therefore be carefully planned.

Wood *et al* (1995:95) recommend the development of a working document. The working document is a point of departure for making decisions, and contains the lists, diagrams, and text that people suggested during meetings or phone conversations before the session. Therefore, everything contained in the working document is proposed, and the issues in the document are a point of departure for discussion within the JAD session. Once it has been developed, the document must be sent out to each participant before the actual JAD session, to allow them time to review it and to do any research or preparation that is necessary.

Once the facilitator has developed a working document, Dennis *et al* (2000:122) suggest the identification and ordering of the information needed or the analysis technique to be used (e.g. problem analysis, process analysis, breaking assumptions). They further recommend that it is best to proceed top-down in JAD sessions when gathering information, or from the simplest and least challenging analysis techniques to the more innovative ones.

Next, the scribe must be trained, and the equipment needed for the session must be decided on. The equipment needed for the session generally consists of various visual aids, which help to keep the JAD participants focused and can clarify the decisions that are being made. Table

3.3 highlights some of the most commonly used visual aids. The description of these visual aids has been adapted from Wood *et al* (1995:101) and Dennis *et al* (2000:261).

Name of Visual Aid	Description
Flip Charts	• Use flip charts for information you want displayed throughout the session, e.g. session agenda
Magnetics	• Thin sheets of vinyl cut into various shapes, sizes and colours made magnetic by attaching magnetic material to the back of the shapes. • Can be written on using special pens • Can be used for data elements
Overhead Projection	• Use overhead projector or data projector to transpose text or images from transparencies onto a screen or wall. • Transparencies can be written on – quick update • Useful when presenting something for review
Electronic White Boards	• Can be used both as a visual aid, and also as a way to document decisions in the session. • Free standing, can be moved around, have white, scrollable surfaces from which text can be printed.
Data Projectors	• Display images from a PC onto a surface large enough to be viewed by all participants. • Can display screen images for a particular computer application – e.g. to display diagrams created from CASE tool. • Can also be used to display prototypes
Tape Recorders	• May inhibit discussion because people may be unwilling to talk about sensitive political issues if their voices are being recorded.

Table 3.3: Characteristics of Various Visual Aids Used in JAD Sessions

A week before the session, both Wood *et al* (1995:107) and Dennis *et al* (2000:123) recommend that a pre-session meeting be held with all the participants in the JAD session. Wood *et al* (1995:107) summarise the purpose of this meeting as being to establish management commitment, summarise the JAD process and distribute and discuss the working document (if the document has not been sent out already). Dennis *et al* (2000:123) further elaborate that it is important that the participants understand precisely what they are going to be providing information about, and the pre-JAD session should clarify this information for them in order to enable them to focus on the pertinent issues during the JAD session itself. This is also the first time that all the JAD participants will be together, so it should be seen as a chance to establish group rapport before the formal JAD session.

The JAD session is usually conducted off the site of the users' workplace, and the day before the session, the facilitator is required to set up the JAD session venue. Hoffer *et al* (1998:26) explain that JAD sessions are usually held in special purpose rooms where participants sit around a number of table pushed together to form a large U-shape or hollow square without one side. Wood *et al* (1995:110) assert that only the facilitator and the scribe should be allowed in front of the square. The basic set-up of a JAD room is shown in Figure 3.3.

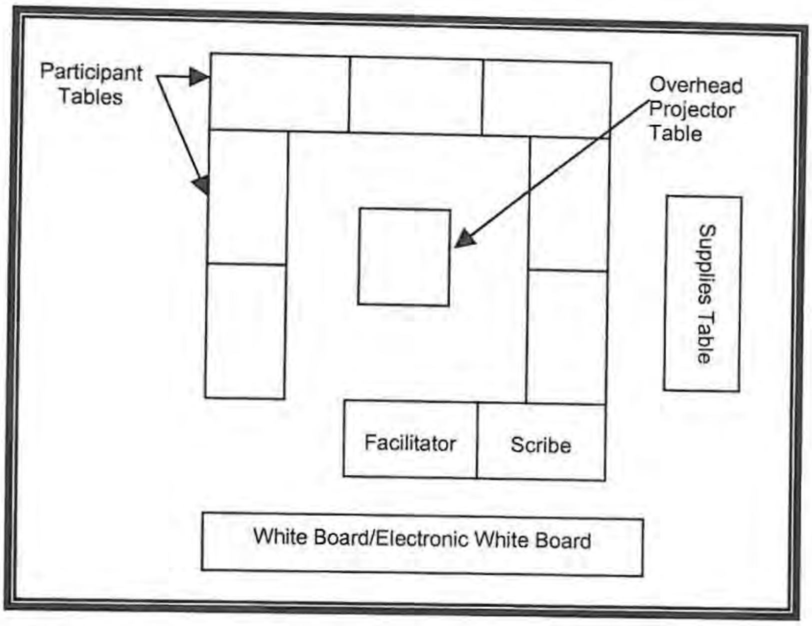

Figure 3.3: Table Arrangement for a JAD Session *[Wood et al (1995:110)]*

3.4.4 Implementation of the JAD Session

As mentioned before, most JAD session should follow a formal, pre-defined agenda. However, Wood *et al* (1995:117) warn that no two JAD sessions are alike, although the author believes that there are certain basic foundations that contribute to the execution of a successful JAD session. The actual events in a JAD session described by various authors including Wood *et al* (1998:117), Hoffer *et al* (1998:261) and Dennis *et al* (2000:123) are briefly discussed below.

1. Opening the Session

The facilitator opens the meeting with a brief welcome and run-down of the agenda for the day. The facilitator will also mention various administrative items, the session objectives and the ground rules for the session (e.g. one person speaks at a time).

2. Business Overview

This may be presented either by the facilitator or the corporate sponsor. Wood *et al* (1995:261) believe that it should be presented by the facilitator when opening the session, whereas Hoffer *et al* (1998:261) are of the opinion that presenting the business overview is the corporate sponsor's job. The author believes that the corporate sponsor should present the business overview, as he has more knowledge of the organisation itself, and will be able to present the overview in a manner that is relevant to the organisational participants. At this stage, the corporate sponsor should also explain the importance of upgrading to or building a new system in terms of the organisational benefits that will be derived from such a new or improved system. He should also aim to urge the participants to discuss their needs and requirements carefully and completely in order to ensure that the new or improved system will indeed provide the promised benefits.

3. Problem Presentation

This presentation may be performed by a senior analyst who has previously gathered information about the problems that users experience with the current system through the use of other RE techniques.

4. Discussion

This is the main body of a JAD session where the facilitator opens the discussion to users and managers in the room. Analysts and other IS people may ask questions directed at gathering user requirements, but the facilitator must ensure that users and managers are able to talk about any issues that they see as relevant. Often, disagreements may arise, and the facilitator must ensure that excessive amounts of time are not spent trying to resolve these disagreements. These issues become open issues, which are transferred to the flip chart, and may be returned to later on in the session or in another session. Dennis *et al* (2000:123) also state that a facilitator must perform four main functions during the JAD session:

- Ensure that the group does not digress from the agenda.
- Help the group understand the technical terms and jargon that surround the systems development process, and must also help the participants understand the specific analysis techniques used.
- Structure and record the group's input on a public display area (e.g. whiteboard), and help the group recognise key issues and important solutions.
- Remain neutral and simply help the group through the process without offering his own opinions.

Most importantly, the facilitator must ensure that everyone is given a chance to voice their opinions.

5. Building a data model

Analysts often find it helpful to build a data model of the users' requirements as they are being identified. The analysis technique to be used should have been explained to the users before hand, but the facilitator can reinforce this explanation by a quick summary of the key points of the technique. Data models can be built quickly by using Entity Relationship

Modelling, where each object that the users wish to store information about is known as an entity which has specific characteristics known as attributes. Entity names can be written on magnetics, which may then be transferred to a magnetic board to build up a rough Entity Relationship Model.

6. Closing the session

The facilitator must close the session on time, with a quick review of the salient points for the day, and a reminder about the date and time for the next JAD session.

Each JAD session differs from the next because analysts are looking for different types of information in each JAD session. In summary, most JAD sessions should begin with a re-cap of the previous JAD session, an overview of the agenda for the day, proceeding to a discussion on the pertinent issues, and closing with a quick re-cap of key points.

3.4.5 Following Up the JAD Session

As with interviews, Dennis *et al* (2000:125) advise that a post-JAD session report should be prepared and circulated among the session attendees. This should be done after each JAD session, and it should build up to the final report that is produced after the last JAD session in the RE phase. Wood *et al* (1995:150) explain that the final document is important, as it is the culmination of all that has gone into the JAD project. They further describe it as a "comprehensive synthesis of agreements made in the session." This final document is also a major input into the SRS document mentioned in earlier chapters.

3.4.6 Points of Caution

Shelly *et al* (1998:3.23) assert that compared to other RE techniques such as interviews and questionnaires, JAD is more expensive and can be cumbersome if the group is too large compared to the size of the project. JAD is also a time consuming and resource expensive technique, as it requires that a large number of users are absent from their work while they participate in a JAD session. This could lead to resentment from the users who are "left behind" and have to pick up extra workloads to compensate for their colleagues' absence. This may lead to an aversion to the system being developed,

Dennis *et al* (2000:121) points out that JAD sessions may also suffer from the traditional problems associated with groups. For example, sometimes, people are reluctant to challenge the opinions of others (particularly their bosses), a few people may dominate the discussion, and not everyone may participate.

Despite these disadvantages, JAD is a RE technique that is constantly gaining popularity, because it does allow analysts to gain a complete and comprehensive understanding of an organisational environment and its information needs through constant interaction with a number of key users and managers within the organisation. Shelly *et al* (1998:3.23) firmly believe that when successfully used, JAD can result in a more accurate statement of system requirements, a better understanding of common goals and a stronger commitment to the success of the new system.

3.5 Other Requirements Elicitation Techniques

There are several other fact-finding techniques that can be used to support the three main RE techniques discussed above. These are briefly discussed in the following sections.

3.5.1 Document Review

Hoffer *et al* (1998:253) explain that asking questions of the people who use a system every day or who have an interest in a system is an effective way to gather information about current and future systems. Interviews and questionnaires can be used to ask questions and collect the desired information. These RE techniques can be enhanced by examining both system and organisational documentation, in order to discover more details about current systems and the organisation these systems support.

The analyst should review as much documentation as possible in an attempt to gain a complete understanding of the organisation and its systems, and to thus identify future system requirements. Kendall *et al* (1999:89) classify documentation as quantitative or qualitative.

Quantitative documents have a specific purpose and an audience at which they are targeted. Examples of such documents are reports used for decision making, performance reports, records and data capture forms. Qualitative documents are described by Kendall *et al* (1999:89) as those that reveal expectations for behaviour of others that their writers hold. They need not be aimed at a specific audience and may not follow a predetermined format.

Examples of qualitative documents are memos, organisational mission statements, business policy manuals and signs on bulletin boards and in work areas.

Hoffer *et al* (1998:253) reveal several points that an analysis of existing documentation may bring to light:

1. Problems with existing systems
2. Opportunities to meet new needs.
3. Organisational direction that can influence information system requirements.
4. Titles and names of key individuals who have an interest in relevant existing systems.
5. Values of the organisation or individuals who can help determine priorities for different capabilities desired by different users.
6. Special information processing circumstances that occur irregularly and that may not be identified by any other requirements determination technique.
7. The reason why current systems are designed as they are, which can suggest features left out of current software which may now be feasible and more desirable.
8. Data, rules for processing data, and principles by which the organisation operates that must be enforced by the information system.

Dennis *et al* (2000:128) draw attention to the fact that organisational and system documentation only represent the formal system that the organisation uses. Often, the "real'" or informal system differs form the formal one and these differences, particularly large ones, give strong indications of what needs to be changed in a new system. For example, forms that are never used may be eliminated.

There are several disadvantages to using document analysis. Curtis (1998:326) explains that firstly, there is a great deal of documentation, particularly in large organisations. The analyst has to read extensively in order to gather a small amount of useful information. This can be alleviated somewhat by only reviewing a sample of selected documentation, but the analyst may miss certain important information in this way. Secondly, Curtis (1998:326) states that unlike interviews, where the analyst can direct the information that is provided by targeted questions, documents cannot be so easily probed. Another disadvantage of document analysis is that current systems may not be well documented, and will therefore not provide a complete picture of system capabilities. Other techniques such as observation should be used to gain a more complete picture of how the current system operates. Finally, documentation may be out of date and the analyst has little way of knowing this.

Despite these disadvantages, more authors and practitioners seem to agree that document analysis is an excellent way of uncovering the information requirements of an organisation that may not be revealed through the use of interviews and questionnaires. By reviewing existing documentation, analysts can identify areas that need further investigation, perhaps through the use of interviews or questionnaires.

3.5.2 Observation

Whitten *et al* (1998:628) assert that observation is one of the most effective data collection techniques for obtaining an understanding of the system. It also allows the analyst to understand the work procedures that are used by employees in carrying out their duties.

The other RE and fact-finding techniques that were discussed previously provide the analyst with what Hawryszkiewycz (1998:92) refers to as an "etic"" or outside view of the system, whereas observation provides the analyst with an "emic" or inside view of what the system user sees. Therefore, observation places a different orientation on information gathering, with the emphasis being on observation of system activities, and perhaps even active participation in these activities by the analyst.

According to Jordan (1993) as cited by Hawryszkiewycz (1998:93), observation involves an analysis of several conceptual areas within an organisation. These are listed below:

1. Analysing people's roles
2. Analysing interaction between employees as well as between employees and the system
3. Analysing location
4. Analysing artifacts
5. Task analysis

Hawryszkiewycz (1998:92) cites a number of advantages related to the use of observation as a requirements gathering technique:

1. The system is directly observed as it actually works.
2. Users are not disturbed in their activities.
3. Information is gathered directly and not from an informal description obtained through interviews and questionnaires.

Kotonya *et al* (1998:68) add that certain tasks are very difficult for an individual to explain, as they have become intuitive through routine, and are therefore not consciously thought about by the person performing the task. The nature of these tasks are better articulated through observation rather than through verbal or written description. Kotonya *et al* (1998:68) cite Gougen and Linde (1993) who state that it is very difficult to describe how to tie a shoelace, but much easier to demonstrate the process.

Also, Dennis *et al* (2000:128) report that observation allows the analyst to check the validity of information gathered from indirect sources such as interviews and questionnaires. Hoffer *et al* (1998:252) further elucidate that people are not always reliable informants even when they try to be reliable and tell what they think is the truth. This is because they may not be able to accurately and objectively discuss infrequent events, issues from the past or issues for which they have considerable passion. Observation enables the analyst to supplement and corroborate people's information by watching what they do or by obtaining relatively objective measures of how people behave in work situations.

Observation as a technique of information gathering for requirements identification also has several disadvantages. Whitten *et al* (1998:629), Hawryszkiewycz (1998:95), Shelly *et al* (1998:3.14) and Hoffer *et al* (1998:253) all make reference to the Hawthorne effect, which means that people will behave differently when they know that they are being watched. Hoffer *et al* (1998:253) also point out that observation typically cannot be continuous, and will therefore only provide a snapshot image of the person or task being observed. This snapshot may not include important events or activities. Kotonya *et al* (1998:71) note that observation is also a very time consuming technique. Hoffer *et al* (1998:253) agree, and explain that because of the time involved in implementing this technique, only a limited number of instances of conceptual areas can be observed. Once again, a sample size which includes a complete set of both normal and abnormal conditions must be defined, and this is in itself a time consuming and difficult task.

3.5.3 Scenarios

According to Kotonya *et al* (1998:64) system stakeholders find it easier to relate to real-life examples rather than abstract descriptions of the functions provided by the system. Therefore, they sustain that it is often useful to develop a set of interaction scenarios and to use these to elicit and clarify system requirements. Sommerville *et al* (1997:99) define scenarios as examples of interaction sessions, which are concerned with a single type of interaction between an end user and the system. End-users simulate their interaction using the scenario and explain to the analyst what they are doing and the information which they require from the system.

Sommerville *et al* (1997:99) declare that scenarios can be thought of as stories which explain how the system is used. Kotonya *et al* (1998:64) are of the opinion that scenarios should contain the following information:

1. A description of the state of the system before entering the scenario.
2. The normal flow of events in the scenario.
3. Exceptions to the normal flow of events.
4. Information about other activities which might be going on at the same time.
5. A description of the state of the system after completion of the scenario.

Sommerville *et al* (1997:100) show that applying a scenario involves the analyst and the system end-user working through the scenario together with the analyst taking notes of the user's comments, problems and suggestions. The user simulates the use of the system, following the scenario and points out areas where the scenario is incorrect, simplistic, variable, etc.

Scenarios are primarily useful for adding detail to an outline requirements description. Jalote (1997:137) contributes that they are also useful for clarifying misunderstandings in the human-computer interaction area. Kotonya *et al* (1998:64) cite another advantage of scenarios to be that simply the process of developing a scenario can help with requirements understanding. This is because discovering possible scenarios exposes the range of possible system interactions and reveals system facilities that may be required. Scenarios are also very intuitive, and some people may be able to teach themselves to develop scenarios, leading to lower training costs.

They also have several disadvantages. Kotonya *et al* (1998:66) explain that they take time to develop as they involve interaction with the system stakeholder to understand what should happen. However, once a scenario has been developed, it can be re-used in a different system. Secondly, because scenario development involves users spending a great deal of time interacting with analysts, Sommerville *et al* (1997:101) warn that users may not be able to take enough time away from their normal job to work through scenarios. The analyst may also find that the end users who wish to be involved are interested in the computer system and the automation of their work, and therefore their interactions may not be typical of the normal user, and may suggest requirements that are not strictly necessary.

3.5.4 Prototyping

Kotonya *et al* (1998:73) define a prototype as an initial version of a system that is available early in the development process. Kendall *et al* (1999:199) believe that prototyping of a software system is a worthwhile technique for quickly gathering specific information about users' information requirements. They further explain that prototyping during the RE phase is used to gather initial reactions from users and managers to the prototype, user suggestions about changing or cleaning up the prototyped system, possible innovations for it and revision plans detailing what needs to be done first or which branches of an organisation to prototype next.

Jalote (1997:116) note that the basic idea behind prototyping is that clients and users are able to assess their needs much better if they can see the working of a system, even if the system is only a partial system. In this way, prototypes can be used along with scenarios for eliciting requirements, with the analyst and user working through the scenario using the prototype to identify interaction problems and needs.

There are several advantages of using prototypes for RE. Hawryszkiewycz (1998:94) is of the opinion that prototyping creates a culture of democracy by involving users in its development, rather than a culture where only the analyst and the designer play a leading role. In this way, it can ensure user commitment to the developed system by involving users early in the decision making process. Kotonya *et al* (1998:74) list several other advantages:

1. The prototype may help to establish the overall feasibility and usefulness of the system before high development costs are incurred.
2. Prototyping is the only effective way of developing system user interfaces. If a prototype has been developed as part of the requirements process, this can later reduce development costs for the system.
3. Prototype implementation requires careful study of the requirements. This in itself often reveals requirements inconsistencies and incompleteness.

There are, however, costs and problems associated with prototyping. Kendall *et al* (199:208) raise the concern that it may be quite difficult to manage prototyping as a project within the larger systems effort. Secondly, they voice the idea that users and analysts may adopt the prototype as the completed system, when it is in fact inadequate and was never intended to serve as a finished system. A related disadvantage cited by Kotonya *et al* (1998:75) is that the prototype may mislead users, because they think that the system as a whole will have the same performance and characteristics as the prototype, and will therefore express their requirements with this in mind. Hoffer *et al* (1998:264) suggest the prototyping may hold the drawback of causing a tendency to avoid creating formal documentation of system requirements, which can then make the system more difficult to develop into a fully working system. They also explain that prototypes are often built as stand-alone systems, thus ignoring the issues of sharing data and interactions with other existing systems. Finally, Kotonya *et al* (1998:75) add that developing a prototype may increase costs during the RE phase, and may extend development schedules, thus causing the final delivery date of the product to be delayed.

3.5.5 Rapid Application Development

According to Martin (1991:viii), as quoted by Vat (2000:66), Rapid Application Development (RAD) is a "development lifecycle designed to give much faster development and higher quality results than those obtained with the traditional lifecycle. It is designed to take maximum advantage of the powerful development software that has evolved recently." Therefore, RAD is not a RE technique as such, but a methodology that combines several development methods in order to create a new strategy for developing software systems. Vat (2000:66) states that RAD relies on highly interactive systems development methods with extensive user involvement. Hoffer *et al* (1999:486) add that RAD also requires the use of CASE tools and code generators.

During the RE phase, RAD uses prototyping and JAD to gain an understanding of user requirements. Preliminary JAD sessions reveal initial user requirements which are then turned into prototype design specifications. Dennis *et al* (2000:10) explain that code generators automatically produce prototypes from the initial design specifications, thus speeding up the production of prototypes, which can then be used to gather further requirements or to change existing requirements.

In consultation with Hoffer *et al* (1999:486), Martin (1991), Shelly *et al* (1998:3.23) and Whitten *et al* (1998:636), Vat (2000:66) cites various advantages and disadvantages of using RAD for RE. Some of the advantages of RAD include:

1. Reducing development time.
2. Requires smaller development teams.
3. Results in significant cost savings.
4. Involves high user involvement.

5. Provides high quality system data and process discovery and documentation.
6. High speed of development results in the system delivered being closer to business needs at the time of delivery.

The disadvantages of RAD are as follows:

1. Stresses the mechanics of the system itself without any attention to the company's strategic business needs.
2. It only works well for systems which need to be developed quickly.
3. Where speed is a goal, other important aspects of system development are left out.
4. It leaves little room for understanding the business area.
5. It is characterized by high reliance on high involvement of key users, and takes those users away from their normal work.

3.5.6 Technical Review

According to Gause and Weinberg (1989) as quoted by Vat (2000:67), a technical review is a principle tool which customers can use throughout the requirements process to test whether requirements contain all and only reliable information. Vat (2000:67) concludes that it is a testing tool for indicating the progress of the requirements work and provides feedback of issues to the systems analyst to help improve the product, and feedback to management on the actual technical status of the systems development project. Vat (2000:67) goes on to state that it is normally done in a meeting situation, and involves the users, managers and IS professionals. The objective of the review is to find out if each requirement does the job which it is supposed to do, and the answer is documented in a review report. Vat (2000:67) mentions the following advantages of the technical review:

1. They are an excellent requirements validity check.
2. They save money in the long run.
3. They contribute towards user "buy-in" and management support.
4. They can reveal patterns among issues over time.

An important disadvantage noted by Vat (2000:67) is that participants may be averse to criticism, and if a technical review is done poorly it can be highly demoralizing.

3.6 Conclusion

The foregoing discussion identified several of the traditional techniques that can be used to elicit requirements from users during the systems analysis phase of the SDLC. The three techniques discussed in the most detail were interviews, JAD and questionnaires. The exposition focused primarily on these techniques because most authors reviewed identify these three techniques as frequently used techniques of requirements elicitation. Several other traditional techniques were discussed more briefly, and it is apparent that each technique possesses its own unique advantages and disadvantages and is varyingly suited for gathering certain types of information. It is also apparent that the techniques have varying levels of human interaction between the requirements gatherers and the requirements providers. The varying capabilities of the techniques mean that no one technique is can be used on its own to gather a complete and accurate set of user requirements, and therefore, the techniques must be used to complement one another. The following chapters provide background information on the concept of a virtual environment and virtual teams, and show how the three major techniques of RE (JAD, interviews and questionnaires) can be adapted for use within a virtual environment.

Chapter 4

Virtual Teams

4.1 Introduction

The previous chapter highlighted the various traditional techniques of RE. It was noted that the implementation of these techniques requires the participation of both the system developers and the eventual system users working together as a team to identify problems with the current system as well as the specifications for the new system. Traditionally, development teams were co-located in the same geographic vicinity, but in recent times, a new team paradigm has come to the fore as a result of advancements in communication technologies. Telecommunications technologies have advanced in leaps and bounds over the past ten to twenty years, and their resulting integration into business has lead to the introduction of virtual teams.

This chapter discusses virtual teams, and explains why and how virtual teams can be used successfully in software development, and specifically in RE. This is used as a foundation for the next chapter, which shows how the several major traditional techniques of RE may be adapted into the virtual environment in order to provide a completely virtual environment for eliciting system requirements and organisational knowledge.

This research regards the RE team as consisting only of members of the development organisation. Although the RE phase necessitates the participation of system users and developers for the identification of system requirements, the majority of user-developer interactions occur during the implementation of the RE techniques. In contrast, members of the development organisation work together constantly in their aim to achieve the overall goal of a complete and correct SRS. Therefore, 'team' in this context refers specifically to the people who are members of the development organisation, and interact on a daily basis with the ultimate aim of gathering a complete and accurate set of requirements for the SRS.

4.1 The Evolution of Teams

Section 1.1 in Chapter 1 explained that organisational groups have changed significantly over the last 20 years because of changes in organisations and the nature of the work they do. According to Kimball (1997a), knowledge management has become the watchword for competition in the 21st century. Knowledge management prescribes harvesting the formal and informal learning experiences and skills of members of the organisation so that knowledge is available to the whole organisation [Kimball (1997a)]. Thus, Windsor (2000) affirms that organisational competitiveness relies heavily on the calibre of the people in the organisation and the knowledge and skills that they bring to the organisation, resulting in people having become a major organisational asset for any competitive organisation. This emphasis on people has also increased the importance of relationships between people both inside and outside the organisation. The emphasis on global organisations and networking has seen organisations realise the benefits and necessity of inter-organisational co-operation.

Kimball (1997) affirms that all these changes in organisations and the business world in general have changed how teams are formed and how they operate. The following table shows how the nature of teams has changed as a result of organisational changes:

From	To
1. Teams have fixed membership	1. Teams have shifting membership.
2. All team members drawn from within the organisation.	2. Team members can include people from outside the organisation (clients, collaborators).
3. Team members are 100% professionally dedicated to the team.	3. Most people are members of multiple teams.
4. Team members are co-located organisationally and geographically.	4. Team members are distributed organisationally and geographically.
5. Teams have a fixed starting and ending point.	5. Teams form and re-form continuously.
6. Teams are managed by a single manager.	6. Teams have multiple reporting relationships with different parts of the organisation at different times.

Table 4.1: Changes in the Nature of Teams *[Adapted from Kimball (1997)]*

Each point in the right hand side of the table can be applied to RE teams. Firstly, teams have shifting membership, in that various software development team members may participate at different times during the RE process. For example, during the initial phases, when gathering organisational knowledge is the main focus of RE, only the analyst may be involved from the development side. When specific requirements are being gathered, for instance those regarding the look and feel of the proposed system, system designers may also be involved.

Secondly, team members can include people from outside the organisation, such as JAD facilitators. Thirdly, most people are members of multiple teams. Thus, system developers may be a part of one or more development teams, and may work in varying capacities in each team. The fourth point is discussed later in this section.

Fifthly, teams form and reform continuously. This refers to the shifting membership of RE teams that was mentioned earlier, with varying members of the development communities participating in the process at different times. Finally, teams have multiple reporting relationships with various parts of the organisation at various times. With regards to systems development, teams will have to report to the stakeholders, corporate sponsor, the project manager, the corporate board and various other concerned parties at different times.

Referring back to the fourth point, one can see that teams have evolved from members being co-located to members being distributed organisationally and geographically (i.e. from co-located teams to distributed teams). Unlike the other points in the table, the foregoing chapters discussing RE do not support this statement. However, the author believes that software development, and RE in particular, can be conducted effectively and efficiently using such a method of dispersed work.

Teams with distributed membership allow members in various locations to use communication technologies to collaborate on a common project. Many writers on the subject refer to distributed teams as virtual teams, however the author believes that although all distributed teams are virtual teams, in theory, all virtual teams may not be distributed teams. For example, a non-distributed virtual team is one where team members work together in the same office, but use virtual communication technologies (such as electronic mail) to collaborate on a common project. Co-located virtual teams such as this will not be considered in the research paper, and therefore, for the purposes of this paper, the terms "virtual team" and "distributed team" will be used interchangeably.

4.2 Virtual Team Definition

The term "virtual team" implies two sub-components – the virtual aspect, and the team aspect. Jarvenpaa and Leidner (1998) note that the concept of virtual implies permeable interfaces and boundaries, project teams that rapidly form, reorganize and dissolve when the needs of the dynamic marketplace change, and individuals with differing competencies who are located across time, space and cultures. A team is defined by Aranda and Aranda (1997:23) as a group of people working together towards a common goal. According to Lipnack *et al* (2000), a virtual team works across space, time and organisational boundaries, with links strengthened by webs of communication technologies. Adding the team definition to this, we can define a virtual team as a group of people who work together on a common project across space, time and organisational boundaries, with links strengthened by webs of communication technologies.

Lipnack *et al* (2000) discuss three principles of virtual teams:

1. People: Virtual teams are composed of independent members with significant autonomy and self-reliance. Leadership is informal and shared, and most members are leaders at some point in the process. For example, during the RE phase, the analysts on the project team may hold leadership roles. The roles may shift to the designers on the team when the project moves into the design phase.
2. Purpose: The virtual team creates co-operative goals, undertakes independent tasks and reaches for concrete results.
3. Links: The explosive development in communication technologies allows for the creation of virtual teams. Multiple, constantly enhanced modes of communication are possible, providing access to vast amounts of information and interaction.

Communication is therefore an important aspect of virtual teams, more so, perhaps than with traditional teams. Unlike in traditional, co-located teams, communication between members of a virtual team must be supported by technology. The technology used to support such communication is known as collaborative technology, and these are discussed in the following section.

4.3 Collaborative Technology for Virtual Teams

The Shannon-Weaver model of communication as cited by Aristotelous (1999:40) depicts several facets of the communication process: the information source, the transmitter, the signal, noise, the received source, the receiver and finally the destination. The model can be modified for virtual communication by including collaborative technology between the transmitter and the receiver. This is shown in Figure 4.1.

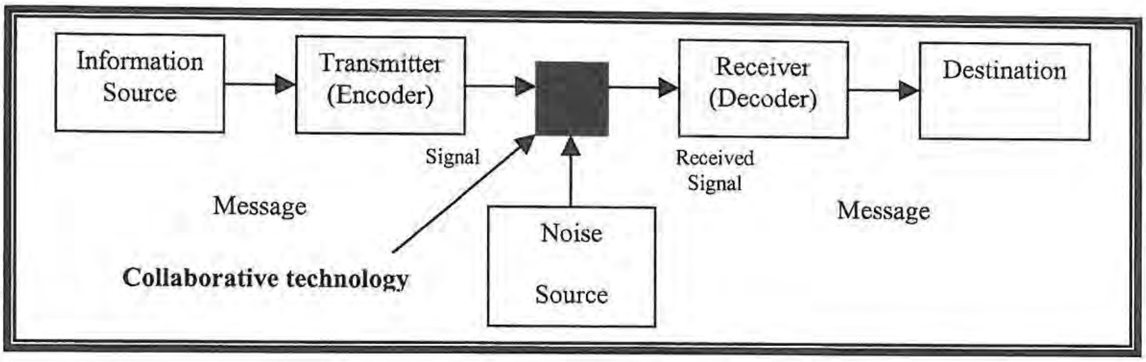

Figure 4.1 Shannon-Weaver Model *[Aristotelous (1999:41)*

Aristotelous (1999:41) supports this modification by explaining that collaborative technology is the communication device that supports communication between virtual team members. Although this model is not discussed in detail in this research, it is included here to introduce the conceptual position of collaborative technology in the virtual communications process. The model shows that collaborative technology is the principal material medium that allows communication to take place in a virtual environment.

Sparg (1999:20) confirms that there are many terms used to describe the technology that aids communication in a distributed environment: Groupware, Collaborative Computing, Work Group computing and Computer Mediated Collaboration. He goes on to cite Beauvais (1999:22) who declares that various authors (Grudin, Ramage and Coleman) have discussed the issue at length and essentially agree that all terms are synonymous. Further, Vat (2000:85) states that the following terms essentially mean the same thing: geographically distributed enabling technology, distributed communication technology, group support systems, computer supported collaborative work, computer mediated communication, executive information systems, group communication support systems, group decision support systems, orgware and groupware. In this study, the terms most commonly used to discuss these technologies are groupware and collaborative technologies, and these terms will be used interchangeably.

Carmel (1999) explains that virtual teams are supported by hardware and software technology. He determines general hardware requirements to include telephones, personal computers, modems, communication links, public switched networks and local area networks. Software requirements are the computer applications (e.g electronic mail applications) that use the hardware technologies to allow team members to communicate with each other. The software and hardware together make up the collaborative technology required for communication between geographically distributed virtual team members.

According to Majchrzak, Rice, King, Malhotra and Ba (1999), collaborative technologies for supporting virtual communications should include at a minimum, a virtual workplace that provides a record of the process of the group, an agenda, libraries of solutions and practices, different forms of interaction, meta information and shared information storage, access and retrieval. They further conclude that as a result, such systems facilitate the access, creation, processing, storage, retrieval, distribution and analysis of information across positional, physical and temporal boundaries. Collaborative technologies vary in terms of the support they provide for synchronous and asynchronous communication, as well as the degree of communication richness they provide.

Asynchronous technologies are those that allow group members to communicate across time and space. In other words, asynchronous collaborative technologies do not allow team members to communicate in real time. According to Carmel (1999:96) such technologies are convenient and comfortable to use when team members are distributed across time zones. However, communication using only asynchronous technology may lead to a reduced sense of team "belonging" as the team members never interact with each other in real time, and may therefore take longer to get to know each other, and to work effectively as a team.

Synchronous collaborative technologies include most electronic conferencing tools. These conferencing tools enable people to communicate and collaborate across various locations at the same time. According to Stair and Reynolds (1998:290) and Laudon *et al* (1998:273) the development of synchronous communication technologies has enabled companies to reduce travel expenses and time, as team members need not waste corporate time and money traveling to meet at one geographic location. Instead, geographically dispersed group members can meet with their teams from the comfort of their own offices. Stair *et al* (1998:291) also mention that synchronous communication technologies allow for direct interaction between team members, thus allowing them to get to know each other better than through asynchronous communication such as electronic mail. This in turn fosters team work.

However, co-ordination across various time zones may lead to problems. Synchronous communication implies that all team members must meet at the same time, and this may be a problem where team members are located in differing time zones although group schedulers can be used to alleviate this problem to a certain extent.

Lau, Sarker and Sahay (1999) state that the accessibility, synchronicity and richness of the communication medium are some of the important factors which determine the extent to which certain types of technologies would be used and their frequency of usage. More so, Lau *et al* (1999) assert that successful virtual teams often use different technologies to enhance the breadth and depth of their communication. Communication richness is defined by Carmel (1999:48) as a two-way interaction involving more than one sensory channel. Therefore, video-conferencing is a richer communication medium than voice mail, as it uses both visual and audio channels.

Lau *et al* (1999) also explain that time zone differences and physical distances between virtual team members can influence how they communicate with each other. This is well supported by Carmel's (1999:92) time-place matrix, which shows that because of time zone differences, synchronous collaborative technology tools may be less useful in virtual systems development teams. However, this must be balanced out against the fact that synchronous tools such as video-conferencing provide more communication richness than asynchronous communication tools.

Appendix A provides a list of various collaborative groupware technologies, and several of these collaborative technologies are discussed in greater detail in Chapter 5.

Although such supporting technology is necessary and important, it is but one aspect of the virtual team paradigm. The preceding definition of virtual teams show that there are two important and interdependent elements to a virtual team. The virtual aspect indicates a reliance on technology, however it is vital to note that the technology is useless without people to direct its use. Technology is an enabler of virtual communication but it is the team members who determine the effectiveness of the technology through the way in which it is used. Lipnack *et al* (2000) insist that a virtual team is ten percent about the technology and ninety percent about people.

4.5 Rationale for the Use of Virtual Teams

Silberstein (2000) quotes Bob Nelson, president of Nelson Motivation Inc. as stating that "virtual teams tap the benefits of people's expertise without the hassles of facilities and travel. This has increasing value as working hours are becoming more variable and more employees are telecommuting." These and other advantages of virtual teaming are discussed later in this section.

The software industry is uniquely positioned to take advantage of the opportunities offered by such a method of dispersed work. The very nature of industrial software development requires the use of teams consisting of analysts, designers, programmers, sponsors and user to name but a few types of team members. More so, the ability to build a team consisting of members from all over the country, continent or world offers many advantages. Further, Jarvenpaa *et al* (1998) are of the opinion that as companies expand globally, face increasing time compression in product development and use more foreign based sub-contracting labour, virtual teams promise the flexibility, responsiveness, lower costs and improved resource utilization necessary to meet the ever-changing task requirements in highly turbulent and dynamic business environments. Carmel (1999) states that globally dispersed teams are present in various companies in the software industry, such as Lotus, Texas Instruments, Microsoft, IBM and Sun Microsystems to name but a few. Mclaughlin (1995) mentions several reasons for using virtual teams for collaborative software development projects. These reasons are discussed below with specific reference to RE.

1. **Too expensive to re-locate staff. A large development project may span several** geographical boundaries (cities, provinces or countries), and in many cases it is extremely expensive to gather all those people involved in and affected by the project in one location in order to elicit all the system requirements. Distributed RE can solve this problem by using communications technologies (such as videoconferencing) that allow groups of people to communicate with each other while being geographically dispersed.
2. **Sub-contract or outsource part of a project.** The development team may not have all the necessary capabilities required to build a successful system. For example, a company

may outsource the analysis phase of the systems development lifecycle to an external consulting firm that possesses the appropriate analytical experience and knowledge.

3. **Joint venture with another organisation.** This is similar to the above point in that joint ventures aim to capitalize on the experience and knowledge of employees in two or more firms in order to produce more accurate and complete system requirements. Team members are able to meet without incurring travel costs or personal inconvenience.
4. **Internationalisation of products.** Various international branches of a multi-national company may need to collaborate on a product which is to be implemented at each branch. Virtual work allows this to take place in a cost-effective and minimally disruptive manner.

In addition, Carmel (1999) discusses three other advantages:

5. **Best in the world.** This means that companies are able to employ the best available analysts and developers in the world, regardless of their geographic location. Chase (1999) adds that virtual work allows teams to move quickly (thereby reducing the time period for a development lifecycle). She goes on to say that in order to move fast, a team must possess the best and the brightest people available, thereby reducing the learning curve for team members.
6. **Location transparency.** This is the ability to work with other colleagues or groups as if everyone were present in the same room. The location of each team member is transparent (not obvious) to other team members. Location transparency enables virtual groups to experience the benefits of working as a team while also capitalizing on the considerable time and cost reductions that are the direct result of the virtual way of working.
7. **Follow-the-sun.** Given time zone differences, a globally dispersed project can be worked on around the clock, thereby collapsing time to market for project completion.

Other advantages include:

8. **Telecommuting.** Telecommuting allows virtual team members to work from home by using various communication technologies to interact with their work colleagues and the office. According to Bidoli (1999) telecommuting is a trend that is increasing for numerous reasons. Firstly, commuting in a large city is stressful and time consuming due to traffic congestion. Secondly, Saldarini (2000) agrees that employee productivity may be increased due to fewer interruptions and traveling hours. Thirdly, costs will be reduced and flexibility increased. Bidoli (1999) further asserts that skilled workers are

demanding a better balance between their personal and work life, and telecommuting enables them to achieve this equilibrium. The company also wins in terms of reduced costs as a result of less office space being required.

9. **No restriction to office hours.** A direct result of telecommuting is that team members need not work during traditional office hours, except, perhaps when there is a need for meetings.
10. **Minimising personality clashes.** Team members who are not co-located may not experience the personality clashes that may be experienced by teams who work closely together in the same physical location. This advantage arises, paradoxically, out of a common disadvantage of virtual teams. The overriding challenge for any virtual team designer is to provide a seamless working environment, where location is transparent. However, this is not always possible, and when the environment is not seamless, and team members feel more distant from each other, they may be on their best behaviour, thus eliminating the personality clashes that may be felt by team members who know each other well enough to be themselves in the team environment. Chase (1999) quotes Trina Hoefling, principal and lead consultant of the Consult One Group: "Just like in any team, you don't have to be best friends, but there needs to be some reasonable rapport, respect and confidence in one another's competency. That is even more so in a virtual environment, because you don't have the day-to-day, face-to-face interaction, so that needs to be intentionally created."
11. **Performing Multiple Activities in a Seamless Fashion.** Row (1997) explains that on-line collaboration is often more productive than face-to-face meetings. He goes on to note that in face-to-face meetings, people often do not have access to their companies' IT infrastructures. This means that if they need information from databases or legacy systems, participants must bring photocopies or printouts, or everyone has to crowd around a single PC. On the contrary, if the group gathers on the Web, participants can access the information and resources they need while at the same time interacting with one another using desktop videoconferencing or web-based meeting software.

Despite these advantages, however, there are several disadvantages associated with the use of virtual teams. These disadvantages stem from both the technology used to perform tasks, as well as, more importantly, the effect that the concept and practice of virtual teaming may have on the social and task related dynamics of a virtual team, and therefore the work that they perform. These problems can be categorized as day-to-day interaction problems within the virtual environment, as the method of interaction between team members is completely dependent on technology. These are problems that are common to any virtual team. Virtual teams who are engaged in RE will also experience problems specific to RE, namely, problems regarding the implementation of RE techniques in the virtual environment. Problems in the latter category are examined later in this research, whereas those in the former are examined in the following section.

4.7 General Interaction Problems of Virtual Teams

Most of the disadvantages of virtual teams arise from the need to use technology to communicate both formally and informally within the team. According to DeSanctis and Monge (1998), communication is fundamental to any form of organising, but it is preeminent in virtual organisations. They further assert that without communication, the boundary spanning among virtual entities would not be possible. Further, it must be noted that communicating in a virtual environment is very different to communicating face-to face (because of the reliance on technology), and therefore the major problems experienced by virtual teams involve adjusting to new communication methods.

4.7.1 The Two Dimensions of Communication

According to Lau *et al* (1999), there are two interrelated dimensions to communication: social and task. The social dimension provides the basis and desire for team members to communicate with each other over time, and the task dimension focuses on how well project information, tasks and deliverables are being handled through the communication. The social dimension is also referred to by Kivowitz (1998) as the team domain, and she further elucidates that it includes those aspects of being a team that are behavioural, cultural and interpersonal. The task dimension is referred to by Kivowitz (1998) as the task domain, which refers to the nature of the work being done.

Both the social and task dimensions are composed of sub-entities which the literature reveals as posing problems for virtual team members. Later sections detail the problems that can occur within each sub-entity. Figure 4.2 depicts the components and sub-components for communication within a team, based on the work of both Kivowitz (1998) and Lau *et al* (1999).

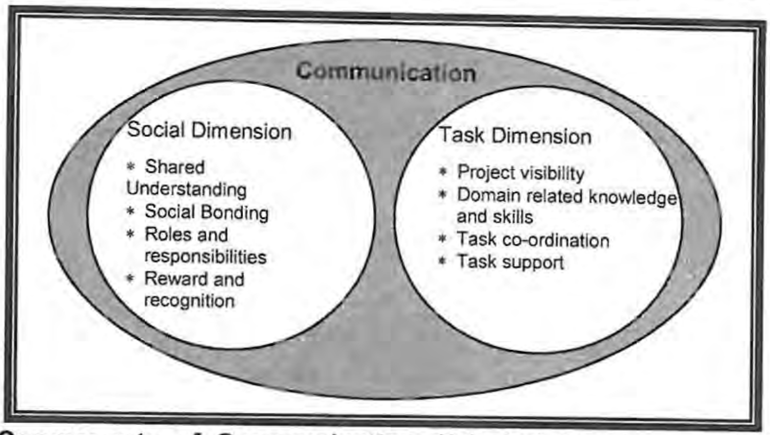

Figure 4.2: Components of Communication *(Adapted from the work of Lau et al (1999) and Kivowitz (1998))*

Interestingly, in contrast with Lau *et al* (1999), Kivowitz (1998) places the sub-component of skills and competencies within the team domain as opposed to the task domain. The author is in agreement with Lau *et al* (1999) on this point, as the skills and competencies are a key component of performing the task, rather than a key component of the social aspect of the team.

Finally, Lau *et al* (1999) refer to the point entitled "task support" as "modes of communication and collaboration." By this, they mean the modes of communication and collaboration that are used to perform work related tasks. Therefore, the author has chosen to substitute the more definitive words "task support" to refer to this final point.

4.7.2 Social Dimension

According to Lau *et al* (1999), the social dimension reflects the part of communication that is directed toward building social relationships and solidarity between virtual team members. It relates to how well team members are able to develop and maintain their personal relationships with each other and with the team as a whole thorough communication during the project. Lau *et al* (1999) and Kivowitz (1998) have identified five aspects to the social dimension (as shown in Figure 6.1). These are discussed below with specific reference to the problems, difficulties and needs that virtual team members have in maintaining these five components.

4.7.2.1 Shared Understanding

Lau *et al* (1999) affirm that shared understanding comes about when team members have a common frame of reference or shared mental model of each others' beliefs, based on their social norms, personal values and past experiences. Shared understanding involves: possessing an idea of the common **purpose** towards which teams are working; a **team culture** which allows individual norms, values and beliefs to converge with the team norms, values and beliefs; and **mutual trust** between members of a team. All team members in any team should possess a shared understanding of one another in order to be successful.

4.7.2.1.1 Common Purpose

Kivowitz (1998) insists that teams must first and foremost have a shared understanding of why they exist, that is, their purpose. Kimball (1997d) agrees in stating that all the research on virtual and distributed teams share the conclusions that having a clear, explicit, compelling, shared purpose around which everyone is aligned is the most important factor associated with team success. Lipnack *et al* (2000), use the word "purpose" to encompass a range of terms from the abstract to the concrete – from vision, mission and goals, to tasks and results.

Gould (1997) mentions a research study that he conducted, which revealed that members of virtual teams often knew what they were doing on an individual basis, but they were not always sure where their progress fitted in to the overall picture. Kimball (1997b) supports this research data by stating that virtual teams have a hard time maintaining the awareness of the whole that helps them feel as if everyone is moving together. Even if a common purpose is defined and agreed upon on formation of the virtual team, it is difficult for virtual teams to stay aligned with this purpose. The reason for this is that virtual team members work with different colleagues at different times, and unlike co-located teams, there is little room for all team members to meet and discuss issues on a more social basis (e.g. in the tea room). Therefore, it is easy for some or all of the team members to lose sight of the overall purpose of the project.

Lau *et al* (1999) further elaborate this point by stating that sometimes distributed team members can have different or local goals that may not be consistent with the overall project goals. Such discrepancies can be detrimental to the team if not reconciled early on. Similarly, when team members do not share a common way of thinking or the same value system, it may be more difficult for these teams to reach consensus on project goals, tasks or deliverables. In either situation, Lau *et al* (1999) state that certain team members may focus only on their local goals , or act on their beliefs, thus undermining the entire project.

Therefore, it can be seen that posessing and being aware of a common purpose throughout the project is the basis of building shared understanding between virtual team members.

4.7.2.1.2 Team Culture

It was mentioned earlier that shared understanding also comes about as a result of team members possessing a common frame of reference with regards to each others values, beliefs and norms. This can be described as the team culture. Massey, Montoya-Weiss, Hung and Ramesh (2001:83) maintain that cultural differences have important implications, since culture is a boundary condition for interpersonal communications. The cultural differences affect how tasks are performed, what communication media is preferred, and how interaction takes place. Where there is a culturally diverse group of people working together in a team, it is often a problem to build a strong and cohesive team culture which reflects the attitudes, norms, values and beliefs of all the people in the team.

Kimball (1997d) states that the culture of a team is influenced by the personalities of the members, the environment in which they work, the nature of the communications media they use, the stories they have to tell about the team, their rituals and celebrations and their shared language. Wisenfeld, Raghuram and Garud (1998) reinforce this point by maintaining that knowledge of the culture of an organisation (or in this case, a team) creates a sense of shared meaning among employees. Wisenfeld *et al* (1998) further maintain that communication helps to create this team culture by providing the social context cues which lead to the perception of social presence and creates a shared interpretive context among team members. Based on the above, it can be said that team culture consists of the following:

1. Personalities of team members
2. Environment in which team members work
3. Nature of the communications media they use
4. Shared language
5. Rituals and celebrations
6. Values, beliefs and norms

Virtual team members are often unable to create a satisfying culture for their team, because interactions only occur when they are necessary in terms of some task that must be accomplished. By contrast, traditional, co-located teams may spend more "spare" time together, (for example, on their coffee breaks), thus building up social ties (and thereby team culture) between themselves.

Kimball (1997b) says that too often, distributed teams are missing many of the elements that are critical to developing culture. She suggests that the overriding reason for this is that a new repertoire of strategies for developing team culture within the virtual environment has not been developed. For example, how can teams create celebrations virtually? How can they make sure that they do not limit their communication to task-specific exchanges that leave out the all-important story telling? They work within the virtual environment, and yet, each team member is also present in a physical work environment – how do they reconcile the two in order to give each other an idea of the environment within which they are working?

The following section discusses some components of team culture mentioned above with regard to the problems that can be experienced in each component. Problems occurring with respect to the personalities of team members are not discussed here, as they are problems that can occur in any team, and this research is focused specifically on the problems experienced by virtual teams as a result of their geographical distribution. The types of communication media used by teams is also not discussed here, because although it is an important aspect of team culture, it also overlaps with the task dimension component of modes of communication and collaboration, and is therefore discussed in detail within that section.

Environment

The environment that any given team member is located in is composed of two contexts – the physical and the social. In a co-located team, it is easy to determine and evaluate each other's social and physical contexts without any team member having to explicitly describe them, because all team members work within the same context.

According to DeSanctis *et al* (1998), successful communication requires the establishment of mutual knowledge, and parties use physical and linguistic co-presence as well as their norms of social context to make inferences about one another's knowledge. This implies that lack of face-to-face contact in electronic communication may negatively impact message understanding. Melymuka (1997) quotes Virginia Lacker, a senior partner at Management Strategies Inc. in San Francisco: "Without face-to-face communication, you definitely lose some of the synergy, the camaraderie…."

Steinfeld, Jang and Pfaff (1999) assert that maintaining awareness of the day-to-day project related activities of group members (physical context) is far more difficult for distributed teams than it is for co-located teams. They clarify that unlike groups working in the same office, who can easily provide updates to each other during routine, daily encounters, distributed groups often go long periods during which they have no information about each others' activities. In addition, Kimball (1997d) explains that problems caused by miscommunication, which can easily be solved when teams are co-located, are much harder to solve in distributed teams. She cites the example of one team member sending another team member an e-mail to which he receives no response. In a co-located team, team members would usually be aware if the lack of response was because the message receiver was away from the office. If the receiver were present at the work site however, it is easy enough for the sender to ask him/her about the lack of response in an informal conversation. However, in a distributed team, when the sender receives no response from the receiver, from the sender's point of view, it could be for a number of reasons:

- The receiver is away from his/her computer and has therefore not read the message.
- There was a technical fault and the intended recipient never received the message.
- The receiver did not understand what the sender was trying to say.
- The receiver thought that the message was stupid, and did not know how to tell the sender.
- The receiver is feeling antagonistic towards the sender for some reason of which he/she is not aware.
- The receiver does not wish to be bothered by matters which seem trivial.
- The receiver is overloaded with work and has not found the time to actually read the message yet.
- The receiver did not think that the message required or merited a response.

Kimball (1997d) explains that the tendency in people who are already feeling tenuous about their relationship (something which is particularly true of a new, distributed team) is to assume the worst-case explanation and to be reluctant to pursue the issue for fear of appearing insecure or silly. She further elucidates that making a telephone call or sending further messages as follow-ups feels less casual, and so individuals are less likely to do it and therefore, misunderstandings are left to undermine the feelings of trust and security necessary to good team performance.

According to DeSanctis *et al* (1998), the fact that parties use their social norms and context to interpret messages and respond accordingly, means that the social and normative context of communication becomes even more important in non face-to-face communication. Kelly and Jones (2001: 78) explain that without a shared frame of reference or context of understanding (developed through ongoing social interaction and negotiation), people have problems interpreting information contributed by others. DeSanctis *et al* (1998) go on to say that mutual message understanding can be highly effective given sufficient contextual information. Therefore, in non face-to-face communication, team members must be trained to provide rich, contextual information to each other in order to increase message understanding and thereby reduce misunderstandings such as the one mentioned above.

Videoconferencing helps to alleviate the need to provide physical contextual information, as team members are able to see the physical context of all the participants in the conference. However, although videoconferencing is effective for JAD sessions, it is expensive and difficult to set up for day-to-day communications between team members. Further, even if cost were not an issue, the fact that team members were not co-located would mean that they would have little idea of each others' social context, resulting in the need for providing contextual information as discussed above.

The social context of a team is encompassed in the norms, beliefs, values and attitudes of members of that team. These are discussed below.

Values, Beliefs and Norms

The values, beliefs and norms of a team also have an important part to play in defining the team culture, as well as the overall goal of promoting shared understanding between team members. Carmel (1999) explains that in a distributed team, language, national traditions, customs and norms of behaviour, organisational norms and local systems development norms could pose a barrier to communication. DeSanctis *et al* (1998) agree by asserting that electronic communication is highly influenced by social norms, with numerous studies showing that electronic communication patterns are less a function of the medium of communication itself than of the norms, practices and social condition surrounding media use.

Lau *et al* (1999) cite a study in which they discuss a certain high performance virtual team which showed that the promptness of the initial communication set the tones of work relations expected and helped to articulate norms which could be drawn up to guide further work.

However, they also discuss a low performance virtual team that was characterised by norms of low interactions, minimal interest and different goals. This, together with the views expressed be DeSanctis *et al* (1998) seems to show that no matter which communication medium is used for virtual team interaction, it can be successful if the norms, practices and social conditions surrounding the use of the technology is shared across the team as a whole.

DeSanctis *et al* (1998) explain that the reliance on technology as a communication medium means that individuals and groups develop certain electronic communication styles or practices, for example, an emphasis on confidentiality in electronic mail communications. If these styles and practices are not adopted across the team, some team members may experience frustration in that issues that they consider important are not considered to be as important by others in their team. This can lead to feelings of alienation and mistrust of other team members. DeSanctis *et al* (1998) also quote studies conducted by Wisenfeld *et al* (1995) and Wilkins (1991), which demonstrate that in addition to varying communication styles and practices, electronic communication is also influenced by previous experiences and social norms of interpersonal interaction of team members, which are then projected into their electronic conversations. They further state that the potential for conflict is substantial, as communication in the virtual team takes place across organisational and social boundaries and as the cultural and professional diversity of relationships increases.

When team members are co-located, they are able to interact socially on a day-to-day basis, thus sharing their individual values, beliefs and norms, and thereby inserting these into the team culture. However, distributed teams often interact only with respect to task-related issues, which means that there is little opportunity to share and manage their individual and group values, beliefs and norms. Further, the dynamic nature of virtual teams may make it difficult for diverse, individual electronic communication styles to converge, or develop new, standard norms for communicating. At their physical work site, each team member is immersed in a certain culture, which may be vastly different to that of the virtual team. Adjusting to being a part of both cultures is difficult. Also, virtual teams are by their very nature, temporary teams which are brought together for a specific purpose (e.g. to elicit requirements for a specific system). Once this purpose has been accomplished, the team dissolves, and team members move on to become members of new teams with different cultures, meaning that each time a new team is formed, team members have to share their values, norms and beliefs in such a way that these can be incorporated into the new team.

Once again, this links up to the need to share contextual information (social and physical). If individual team members are able to provide enough contextual information about themselves to be able to instill consideration of their own values, beliefs and norms in other team members, communication between team members can be highly successful, and will allow them to build up a shared understanding, which helps them to maintain an overall awareness of the task and social related situations of other team members.

Shared Language

According to Carmel (1999:161), shared language is a type of slang that binds the team together. Every closely-knit group has certain slang that they use to talk about common experiences. A shared language makes people feel as if they are part of the group, and it aids to build team culture. Kelly *et al* (2001:79) direct that a shared language also helps to overcome problems of interpretation such as the example described previously, as team members understand each other better when they use their unique, shared language.

Rituals and Celebrations

In addition to shared language, rituals and celebrations are another important aspect of team culture. When teams go out for a celebratory drink once an important milestone of the project has been reached, they bond socially. With co-located teams, it is easy to turn such celebrations into rituals. However, virtual teams, because of their diverse physical locations, are unable to engage in such celebrations. Gould (1997) states: "So far, no one seems to have discovered a technique for successful virtual partying." The absence of any form of rituals and celebrations in a virtual team can hamper the development of team culture.

It can be seen that all the issues which comprise team culture are closely related to one another. Sharing information about each other's physical and social environments enables team members to understand each other better, and to build up a shared language which further facilitates message interpretation. In addition, a cohesive team culture where team members share informal experiences with one another creates a sense of team identity which helps teams maintain their knowledge of a common purpose.

4.7.1.2.3 Mutual Trust

An important component of the shared understanding is developing trust between virtual team members. According to Carmel (1999:142), "trust is essential if people are to depend on one another to meet commitments." As the very nature of a team requires people to depend on each other to perform their project related tasks, it can be surmised that trust is an important team success factor. Cummings and Bromiley (1996:303) maintain that a person trusts a group when that person believes that the group "(a) makes a good-faith effort to behave in accordance with any commitments both explicit or implicit, (b) is honest in whatever negotiations preceded such commitments and (c) does not take excessive advantage of another even when the opportunity is available."

This definition supports the views of Carmel (1999:142) mentioned above, and Kimball (1997d), who states that trust begins to build when team members begin to rely on each other for the performance of specific tasks. It can be said then, that trust derives from team members possessing a common purpose towards which they work together by performing their tasks in alignment with the overall goal towards which they are working.

Kostner (1993:43) notes that there are many opportunities for trust issues to surface when people are distant from each other. Jarvenpaa and Leidner (1998), in their definitive paper on trust in virtual teams concur in stating that the lack of shared social context in most virtual teams leads much of the theoretical and empirical literature on interpersonal and organisational trust to suggest that trust cannot exist in virtual teams. Once again, it is clear then, that trust is closely linked to shared understanding, as the basis of possessing a shared understanding between team members is that of elucidating physical and social context (as described in preceding sections).

Jarvenpaa *et al* (1998) assert that factors such as shared social norms, repeated interactions, and shared experiences have been suggested to facilitate the development of trust. DeSanctis, Wright and Jiang (2001:81) further disclose that trust is communicated through sharing personal emotions and the expression of belief in other competencies. Another factor mentioned by Powell (1990) is the anticipation of future association. Jarvenpaa *et al* (1998) explain that such anticipation of future association is higher among members who are co-located than among physically dispersed members. Furthermore, they quote Latane (1995) as stating that co-location reinforces social similarity, shared values and expectations and increases the immediacy of threats from failing to meet commitments.

Aristotelous (1999:68) quotes Kostner (1999:43) as affirming that distributed environments do not allow team members to be aware of what other team members are doing at every moment of the working day. Therefore, distributed team members often use their own initiatives to fill in blank spaces, usually incorrectly, and often harmfully, as shown in Kimball's (1997d) "no-reply e-mail message" example cited above.

The nature of the distributed environment, combined with the lack of awareness of other team members' priorities (due to a lack of social and physical context cues) also means that team members may make decisions based solely on local priorities, as local is more tangible than distributed. Aristotelous (1999:68) explains the detrimental effects of this as a gain for one individual being an expense for another, thereby further breaking down trust.

From the brief discussion above, it can be seen that trust is an important aspect of communication. A mistrustful environment leads to a breakdown in communication. It can also be seen from the discussion on shared understanding and mutual trust, that the two are closely interlinked. DeSanctis *et al* (2001:81) support this view by maintaining that trust is closely related to building group identity, as it channels the energy of group members toward reaching goals, and serves to motivate group processes and performance. In addition, it was mentioned earlier that trust is communicated through sharing personal emotions and experiences, as well as values, beliefs and norms. Such communication occurs through social interactions within the team.

4.7.1.3 Social Bonding

From much of the literature surveyed, it can be seen that social bonding through informal interaction is an important aspect of the social dimension, and furthermore, assists in building trust and shared understanding. Jarvenpaa *et al* (1998) explain that media richness and social presence theories question the possibility of relationship development (and subsequent trust development) in virtual teams. These theories suggest that computer based communication media may eliminate the type of communication cues that individuals use to convey trust, warmth, attentiveness and other interpersonal affections. However, Jarvenpaa *et al* (1998) also state that empirical studies have found relational information sharing in computer-mediated teams. They further affirm that Walther's social information processing theory shows that computer mediated communication is capable of social information exchange, only at a slower rate than in face-to-face communication.

This shows that social information exchange is possible for virtual teams, and, from the preceding sections, it is obvious that relationship building in the form of social bonding is important in order to build trust and to allow people to feel that they are working together as part of a team. However, it is also clear that the fact that the team members are distributed from each other makes social bonding in a virtual team more difficult than in traditional teams. In addition, Jarvenpaa *et al* (1998) discuss various studies and models which show that, in the absence of individuating cues about others, as is the case in computer mediated communications, individuals build stereotypical information about others based on limited information.

Social bonding is also important in that it allows people to share their norms, values and beliefs across the team in a casual, informal setting, thus ensuring that other team members are cognisant of and considerate towards others in their team. This in turn builds stronger relationships, and thereby mutual trust.

In co-located teams, members can build relationships not only during work hours, but also after work, for example by going out for a relaxing drink after a hard day's work. They are also able to chat informally within the working environment, for example, when they bump into each other in the tearoom. Such casual encounters help to build and reinforce team members' awareness of others' differences and also their similarities to themselves, thus leading them to adjust their behaviour to converge with that of other team members. Virtual teams, unfortunately, lack this ability, as most of their interactions are task based (Kimball (1997c)), and distance prevents them from having face-to-face informal interactions with others. Steinfeld *et al* (1999) support this viewpoint by explaining that because of the need to schedule group meetings in advance, the opportunities for spontaneous and informal real time interactions are limited in distributed groups.

4.7.1.4 Roles and Responsibilities

In any team, it is important that each team member is clear about his/her role(s) with regard to the team. Having a role to play heightens a team member's feeling of contributing something important to the team, leaving him or her feeling fulfilled and satisfied. Kimball (1997b) suggests that when people are together face-to-face, it is quite easy for them to look at each other and decide "who's going to do what." It is much more difficult for a distributed group to ascertain where there are gaps and where it is appropriate to volunteer to become responsible for something. She explains that, often, in a distributed group, team members do not have the experience and skills too "feel out" the group and be comfortable with informal mechanisms to negotiate roles.

In addition, Kimball (1997b) also points out that roles are more complex in distributed groups, as there are more roles needed, and many of them are new and unfamiliar. This view is supported by Qureshi and Zigurs (2001:87), who affirm that although collaborative roles do emerge within a virtual team, they must be made explicit in order to ensure success. For example, in addition to the normal work related roles, distributed teams may also need communication specific roles, such as technical support, knowledge archivists and specialists in using different media.

Roles and responsibilities also provide a basis for what each team member can expect of his or her colleagues. If the roles are clear and explicit, with each team member having a clear idea of who is responsible for what, misunderstandings and frustrations can be reduced, and commitment and trust increased.

4.7.1.5 Reward and Recognition

Hanssen (2000:56) states that TTG Consultants (2000) emphasises the need to increase personal and team morale and boost performance. This is well supported by Kivowitz (1998), who affirms that, to sustain team performance, team based measures and rewards are essential. She further explains that outstanding individual performances should be recognised, but primarily as it supports and extends the efforts of the team. To reward individual success in a team based performance system represents a misunderstanding of team roles, and can fragment team cohesion.

Gould (1997) cites a study in which he states that some management practices (such as recognition) were changed or even eliminated within the virtual environment because of the physical separation of the team. He adds that recognition for team efforts were infrequent, and when it occurred it was via e-mail or a telephone call. It is vitally important that virtual team members in particular are rewarded for their efforts, as they must feel motivated towards working together across time and space towards the project goal. Given the communication barriers discussed in this chapter, working together as a fully functioning team in a virtual environment can be difficult and stressful, and if team members lose their motivation, the project could well fail.

Reward and recognition in co-located teams is also about informal celebrations. However, because of the obvious separation issues, such celebrations are not viable for distributed team members. These celebrations in traditional teams also help to promote social bonding between team members, and allows them to feel more a part of the group. It also helps to build team culture, as celebrations are experiences that are shared across the group.

4.7.2 Task Dimension

According to Lau *et al* (1999), the task dimension refers to the part of communication that is specifically directed at getting the project work done on time and within budget. It addresses how team members engage in communication to deal with project related issues such as sharing information, co-coordinating tasks, meeting deadlines and producing deliverables. There are at least four aspects to this task dimension, as shown previously in Figure 4.2. These are discussed below with specific reference to issues surrounding communications problems.

4.7.2.1 Project Visibility

Gould (1997) mentions that his research study revealed that members of virtual teams often knew what they were doing on an individual basis, but they were not always sure where their progress fitted in to the overall picture. Kimball (1997b) supports this research data by stating that virtual teams have a hard time maintaining the awareness of the whole that helps them feel as if everyone is moving together. This means that virtual teams lack the degree of project visibility that can easily be achieved by a co-located team simply because they are aware of what everyone else in the team is doing as a result of working alongside these people everyday.

Lau *et al* (1999) mention the importance of team members having a common project goal that also integrates any local or personal goals. They further state that this is especially critical for geographically dispersed groups pursuing different individual goals, such as sub-components of a larger project. The need to have shared project visibility among members of a virtual team links closely with the social dimension need to have a shared purpose among virtual team members, and as such, the problems with achieving such project visibility are the same in the task dimension as in the virtual dimension.

Awareness of the tasks being carried out by team members helps them not only to avoid misunderstandings and build up shared understanding, but also to understand where they fit in to the overall project. In this way, team members will be able to align their personal goals (with regards to the tasks they are performing) with their colleagues' goals and thereby the overall project goal. Such awareness also enables team members to share appropriate knowledge with their colleagues, thus leading to everyone being interested and involved in each others' work, and seeing the performance of their own tasks as being a step towards the achievement of the overall project goal. This can keep team members motivated, and also crosses across into the social dimension, by allowing team members to feel as if they are really part of a group which understands each other. Therefore, project visibility, or maintaining an awareness of a team's common purpose is important not only for the social communication dimension, but also for the task dimension.

4.7.2.2 Domain-Related Knowledge and Skills

According to Lau *et al* (1999), team members should possess sufficiently domain related skills and knowledge for the subject area being addressed in the project, and should actively facilitate the transfer of such knowledge and skills to other members. Domain related knowledge and skills are not discussed here, as the author believes that although this is an important component of the task dimension, the problems associated with this component for a virtual team are the same as those for a co-located team.

4.7.2.3 Task Co-ordination

This component of the task dimension of communication encompasses the development of processes for communication, co-ordination and collaboration in the performance of a task (Kivowitz (1998)). Lau *et al* (1999) add that it is the component of the task dimension of communication which allows team members to co-ordinate their project task activities effectively in order to initiate, conduct and complete the project over time.

In a virtual team, it is extremely important that processes for communication are set in place. In a co-located team, such communication processes need not be explicitly defined at all times, as all team members see each other on a day to day basis, and it is therefore easy for them to keep track of one another. Ad hoc meetings can be scheduled with few problems, and collaboration is simply a matter of meeting in someone's office to work on a data model together.

For virtual teams, the situation is quite different. Lau *et al* (1999b) states that managing time and space is important for virtual teams as they affect the pattern and intensity of interactions between team members. Time zone differences and physical distances must be taken into account when co-coordinating the tasks of a virtual team, unlike for a co-located team. Lau *et* *al* (1999) also state that for virtual teams that are further apart in time and space, more effort is needed to co-ordinate their communication and collaboration activities. Accordingly, these teams will become much more dependent on different types of technologies to interact with each other, which brings in further complexity into the process. Therefore, virtual teams must be sensitive to time and space issues when it comes to co-coordinating their work activities.

An added burden to co-coordinating the tasks of distributed team members is the communication technologies that they have to use to interact with one another. Some team members may have different preferences with regard to the technology to be used for communications. For example, one team member might prefer using the telephone for communicating with his colleagues about team-based tasks, while others might prefer to use electronic mail. Although the literature recommends varying the communication media to be used to avoid communication boredom and burnout, standards do need to be set in place for using the most appropriate technology for certain types of tasks. Norms also need to be set in place with regard to how often teams will communicate, and these norms must be cognisant of time and space differences across the team. Communication processes and the types of communication media used are also an important part of team culture.

When teams are co-located, they are able to schedule meetings more easily than virtual teams, because they see each other everyday. On the other hand, virtual teams rely on technology alone for their interactions with others. Gould (1997) cites a research study that he conducted, where one team member said, "[It's frustrating] not being able to get a response from people as soon as you like. Weeks can slip by and we are all doing other jobs." Kimball (1997b) adds that different team members may access various parts of the team's communications system more or less frequently. This means that if some team members check e-mail more often than others, those who check e-mail less often may find it difficult to keep up with the pace of exchange.

For example, if a team leader sends out an e-mail asking for comments on a particular issue, those who check e-mail more frequently will respond almost immediately. When those who check e-mail less often do eventually do so, their responses may be obsolete, as the issue has been resolved without their input, or has moved on to a different level. This may make it more difficult for them to engage with the group, and also leads to a feeling of not belonging to the group.

4.7.2.4 Task Support

This component of the task dimension of communication overlaps with the previous one, which mentioned the need for virtual teams to decide on standards for communication media to be used for their collaborative work. According to Lau *et al* (1999), interactions across time and space as a virtual teams require the use of technology for both substantive and symbolic purposes. Substantive purposes include the sharing of project information, conducting project tasks, as well as pacing and triggering of activities in collaboration (i.e. the task dimension). Symbolic uses of the technology include the articulation of self and group identity and the legitimisation of social norms through team interactions. The accessibility, synchronicity and richness of the medium, as well as the technical experience of the team members, usually determines the extent to which certain types of technologies will be used.

Technological problems were discussed in the preceding chapters, and therefore will not be detailed here. However, it is important to note that according to Steinfeld *et al* (1999), virtual teams often face problems overcoming heterogeneous and often incompatible technology infrastructures. For example, team members may use computers with different operating systems or applications software and network infrastructures may vary widely, giving more capability to team members in some locations than in other. Lack of a harmonised structure increases the effort that distributed team must make to maintain contact and share information.

4.8 Conclusion

This chapter served to introduce the concept of virtual teams, and discussed the reasons for the exponential growth of interest in virtual teams in the business world. The advantages of using virtual teams for software development, and specifically for RE were also discussed. The enabling technologies which support communication between virtual team members can be classified as either synchronous or asynchronous technologies. The accessibility, synchronicity and communication richness provided by the technologies determine which technologies will be used and why.

It was noted that although technology is an important aspect of virtual teams, it is but one component of the virtual team paradigm. The virtual team is completely dependent on technology for communication (informal and formal) and task performance. This chapter examined in detail the two dimensions of communication that must be maintained in order to ensure a successful team, and it discussed how and why virtual teams have problems in achieving such maintenance. Communication between virtual team members is the primary determinant of the success or failure of a virtual team, and therefore, the problems that they may experience when conducting a RE process in the virtual environment must be overcome in order to produce a high quality requirements specification, and as a result, a high quality system. The next chapter discusses how traditional techniques of RE can be adapted for use within the virtual environment.

Chapter 5

Virtual Requirements Elicitation

5.1 Introduction

This section is concerned with the adaptation to a virtual environment of the traditional RE techniques discussed in Chapter 3. As such, each technique is revisited briefly in terms of its characteristics, followed by a brief analysis of the technologies that can be used to implement each technique in the virtual environment. As mentioned in Chapter 3, not all RE techniques are used during the RE phase of the systems development lifecycle. Varying circumstances such as the personalities of the team members and the nature of the system to be developed will determine the best mix of RE techniques.

When discussing RE in a virtual environment, however, an important consideration regarding the techniques to be implemented is the technology available. Vat (2000:160) asserts that despite the advantages associated with the use of communication technologies, their maturity has not yet developed to a point where complex and intricate informal communication processes can be effectively supported. He further explains that ad-hoc meetings are difficult to schedule when teams are communicating solely with the use of communication technologies. The technology itself possesses several disadvantages when put into use. Vat (2000:160) provides the example of desktop videoconferencing, where the camera is usually zoomed in to pick up facial features and head movements, thus excluding the transmission of other body language. He therefore concludes that the choice of communication technologies to support the RE process is extremely important, and that therefore, the choice of RE techniques used in geographically distributed RE is dependent not only on the personalities of the team members and the nature of the system, but also on technological constraints to a certain extent. With this in mind, Vat (2000:161) suggests the use of JAD, interviews and prototyping. To these, the author adds questionnaires, document review, observation, technical reviews and RAD. In short, just about any RE technique can be implemented in a virtual environment with the technology that is currently available, however, their success in the new environment varies from technique to technique.

This chapter, like Chapter 3, focuses mainly on the three principal techniques of RE, namely, JAD, interviews and questionnaires. These techniques of RE are discussed below in terms of their adaptation to the virtual environment In Chapter 3, the RE techniques were discussed in terms of a framework as follows:

1. Introduction to the technique
2. Information sought by the technique
3. Selection of participants for the implementation of the technique
4. Preparation for the implementation of the technique
5. Implementation of the technique
6. Following up the implementation
7. Points of caution

In general, most of the information for each of the elements of the framework remains the same for the implementation of the techniques in a virtual environment, however, elements 4 and 5 will see the most changes once the techniques are used in the virtual environment. The points of caution (element 7) will also differ somewhat in most cases. Additionally, the technology for the implementation of the virtual technique is also discussed. Therefore the discussion below centres around these elements. These are combined in the following framework:

1. Introduction to the virtual technique
2. Technology for the implementation of the technique
3. Preparing for the implementation of the technique
4. Implementing the technique
5. Points of caution

The adaptation of other RE techniques into the virtual environment is also discussed, albeit in far less detail.

5.2 Virtual JAD

5.2.1 Introduction to Virtual JAD

Virtual JAD is one of the more commonly used techniques of virtual RE. One of the reasons for this, as cited by Vat (2000:161) is that structured methods (such as JAD) are easier to implement for group sessions, as the strict control of communication processes, and the pre-defined tools and techniques used make their technological implementation easier. Virtual JAD sessions are prepared for in a similar way as traditional JAD sessions, and should be designed with as much care. Participants for a virtual JAD session should be selected in the same way as for a traditional JAD session, however, the facilitator should be someone who has had some experience in facilitating virtual or electronic JAD sessions.

5.2.2 Technology for Virtual JAD

Because a JAD session is a highly interactive process, videoconferencing would probably be the best collaborative technology to use, as it supports audio and visual transmission, thus improving communication richness. When setting up a distributed JAD session where there are only a few distributed sites with a few team members at each site, the author believes that videoconferencing should be used, as it allows a seamless environment which is very similar to a traditional JAD. However, if the team is quite large, and the majority of team members are not co-located, electronic meeting systems, or preferably, group support systems (GSS) that incorporate electronic meeting systems should be used. In the ensuing discussion, GSS JAD refers to group support systems JAD sessions as well as electronic meeting system JAD sessions.

It could be argued that desktop videoconferencing could also be used, however, the author believes that this would not be useful in a JAD environment unless only one or two of the team members were distributed. The reason for this is that a desktop monitor screen would have to be split up into several windows in order for each team member to see all the others. Clarity would be poor, facial expressions lost, and therefore, many of the advantages offered by videoconferencing become non-existent. Desktop videoconferencing is discussed with respect to interviews in Section 5.3.

In the ensuing discussion on virtual JAD, each component in the framework mentioned above in Section 5.1 is divided into two sub-sections, each of which discuss the component with regard to videoconferencing and GSS respectively.

5.2.2.1 Videoconferencing

Videoconferencing is defined by Goldstein (1995:1) as a "two way exchange taking place in real time by interactive transmissions of images and sound (usually in digital format) between two or more sites, across the world or across the street." O'Brien (1999:380) explains that team collaboration can be enhanced with a full range of interactive video, audio, document and whiteboard communications among the on-line participants, thereby making it the richest communications medium for dispersed groups.

Carmel (1999:99) believes that the sincerity and authority conveyed through body language and eye contact promotes a greater sense of "teamness" that other methods of dispersed communication. For these reasons, the author believes that videoconferencing is an excellent communication medium for dispersed JAD.

When designing a virtual JAD session, whether using videoconferencing or GSS, the equipment to be used to document and visualize the information collected is of extreme importance. The visual aids to be used are relatively limited as compared to traditional sessions, however, the group can use electronic whiteboards and various diagramming tools (CASE tools) to support communication and understanding. Computer Aided Software Engineering (CASE) tools can also be used during traditional JAD sessions, however, they are almost a necessity in virtual sessions. Hoffer *et al* (1999:262) state that for requirements determination and structuring, the most useful CASE tools are for diagramming, and for display and report generation. They further perceive that the analyst can use diagramming and prototyping tools to give graphic form to system requirements, show the tools to users and make changes based on the users' reactions. CASE tools also allow reports to be generated. Hoffer *et al* (1999:262) further note that CASE tools are too slow for the real time pace of most JADs, so the session leader may want scribes to enter information into the CASE tool after the day's meeting is over. Although this may apply to traditional JADs, the author believes that with virtual JADs, the pace may be slower (due to lags, etc.) and therefore, a scribe who is well trained in the use of CASE tools may successfully use these tools during the JAD session itself.

Other technological issues regarding the videoconference enabled virtual JAD are mentioned by Sparg (2000:64-73) in consultation with various authors (Goldstein (1995); Hollan and Stornetta (1992); Inoue, Okada and Matsushita (1997); Elrod, Bruce, Goldberg, Halasaz, Jassen, Lee, Mcall, Pederson, Pier, Tang and Welch (1992); Dourish, Adler, Belloti and Henderson (1994); Koleva, Schadelbach, Benford and Greenhalg (2000); Watson and Sasse

(1998); Gong (1994); Berc, Gajeeska and Manasse (1995); Apperly and Masoodian (1995) and Coleman (1997)). According to these researchers, a videoconference enabled virtual JAD possesses six major components that must be managed when implementing the JAD. Four of these are technology related components (conferencing technology, communication technology, support technology and software and control room) and these are discussed briefly in Table 5.1 below. The remaining components (social environment and physical environment) are discussed in the following section.

Component Name	Factors Affecting Component	Issues
Conferencing Technology	1. Audio functionality	Use full duplex audio to ensure fluid conversation. Use separate dedicated phone links. Configure speakers and audio channels to ensure simulation of realistic environment.
	2. Visual functionality	Visual cues (gaze, facial expression, gesture and body positions) must be supported effectively. Synchronise audio and video. Keep video frame rate as high as possible, and at a minimum of 30 frames per second in order to produce a realistic illusion of movement. Keep image resolution high so that participants can see eye movements of fellow team members. Placement, angles and views of cameras are critical in order to provide a seamless environment.
Communication Infrastructure	1. Network Type	Communication network is required to support collaborative computing technology. Multi media networks that can be used are WANs, LANs, POTs, ISDN-BRI, ISDN-PRI, ATM and SW56. ATM network possesses highest bandwith, and is therefore most effective in supporting a synchronous videoconference.
Supporting Technologies and Software	1. Configurations of support technologies.	Each situation possesses a different ideal supporting software configuration. Ishii and Kobayashi (1992) refer to different configurations of shared whiteboards which support eye contact while using them. LiveBoard, is a directly interactive, style-based large display for use in computer supported remote meetings.
Control Room	1. Technical Equipment	All technical equipment (TVs, projectors, electronic screens, cameras, audio facilities, lighting, electrically operated curtains and blinds, heating and air conditioning) is operated from a remote control room.

Table 5.1: Technological Components to be Managed For a Videoconferencing Virtual JAD

5.2.2.2 GSS JAD

A virtual JAD can also be implemented using Group Support Systems which incorporate electronic meeting systems as discussed earlier. These systems allow team members to type in their comments rather than speak them. According to Nunamaker *et al* (1997), Group Support Systems, (GSS) are interactive computer based environments which support concerted and co-ordinated team effort towards completion of joint tasks. From this definition, it can be seen that GSS are well suited for JAD sessions. Hoffer *et al* (1999:262) and Dennis *et al* (2000:122) explain GSS have been designed specifically to help alleviate some of the problems with group meetings. In a large group meeting, there is often not enough time for every single person in the group to speak. Further, one or two persons may dominate the discussion, and several people may say nothing at all. Thirdly, some people are often afraid to speak out for fear of criticism or retribution.

When using a GSS however, all members of the group can see what the others are typing, and if each person keeps his identity anonymous, there can be no fear of criticism. Also, it is unlikely that any one person could dominate a discussion where all group members are typing, and therefore, a JAD facilitator can obtain contributions from every person involved in the meeting. In this way, more ideas can be obtained and discussed, thus making for a more effective JAD session. Hoffer *et al* (1999:262) quote a study by Carmel, George and Nunamaker (1992), where it was found that GSS supported JADs were more time efficient than traditional JADs, and participation was more equal because there was less domination by certain individuals than in traditional JADs. The study also found that GSS supported JADs had other less desirable effects; the sessions were less structured and it was more difficult to identify and resolve conflicts, due partly to the anonymity of the interaction.

Team rooms are groupware systems that have received a great deal of attention during recent years. According to Sherman (1999), team room software "provides metaphorical and practical context for collaboration" and team rooms are virtual, web-based rooms which allow participants in a meeting to brainstorm, evaluate ideas, share documents, and collaborate in other ways.

Sherman (1999) goes on to say that all team room applications must provide a central secure document repository and maintain an audit trail of all activity. Like traditional document management systems, these applications control access to files using permissions, monitor file usage and status and can automatically update team members about changes to a file. Therefore, it can be seen that team rooms can be used not only as a conferencing technology for a JAD session, but also as support technology for team members as they work outside of their normal meeting times from their distributed locations. The actual functioning of team rooms is described later in the section on JAD implementation.

The table below highlights several technological issues arising from the use of groupware such as team rooms for distributed RE. The contents of the table result from the findings of Nunamaker *et al* (1997), Sherman (1999) and Herlea (1997).

Component Name	Factors Affecting Component	Issues
Conferencing Technology	1. Modularity	EMS software should be built into collection of special purpose modules. E.g. Module A allows idea generation, Module B allows idea exploration, Module C allows idea evaluation. Flexibility is increased, and modules can be reused. Team rooms allow for this by providing different virtual rooms where this can take place.
	2. Interface choices	Subtle differences in user interfaces make large differences in group dynamics. E.g. an idea generation tool with a five line per comment submission encourages concise expression of ideas and enables group to quickly explore a broad range of ideas. An idea generation tool that permits long comments about a few items will encourage in-depth examination of issues. Decide on user interface depending on what needs to be tackled during the JAD.
	3. Structure and Flexibility	Successful meetings require both structure in the group's approach to its task, and flexibility in adjusting its approach as new information is introduced during the course of the meeting. GSS software must provide for both faces of this paradox.
	4. Data Portability	GSS must allow for simple and seamless transmission of group information from one group module to the next. Users should also be able to switch between modules quickly and easily in order to maintain pace.
	5. User Learning Curve	Modularisation of the tool helps to keep group interfaces simple. Therefore, use a GSS which possesses several modules with simple interfaces that are consistent and easy to learn and use. Have a short training or refresher session prior to the meeting.
Communication Infrastructure	1. Network Type	Communication network is required to support collaborative computing technology. Multi media networks that can be used are WANs, LANs, POTs, ISDN-BRI, ISDN-PRI, ATM and SW56.
	2. Servers	A team room is operated through a main server located somewhere in the world. People interact with the server and one another through replication (i.e. server updates person's local team room copy with most recent information it holds at the same time as it updates itself with the information on that person's local copy).
Supporting Technologies and Software	1. Configurations of support technologies.	Each situation possesses a different ideal supporting software configuration. Most GSS meeting systems possess a number of modules or "rooms" which allow document sharing, electronic whiteboards, instant messaging and audit trails of virtual conversations.

Table 5.2 Technological Components to be Managed for a GSS JAD

5.2.3 Preparation for the Virtual JAD

Sparg (2000:74-84) proposes several management strategies for virtual JADs based on the conclusions and findings of various authors mentioned above. Hanssen (2000:29-41) identifies a meeting structure to enhance appropriate and effective human interaction in a geographically distributed RE environment which can be applied to a virtual JAD. Both these studies focus on videoconferencing as the primary communication tool for the JAD session, however the principles discussed and the conclusions drawn can easily be applied to GSS JAD sessions as well. Thus, both videoconferencing JAD sessions and GSS JAD sessions are discussed in this section.

5.2.3.1 Videoconferencing JAD

Sparg's management strategies centre around the aforementioned six components that must be managed when implementing a virtual JAD using videoconferencing. The components can also be applied to GSS JAD, as the process of JAD remains more or less the same; only the technology is different. These six components are comprised of conference technology, communication infrastructure, support technologies and software, control room, physical environment and social environment. The first four components are technological issues which were discussed in the preceding section. However when preparing for a virtual JAD session, the other two factors (physical environment and social environment) are also important. The physical environment is where the user is actually present, while the social environment provides the context within which JAD participants interact with each other. Table 5.3 highlights the various issues surrounding the physical and social environment when videoconferencing is used as the primary conferencing technology.

Component Name	Factors Affecting Component	Issues
Physical Environment	1. Ambient Noise	Minimise movement of furniture, keep doors closed, use carpeted room, check projector fans for noise, soundproof walls, avoid side conversation, use system with audio controls to manipulate microphone levels.
	2. Lighting	Use dimmer, make sure lights do not wash out image projection, allow sufficient light for written work, make sure that filmed participants are clearly lit so that clear image is projected.
	3. Conference layout	Various proposed layouts (see section 5.2.5)
	4. Individual workspaces	Use wireless pen based notebook computer and other essential meeting related materials to support different participants.
Social Environment	1. User background	Individual factors (personality, sex, age, experience, attitudes and values) and group factors (type of group, group norms, leadership and status) all impact on success of a videoconferencing session and interaction with the technology. Technology can be used to control interruptions and dominance by certain participants although care must be taken when doing so. Therefore, facilitator should understand user backgrounds of participants and then use the technology to his advantage.
	2. Group Configuration	Point to point communications which involve only one hardware configuration at each end of the connection is the best configuration. Factors affecting group configurations are: hearing and seeing the speaker, adequate display size, loudspeaker placement, speakers' ability to see all participants in the conference. Group configuration affects conferencing technology and support technology.
	3. Organisational Context	Corporate culture, reward structures, time constraints, competition among colleagues, conflicting interests and mixed cultures influence the use of collaborative technologies. Acceptance of various communication media among participants is influenced by prior experiences of a group. All participants must be competent in the use of the technology.
	4. Virtual Social Distance	Distances between people vary according to their relationship with one another. Sensed distance between participants is influenced by the spatial distance from the screen, the size and quality of the images, backdrops and voice fidelity.

Table 5.3 Physical and Social Environment Components to be Managed for a Videoconferencing virtual JAD

The JAD session must be prepared for in a structured fashion, in much the same way as for a traditional JAD, although more attention should be paid to the technology that is to be used. The steps required for the preparation of a distributed RE JAD using videoconferencing are discussed below:

Step 1: Develop a web page for the project. Paul (1999) as cited by Hanssen (2000:34) suggests that the web page allows a central location where all information pertaining to the virtual team can be assessed. Paul (1999) recommends that the web page should include a help centre, a library of all draft documents (e.g. the working document) and designs, a café for informal chats, and similar spaces that are found when co-located teams are working together on a project.

Step 2: Develop the working document as discussed in Chapter 3

Step 3: Determine the analysis technique to use as discussed in Chapter 3

Step 4: Train scribe and determine the required equipment. For a videoconference, Sparg (2000:80) states that the minimum hardware requirements are: cameras, projectors, projector screens, microphones and speakers.

Step 5: Recruit remote location managers and hold a meeting with them so that they are aware of the issues that may arise with respect to the virtual JAD. (Remote location managers are discussed in more detail in Section 5.2.4).

Step 6: Determine meeting locations. This is more complex for a distributed JAD session, as there will be numerous physical sites that must be booked and prepared.

Step 7: Send out meeting agenda. Hanssen (2000:33) cites the Online Women's Business Centre as suggesting that the agenda should prioritise items that require more team participation to come first.

Step 8: Prepare and arrange all equipment in each distributed venue. This must be done as discussed in the management strategies above, with due consideration to the conferencing technologies, the communication technologies, the support technologies, the control room, the physical environment and the social environment. The actual layout of each distributed venue is discussed in Section 5.2.4.

Step 9: Hold a pre-meeting. In a traditional JAD, a pre-meeting is held in order to establish management commitment, summarise the JAD process and distribute and discuss the working document. In the case of a virtual JAD, the pre-meeting can also be used as a "practice run" to familiarise all participants with the technology to be used.

Step 10: Put in a backup plan. Sparg (2000:76) is of the opinion that a backup plan should be put in place. This ensures that if, for example, the video network goes down, the conference can proceed in the form of an audio conference.

Step 11: Last minute check. This should be done the day before the JAD, and it is each remote location manager's responsibility to see that all equipment is ready for the following day's JAD session.

Step 12: Contact with other venues. Sparg (2000:76) states that at least 45 minutes before the JAD session begins, it must be ensured that the control room has contact with all venues and that all equipment is operational.

5.2.3.2 GSS JAD

Because GSS supported JAD conferences do not support the audio and visual sensory channels, the physical and social environments do not play as large a role in the management of such a conference. The group physical environment is non-existent, as each participant works from his or her own computer, in his or her own office. Therefore, preparation for a GSS supported JAD does not involve preparation of the physical environment. However, it is important to note that when using team room based applications, *simulation* of the physical environment is of the utmost importance. This is where the design of the virtual space comes into play.

Herlea (1997) explains that awareness of other users in the work space is important in simulating the real physical space. Therefore, a team room application should allow for the display of a list of users who are currently connected to the group server, as well as the room each user is currently working in. This facilitates locating other users, and making contact with them. This is especially important during the JAD session, where participants in the process will need to switch between rooms quickly and easily. However, such a simulation of the real physical space impedes on one of the major advantages of GSS which is the ability to provide an anonymous forum where any participant will feel free to contribute ideas without fear of criticism or retribution. Therefore, the facilitator must decide when anonymity is necessary and when it is not. This will depend on the nature of the topic(s) under discussion in the JAD session.

The social environment depends, as with the videoconference JAD, on user background and organisational context. In the case of a GSS, where direct interaction with technology is required in order to communicate, Aram (1998) states that computer literacy and language competence in particular may pose power differences between participants. Therefore, the facilitator must be able to manage these issues effectively in order to ensure complete participation by all.

The steps for preparing for a GSS supported JAD are as follows:

Step 1: Set up team rooms. The various team rooms which can be accessed by each team member serve a similar purpose as the web page in the videoconference JAD.

Step 2: Develop a working document as discussed in Chapter 3

Step 3: Determine the analysis technique as discussed in Chapter 3

Step 4: Train scribe and determine necessary equipment. There are a wide variety of groupware team room applications to choose from, each with their own strengths and weaknesses. The author recommends that the nature of the chosen application should depend on the project, and the type of JAD sessions to be run.

Step 5: Determine technical staff who can set up the application for remote users. The technical staff do not have to be present during the actual conference; their job is only to make sure that the applications are set up and running smoothly. It would be of some benefit for each user to have someone to show them how to use and run the programs, but this is unrealistic if most participants are distributed, and the author believes that with sufficient training, the applications can be used quite easily even by non technical people.

Step 6: Place meeting agenda in one of the team rooms

Step 7: Hold a pre-meeting to help users to become comfortable with the technology.

Step 8: Put in a back-up plan

Step 9: Last minute check. This should take place just before the meeting; the facilitator must ensure that every participant is on-line and able to participate in the meeting.

5.2.4 Implementation of the JAD

5.2.4.1 Videoconferencing JAD

Because technology is an integral part of the virtual JAD, Vat (2000) recommends the use of a technological manager and a communication flow manager who are required to manage and support the technology and the communications flows between participants respectively. Sparg (2000:75) explains that the technological manager should ensure that:

- The collaborative technology used is fully functional
- The participants are comfortable with the use of the collaborative technology
- The other technical staff are fully informed about the new technology and procedures
- The procedures required to run a successful meeting are correctly carried out.

The communication flow manager is responsible for controlling the communication flows between participants with respect to the technology enabling those flows. Both managers are situated in the control room. In addition, Sparg (2000:75) recommends the presence of a remote support manager at every remote site. Such a person requires inter-personal, analysis and technological skills. The role of the remote support manager is to:

- Assist users having difficulty with the technology
- Assist and support the facilitator in eliciting requirements

- Support and encourage team building among remote participants
- Set up the conference technology beforehand
- Ensure equipment is operational
- Report to top management on progress

The physical layout of each site takes into account each of the management strategies proposed by Sparg. These management strategies are designed in such a way as to provide a seamless meeting environment for distributed participants. This means that the participants should feel as if they are all attending one meeting together in one venue. Sparg (2000:78) cites a conference layout proposed by Okada *et al* (1994) which reflects each management strategy. Therefore, the conference layout depicted below in Figures 5.1 and 5.2 takes cognizance of the communication technology, the conferencing technology, the support technology, control room, physical environment and social environment that were discussed in preceding sections. For the purpose of this example, it is assumed that there are three sites, with the facilitator being located at Site 1.

As can be seen from Figure 5.1, the screens at each remote site are set in a horseshoe layout in front of the physically present participants. Sparg (2000:78) explains that the horseshoe layout for the screens is proposed in order to reduce head movement of each physically present participant. The layout for conference Site 3 can be seen in Figure 5.2 where participants from Sites 2 and 1 are projected onto Screens 3 and 1 respectively. The layout for conference Site 2 is the same, apart from different sites being projected onto different screens.

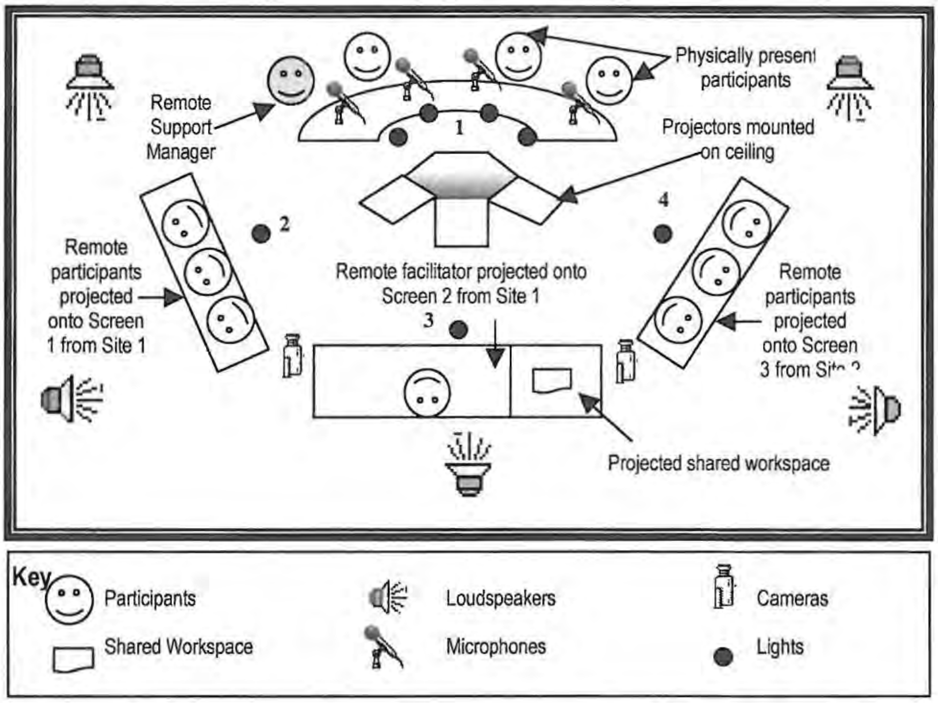

Figure 5.1: Layout of Site 3 for a Videoconferenced JAD *[Okada (1994) as cited by Sparg (2000:78)*

The site where the facilitator is physically present however (Site 1) is set out slightly differently (see Figure 5.2). Sparg (2000:79) cites Okada (1994) who explains that the light positioned at 3 should be approximately four metres in front of the facilitator in order to illuminate him/her for filming. The camera opposite the facilitator, behind the physically present participants, captures gaze, multiple eye contact and direct eye contact.

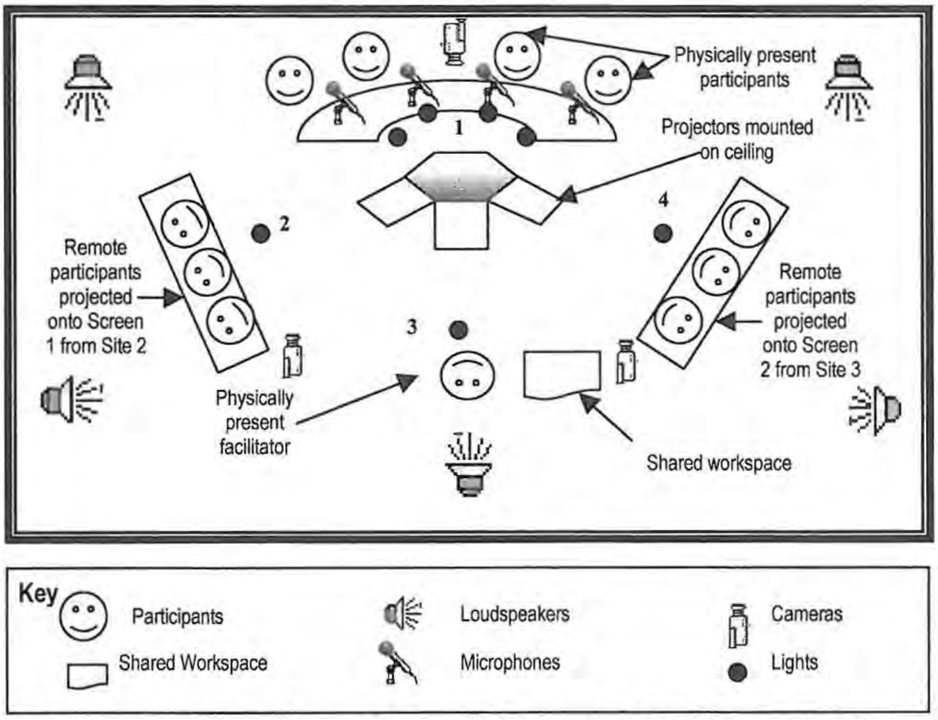

Figure 5.2: Layout of Site 1 for a Videoconferenced JAD *[Okada (1994) as cited by Sparg (2000:80)*

The JAD session itself proceeds along the same structural guidelines set out in Chapter 3 for the traditional JAD. There are six steps within the implementation of the JAD session:

1. Opening the session
2. Business overview
3. Problem presentation
4. Discussion
5. Building a data model
6. Closing the session

In a videoconferencing JAD, Sparg (2000:82) states that the facilitator requires a board on which he can write and draw diagrams related to RE. Thus the LiveBoard mentioned earlier should be used in conjunction with the conferencing technology. The captured screens from the Live Board during the conference can be stored on a server for later review by the facilitator and any member of the team. In addition to this, Sparg (2000:82) also recommends that a video of the conference be recorded and kept because:

- The facilitator can refer back to issues that were previously pointed out
- The stored video can always be accessed for learning purposes
- Once the requirements document has been signed off by the users the stored video is evidence that all the requirements were obtained.

5.2.4.2 GSS JAD

When implementing a GSS supported JAD using a team room type application, physical site layout is non-existent. The virtual space, and the way in which it is set up is extremely important, however. Herlea (1997) describes a demonstration of a team room application known as TeamRooms as applied to the RE process.

Firstly, she discusses the virtual rooms themselves. As mentioned in Section 5.2.3, the generic rooms should be set up by the facilitator beforehand, but the application should allow for rooms to be set up as and when they are needed during the JAD session. Herlea (1997) explains that each room contains both generic communication tools (a chat tool and a backdrop acting as a shared whiteboard) and any number of applets needed to support the group's work. The rooms in TeamRooms were created specifically to support the requirements gathering process. Figure 5.3 shows the existing rooms in the system. The participants may enter any room in the workspace by clocking on the name of the room and work with other users in the same room. Herlea (1997) created the following rooms to support collaboration over the electronic meeting space. Although the rooms are aimed at allowing collaboration for gathering requirements, they were not specifically created for an electronic JAD session. However, they can be modified slightly in order to serve as virtual workspaces for conducting an electronic JAD.

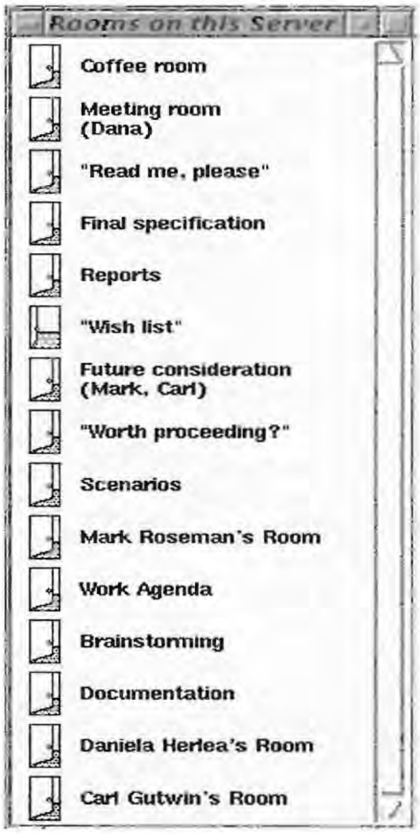

Figure 5.3: Rooms in the meeting workspace *(Herlea (1997)]*

- Brainstorming room – used to record all "quick ideas" generated throughout the JAD
- Meeting Room – used as a general working space that gathers the participants. This can be used as the thread that ties the JAD session together. Participants will have to move from room to room, but will always come back to the meeting room for discussion.
- Work Agenda Room – used to keep an agenda of the meetings, used mainly by the facilitator.
- Documentation Room – used to record the elicited requirements. Although this room is accessible to all participants, the author recommends that only the scribe and facilitator have the ability to update the documentation. The room should provide the scribe with access to Case tools, and any other documentation tool deemed necessary.
- Scenarios Room – used to build scenarios of future situations.
- "Wish List" Room – used to store the initial list of requirements.
- Future Consideration Room – used to record the intermediary results of the process.
- Final Consideration Room – used to store the final document of requirements, used by the design team in implementing the system.
- Reports Room – used to communicate and inform about progress.
- "Worth Proceeding?" Room – used to test the prototypes against the requirements.
- Read Me Room – used to leave notes for other participants in the process (outside the JAD session).
- Personal Rooms – used to store users' own artifacts.

As with any JAD session, Herlea (1997) explains that the facilitator of a TeamRooms meeting has a critical role in organizing the work of a RE team. She further states that he or she enables effective communication, works as a project manager for the elicitation team, can have the knowledge of the room and action of each participant in the working space

Kimball (1999) highlights the importance of opening and closing rituals in a distributed meeting. She describes the necessity for the virtual equivalent of "opening the space." This can be achieved by walking around the circle and making eye contact with each participant. In order to allow for this in the virtual environment, Hanssen (2000:36) asserts that there should be an indefinite pre start time in which the participants can participate in informal chats in a virtual café, or, in the case of a GSS JAD, in an informal meeting room. Similarly, the closing ritual should also allow participants to gather in a virtual café / informal meeting room for informal chats if they so desire. When a traditional JAD is over, people leave the venue in groups, chatting informally about what took place during the session itself. This allows them to gain closure, and it is just as important to allow for this in a distributed environment.

Despite the differences between the traditional and virtual environments, once the JAD session is under way, the JAD process for the two is almost identical. In fact, the closer the virtual JAD is to a traditional JAD in terms of participant interactions, the more successful it can be seen to be, as one of the overriding goals of a virtual JAD is to provide a seamless environment within which to collect requirements.

In this sense, a videoconference JAD mimics a traditional JAD much more effectively than a GSS JAD could. The reason for this is that once the equipment is set up, and the participants can all see each other, most of them have no direct interaction with the technology. In a GSS JAD however, all participants rely on direct interaction with the technology in order to communicate, and therefore, a GSS JAD is quite different to a videoconferencing JAD in practice although the underlying principles and concepts remain the same. This does not mean, however that GSS JADs are not effective. GSS JADs open up a range of possibilities for participant interactions which are enabled by the technology, and which, if used effectively, could provide for a satisfying and effective RE process.

5.2.5 Points of Caution

Despite the obvious benefits of virtual JAD, there are some points of caution to look out for. Many of these were discussed within the preceding sections, so they are examined very briefly in this section.

5.2.5.1 Videoconferencing JAD

Firstly, videoconferencing, despite offering the most communication richness, can only be used when there are only a few remote sites from which participants will conference. The reason for this is that the technology itself is expensive and difficult to set up, and if it is necessary to set up the technology at many sites, the cost advantage of conducting a virtual JAD (i.e. no travel costs) will fade away. Also, a technical person must be present at each site as the remote support manager who will manage the technology and provide assistance to non technical users. To make this worthwhile in terms of cost, the remote site must host a number of participants. It can be argued that desktop videoconferencing can be used if multiple participants are dispersed, and as this is cheaper than implementing full videoconferencing, the cost advantage may still be held on to. However, desktop videoconferencing with multiple participants in remote locations leads to other problems, such as poor picture clarity caused by a desktop window filled with the tiny images of a number of individuals.

Further, aside from the technology, the high bandwith and dedicated phone lines needed to run a "smooth" videoconference (no jerks, delays between audio and video (O'Brien (1999:380)) are also expensive, and, as mentioned by Sparg (2000:89) may be out of reach for the average South African organisation.

Also, videoconferenced JADs are prone to the same group related disadvantages as traditional JAD sessions, with some people dominating the discussion and others not participating for fear of criticism or retribution, or from a reluctance to use the technology. Consequently, it is important that the guidelines for traditional JAD sessions are followed when implementing a videoconferencing JAD session.

Harpur (1998:51) highlights the fact that the virtual environment introduces a number of barriers to non-verbal communication. In some respects, because the videoconference is so similar to a face-to-face meeting from the participants' perspective, it is easy to lost sight of the fact that it is in fact a virtual meeting, that is dependent on technology for the interaction of the participants. An important JAD facilitator skill is the ability to read the body language and non-verbal cues of participants, as such cues allow facilitators to pick up the feelings and emotions of participants that may otherwise not be communicated explicitly. For example, nail-biting indicates nervousness, yawning indicates boredom, and so on.

By observing such non-verbal cues, facilitators are able to react to them in a positive manner (for example, setting the participant's mind at ease tactfully, or calling a break). In a videoconferencing JAD environment, although the facilitator is able to see all the participants, such non-verbal cues are more difficult to pick up. For example, the facilitator may not be able to determine whether participants at a remote site are reacting to the proceedings of the conference, or some distraction at their physical site. In a similar fashion, it may be difficult for facilitators to read people and their intentions as clearly as they could in the traditional environment.

Furthermore, Harpur (1998:51) explains that the facilitator may not be able to control participants as easily using non-verbal communication. As the participants are simply images on the projector screens, it is, for example, impossible for the facilitator to directly approach a shy participant, or to turn his/her back on an arrogant participant.

Briggs *et al* (1998) and Adkins (1999) explain that back channels of communication do not evolve naturally in the virtual environment. Back channels of communication, in the context of traditional JAD sessions, refer to the informal interactions of the JAD participants regarding their opinions and beliefs as to the proceedings of the JAD session. In traditional JAD sessions, participants leave the JAD room chatting about issues that arose within the JAD session, or they spend their breaks discussing these issues, or meet informally before the JAD session to confirm meeting content with one another. In the videoconferencing JAD environment, because of the disparate locations of the participants, such back channels do not evolve between all the participants.

This impacts negatively on the JAD session, as Briggs *et al* (1998) and Adkins (1999) assert that the existence of such back channels allows the facilitator to make direct, informal contact with the JAD participants, and furthermore, allows the facilitator to use the information collected from these back channels to evaluate the JAD session and him/her self, thereby enabling him/her to prepare a more suitable JAD session for the next meeting.

Sandelin (1998) as quoted by Hanssen (2000:16) describes a number of facilitation skills for a videoconferencing JAD session. In a virtual environment, the emphasis of these skills is slightly different, and facilitators should be made aware of and trained in the adapted and new skills required of a facilitator in a videoconferencing JAD session. These skills are discussed in more detail in the following chapter but are not examined in great depth, as the identification and detailed description of all the facilitation skills required in a videoconferencing JAD environment can be considered to be subject matter for a thesis in its own right. The primary acknowledgement here is that videoconferencing JAD facilitators should be aware that their traditional facilitation skills cannot all work successfully within the virtual environment, and they should therefore aim to acquire and use facilitation skills that are more suited to the dynamics of a videoconferencing JAD session.

Finally, it must be noted that group dynamics are more difficult to maintain in the videoconferencing JAD environment. Johnson and Johnson (1994) explain that effective group dynamics are difficult in the virtual JAD environment because of the psychological hurdle caused by the technology barrier. The technology barrier leads participants to view themselves as being removed from others in the group, meaning that it is difficult to communicate their ideas and feelings effectively in the JAD session. Further, it may be the case that participants bond more closely with people who are at the same JAD site as themselves, thus fragmenting the virtual JAD group into smaller components, once again leading to a breakdown in effective group dynamics.

In addition, the facilitator's site may be perceived to be the "main site", leading to feelings of isolation for participants who are at other sites. This may cause an imbalance in feelings of power and equality, and may lead to conflict situations. Such a breakdown will indirectly affect the production functions of a group, that is, problem solving, active participation, commitment to goals and decision making.

5.2.5.2 GSS JAD

A GSS JAD, such as can be achieved through the use of a team room application, can overcome many of the traditional problems associated with groups. However, there are still a few points of caution to note when implementing such a JAD. Firstly, according to Aram (1998), power differences can emerge between users as a result of varying levels of computer literacy. When using videoconferencing for the JAD session, most participants do not have to interact directly with the technology. The conference room is set up by technical staff, and participants merely sit at their designated positions and interact using verbal and visual cues.

When using a GSS however, people do have to interact with the technology itself in order to communicate with fellow team members. As a result, non-technical users may not feel comfortable using the technology, and will therefore not use it to its full potential. Some participants (generally those from the user community) may not type as fast as others and may end up feeling frustrated as the conference proceeds because the discussion is moving too fast for their limited typing skills. This is very dangerous, as it may lead to a tendency for the development team to dominate the discussion, meaning that the requirements gathered from the user community could be incomplete, inconsistent, or simply wrong. Aram (1998) also explains that the need to use technology might cause increased anxiety among non-technical users, once again leading to incomplete or wrong requirements.

Furthermore, GSS JADs often threaten the spontaneity of the dialogue, as people think more carefully about what they write than what they say. This may mean that certain, sensitive issues which may arise spontaneously in a traditional JAD do not arise in the GSS JAD, because of the perceived formality of the medium of communication.

In addition, as with the videoconferenced JAD, back channels of conversation do not evolve naturally, there is no form of non-verbal communication, facilitation skills required are different, and there is difficulty in building and maintaining effective group dynamics. Moreover, as the GSS JAD focuses the attention of the participants on the collaborative technology, these problems may be exacerbated.

5.3 Virtual Interviews

5.3.1 Introduction to Virtual Interviews

In Chapter 3, an interview was defined by Kendall *et al* (1999:111) as a directed conversation with a specific purpose that uses a question and answer format to gain information. It is possible to conduct interviews virtually, although if large numbers of users from varying geographic locations are to be interviewed, this can be prohibitively expensive. The virtual interview should be prepared for in a similar fashion as the traditional face to face interview, with an agenda, due regard to the question formal (closed, open, probing questions) and the interview structure. Participants are selected in the same way.

5.3.2 Technology for Virtual Interviews

Due to the one-on-one nature of interviews, videoconferencing is recommended as the collaborative technology of choice for interviews. It was previously mentioned that interviews are important not only for the facts and opinions obtained from the interviewee, but also for the observation of body language, emotions and other signs of what people want and how they assess their situations. In the absence of face-to-face contact, videoconferencing is the next best alternative. However, full videoconferencing can only work well if all the users are from one office, as this means that the videoconferencing technology need only be set up at the user site once, in a private room, which each user enters at his/her prescribed interview time. If a large number of users are distributed, full videoconferencing is not a viable option, as setup costs would be too high. Full videoconferencing was discussed in detail in Section 5.2 and will therefore not be discussed again here.

A cheaper method of enjoying the benefits of audio and video during the interview is to use desktop videoconferencing for the interview. According to Evans (1997), Desktop Videoconferencing (DVC) is computer facilitated two-way interactive voice and sight communication between to two or more individuals at distant locations. It allows users to communicate face to face with others over distances of a few metres or thousands of kilometres. Thus, it is possible to use this technology for interviewing potential system users in order to gather systems requirements.

According to Matney, Franz and Barrett (1998), there are over 70 desktop videoconferencing products on the market. The technology required to implement desktop videoconferencing is discussed by various authors such as Evans (1997), Wong (1998) who discusses a specific application (CU-See Me), the videoconferencing team at the University of Michigan (1998), Pearl (1992), Matney *et al* (1998) and the Eastman Kodak Company (2001). This is summarised in Table 5.4.

Component Name	Factors Affecting Component	Issues
Conferencing Technology	1. Basic Computer Requirements	Minimum CPU specification is 486 DX processor. Operating system of Windows 3.1 or higher running in Enhanced Mode. Windows Sockets compliant TCP/IP stack (Winsock). 256 colour (8 bit) video driver at any resolution. CODEC (COmpression-DECompression) circuitry for compressing and decompressing analog bandwith.
	2. Audio functionality	Windows Soundboard that conforms to the Windows Multimedia specification. Full duplex audio recommended. Use headphones instead of speakers to reduce echo and feedback. Use hands free, sensitive microphone.
	3. Visual functionality	Video capture board that supports Microsoft Video for Windows and a video camera to plug into the video capture board OR a Connectix QuickCam camera (no video capture board required).

Communication Infrastructure	1. Network Type	Most desktop videoconferencing systems can run over a typical corporate network (e.g. IP network or corporate WAN). Ordinary phone line service (POTs) generally inadequate; at 4-8 frames per second, images are jerky and unnatural, and audio suffers from delay. ISDN is dedicated line with higher bandwith, therefore speed of transmission is constant. Ethernet has even higher bandwith, but speed of transmission varies according to how many people are currently using the network.
Supporting Technologies and Software	1. Software for desktop videoconferencing	Over 70 different options, e.g. Microsoft Netmeeting, White Pine's CU-See Me, VDO phone.
	2. Extras	Look for desktop videoconferencing software that possesses electronic whiteboarding, file transfer and application sharing.

Table 5.4: Technology Related Components to be Managed when Desigining a Desktop Videoconferencing Interview *(Evans (1997), Wong (1998),The videoconferencing team at the University of Michigan (1998), Pearl (1992), Matney et al (1998) and the Eastman Kodak Company (2001]).*

The following table (based on the work of Evans (1997)) shows how desktop videoconferencing compares to full videoconferencing.

Characteristic	Full Videoconferencing	Desktop Videoconferencing
1. Reach	Able to reach very limited number of sites	Able to reach limited number of sites (but more than FVC)
2. Interactivity	Face-to-face interactivity	Face-to-face interactivity
3. Video	Almost broadcast quality, near full motion video.	Lower resolution, less than full motion capabilities.
4. Use	Cost effective when there are only 2/3 sites.	Cost effective with multiple sites.
5. Scheduling	Time consuming and laborious because of the need to ensure that the conference facility at the remote site is free for use by the interviewees.	Easy to schedule because both interviewer and interviewee can interact from the comfort of their own computers. Other facilities need not be booked.
6. Access	Connection must be made by technical staff from both ends.	Connection is made via the computers over an ISDN. The analyst can guide the interviewee through the process over the phone.

Table 5.5: Comparison between Full Videoconferencing and Desktop Videoconferencing *[Includes Evans (1997)]*

Thus, it can be seen that the technological requirements and costs necessary to implement a desktop videoconference interview are much less than for a full videoconference. However, it must also be noted that image resolution for the desktop videoconference is fairly low, and this might impact negatively on the observation of body language and emotions.

Where the information to be obtained is not of a sensitive nature, one could even substitute a chat system for videoconferencing. Chat systems are inexpensive and widely available, and, according to O'Brien (1999:383) they enable people to converse and share ideas interactively by allowing them to type in comments, and seeing the responses on their display screens almost immediately. If all the interviewer wishes to do is to gain an understanding of the interviewee's job functions, this may be the easiest and most cost effective way to conduct the interview. The chat system would allow the interviewer and the interviewee to log on to an application that would allow them to discuss requirements over the Internet. NetMeeting is an example of such an application. It is an easy to install and use program, which requires minimum computer specifications, and allows users to communicate in real time over normal phone lines or corporate networks.

To conclude this section, the author notes that full videoconferencing is not a cost effective method of interviewing users. Even when users are located at one site, and only one link needs to be set up, it is probably more cost effective for the interviewer to travel to the user site than to use full videoconferencing. Therefore, although it is possible to use full videoconferencing for a virtual interview, the author recommends the use of chat systems or desktop videoconferencing.

5.3.3 Preparation for the Virtual Interview

When preparing for a virtual interview, the interviewer must proceed in the same fashion as for a traditional interview:

1. Read background material
2. Establish interview objectives
3. Decide whom to interview
4. Prepare the interviewee
5. Decide on question types and structure
6. Determine project team members who will participate in the interview
7. Set the location and time for the interview

When preparing the interviewee for the virtual interview, the interviewer should not only advise him/her of the objectives and scheduled time of the interview, but should also ensure that he/she has been trained in the use of the communications technology to be used. To this end, it is necessary to hold a tutorial session on-line with all those users who are to be interviewed. This can be accomplished quite easily a day or two before the interview, as both chat systems and desktop videoconferencing systems are easy to use and navigate.

When setting the location and time for the interview, the analyst has far more flexibility than when performing this step in the preparation of a traditional interview. The reason for this is that no traveling is involved when desktop videoconferencing and chat systems are used. Both interviewer and interviewee can communicate from their own offices. In today's working world, many employees work from cubicles, which afford limited privacy. The interviewer must research the interviewee's work situation, and consult with him/her and in some cases, a person with appropriate authority to determine a private location from where the desktop videoconference can take place. Privacy is of the utmost importance when the interview deals with sensitive issues, and the interviewer must ensure that the user to be interviewed will be comfortable enough to reveal sensitive information if necessary. The interviewee should videoconference from a private, secure room where there will be no interruptions and he or she is able to provide his or her full attention to the interviewer.

The interviewer should also make sure that both he and the interviewee have set up their locations for maximum picture clarity. The Eastman Kodak Company (2001) has this to say about setting up the locations to achieve clear pictures:

- Make sure participants are well lit with a light source placed behind the camera – never sit in front of a window or other light source
- Wear solid, dark colours. Solid areas of colour are easier for the camera, computer and network to photograph, process and send.
- Consider hanging a pastel sheet in the background if the background is not a plain wall.

5.3.4 Implementation of the Virtual Interview

Chapter 3 discussed several guidelines for conducting a successful interview. These must be followed closely when implementing a virtual interview, although due to the differences in the way in which the participants communicate, some of these guidelines require more attention, whereas others (such as the obvious one of shaking the interviewee's hand) become non-existent.

Other important guidelines come to light as a result of the technological nature of the virtual interview. The Eastman Kodak Company (2001) declares various technological guidelines to adhere to when conducting a desktop videoconference.

1. Adjust camera options
   - Type of Light: Some cameras offer automatic adjustment for different lighting, and this enables one to adjust the camera's colour for fluorescent, incandescent, or natural light.
   - Size of Image: If both parties have a high bandwith connection, they can send each other slightly larger images (if their cameras offer the option).
   - Resolution of Image: A higher resolution sends a clearer, sharper image -- but because each frame contains more data, fewer frames can be sent each second. This

makes motions appear more blurry and choppy. Lower resolution makes the image appear less sharp, but movements appear smoother and more realistic.

2. Getting a better picture
   - The system may have a hard time keeping up with the participants' physical movements, so minimize the number of quick, sudden motions.
   - When using visual aids or graphs, place them on a table or easel instead of holding them – accidental movement will make them difficult to read.

The Eastman Kodak Company (2001) also discusses the conversation skills that need to be cultivated when conducting a desktop videoconference. Because of the time taken to compress and decompress audio and video, there is often an audio lag between the participant speaking, and the other person hearing his or her voice. This often leads to interruptions and awkward miscommunications. To work around the problems experienced by audio lag:

- Avoid using audio cues like "OK" and use visual cues (such as nodding) instead.
- Firmly define the end of conversation with "goodbye" instead of trailing off.
- Whenever you start to speak, finish your thought with one statement with a definite conclusion.
- Give the other speaker a second or two after he/she has stopped talking to make sure he or she has finished.

Chapter 3 divided the interview process into three parts:

- Introducing the Interview
- Conducting the Interview
- Closing the Interview

Desktop videoconferencing allows these three phases of an interview to take place as with a traditional interview. There are, however, several points of caution to be noted, and these are discussed in the following section.

5.2.5 Points of Caution

In Chapter 3, the importance of establishing an interviewer's credibility and trustworthiness was noted. Even in a traditional environment, this is not an easy task, and the psychological distance created by having to use collaborative technologies through which to conduct the interview may cause this to be even more difficult. Without trust, an interviewee may be unwilling to reveal important details, thus causing the interview to fail. Also, when using desktop videoconferencing, Vat (2000:161) notes that the cameras are usually zoomed into the users' faces. Therefore, the interviewer will only see eye movements and facial expressions rather than full body gestures. The interviewer should be aware of the fact that he or she is not receiving the full picture, and should thus concentrate more on clarifying the comments and answers of the interviewee in order to ensure that he or she receives correct and reliable information. This is especially important when the interview deals with sensitive or political issues such as power hierarchies.

When interviewing a user via a chat system, the interview will typically be more informal, and will concentrate on gathering more quantitative information rather than qualitative information such as opinions and feelings. The author is of this opinion because a chat system does not provide a great deal of communication richness, and therefore body language and tone of voice cannot be observed and picked up on by the interviewer as it can be in a face to face environment. Thus, the interviewer must ensure that chat systems should only be used for interviews when gathering quantitative type information of a non sensitive nature.

5.4 Electronic Questionnaires

5.4.1 Introduction to Electronic Questionnaires

As mentioned in Chapter 3, questionnaires are defined by Whitten *et al* (1998:630) as special purpose documents that allow the analyst to collect information and opinions from respondents. The fact that even traditional questionnaires do not require face to face interaction between the analyst and the respondents means that questionnaires can easily be administered through collaborative technologies. There are several advantages to using electronic questionnaires over traditional questionnaires. Wortman and Upcraft (2001) and Kendall *et al* (1999:165) mention the following:

1. **Both quantitative and qualitative information can be gathered.** Closed ended questions with standard answers and response scales can be used. Similarly, open-ended questions that allow the respondent to form and submit their own answers can also be incorporated into the instrument design.
2. **Data can be collected in a user-friendly manner.** Instead of the drudgery of completing and returning a mailed questionnaire, web-based instruments demand far less respondent time and effort.

3. **Respondent time to complete the survey is reduced.** "Point and click" takes less time than responding verbally to a telephone survey or in writing on a mailed questionnaire, *if the amount of time to complete the survey does not exceed seven or eight minutes.*
4. **Data collection time is reduced.** Mailed surveys sometimes take months to complete the data collection process; web-based surveys can take as little as three weeks.
5. **Anonymity can be maintained.** One of the major objections to web-based surveys is that many people believe that anonymity of responses cannot be guaranteed. On the contrary, when placing an instrument on the web, results can be collected without any identifying information attached.
6. **Respondent pool can be increased.** With a web-based survey, researchers can cross the boundaries of time and distance to reach target audiences, particularly if the audience is widely dispersed geographically.
7. **Data can be more efficiently managed.** Unlike other forms of data collection, web-based data can be recorded and analyzed electronically and automatically, saving time and money, and eliminating data recording errors.
8. **Duplicate responses can be identified.** Another concern of critics of web-based data collection is the fear that a rogue computer user might submit multiple responses to the same survey, thus compromising the integrity of the study. On the contrary, software programs can process responses in ways that identify if the same person submits more than one survey.
9. **Instruments can be piloted more easily.** Piloting an instrument can be done through e-mail or web-based approaches. Respondents are asked to fill out the survey and make comments on its validity and clarity, and do so within a very short period of time.
10. **Instruments can be retooled to accommodate changes.** Compared to other data collection methods, surveys can be easily and quickly modified, saving time, money, and inconvenience.
11. **Certain costs may be lower.** There may be some significant cost savings using web-based approaches, compared to other data collection methods, depending upon the availability of computer equipment, software, and expertise.
12. **Greater control over responses can be more easily achieved.** Web-based data collection has greater potential for solving the problem of how to deal with questions that are answered improperly. HTML coding allows for investigators to ask for and receive specific responses without deviation. Further, a survey may be designed that does not allow respondents to skip questions by not allowing those respondents to continue until a field is filled in.

Thus, it can be seen that electronic questionnaires possess major advantages over their traditional, paper based counterparts. The following sections explain the technology required for the questionnaire, the design of an electronic questionnaire, the implementation of the questionnaire, as well as the disadvantages and points of caution associated with electronic questionnaires.

5.4.2 Technology for the Electronic Questionnaire

Unlike videoconferencing, desktop videoconferencing and GSS, electronic questionnaires do not require expensive technology. Although specialised software packages are available for the design and implementation of the electronic questionnaire, for the most part, these are easy to use and inexpensive to buy and implement. Electronic questionnaires can be administered in two ways:

1. Over the Internet, where respondents fill out the questionnaire on-line
2. Via electronic mail

The first option is to implement a web-based questionnaire which can be posted on a website on the Internet. Respondents then log in to the web site, fill in the answers, and submit the questionnaire to a database. There are various software packages which enable analysts to design and implement the electronic questionnaire, each of which offers varying capabilities. Some of these are PinPoint for Windows, DoSurvey and PolyForm. Most of these software packages also offer the questionnaire designer aid in analyzing the results. Various authors and company websites were consulted to determine the technological issues to be considered when implementing a web-based questionnaire. These include Cambridge Software Publishing (2001), Georgia (2000), ResearchInfo.com: The Online Market Research Community (1999), Kenyon (1996), Websurveyor Corporation (2001), Upcraft and Wortman (2001) and DOSurvey Ltd. (2000).

Component Name	Factors Affecting Component	Issues
Technology for the Electronic Questionnaire	1. Basic Computer Requirements	Theoretically, any computer which is capable of running Internet Explorer or Netscape Navigator can be used, but each software package has its own requirements. Both analyst and respondent need to have Internet access.
	2. Server	Many of the software companies who design web-based survey software also offer to store results on their own server. Depending on the package chosen by the analyst, and the sample size, responses can be stored on an external server, an internal company server, or on a personal computer.
Communication Infrastructure	1. Network Type	Any network can be used: POTs, ISDN or Ethernet.
Supporting Technologies and Software	1. Software for sending and receiving the electronic questionnaire	Variety of software to design, implement and analyse questionnaire, e.g PinPoint, DOSurvey, Perception offering various capabilities. Internet Explorer or Netscape Navigator is needed, version depends on software package. HTML editor. Some web survey software require MS Excel or MS Access to which to export the responses.

Table 5.6: Technological Components to be Managed when Implementing a Web-based Questionnaire

These software packages can also be used to design electronic questionnaires and send them to the prospective respondents via electronic mail. For example, Cambridge Software Publishing (2001) explains that PinPoint for Windows questionnaires can be saved as standalone files that are easily attached to any email system. Respondents are then sent the email, and can open up the questionnaire on their desktop PC. No local copy of PinPoint is required for the respondents. They then complete the survey, copy the finished survey into an email back to the person sending out the survey. The email is sent back to the analyst who simply imports each reply into a PinPoint data file, ready for analysis when the survey is complete.

5.4.3 Preparation (Design) of an Electronic Questionnaire

As mentioned before, there are a variety of different web survey software packages on the market. Each of these requires various different types of supporting software and user knowledge. Some require HTML knowledge on the part of the questionnaire designer.

This section highlights one of the many web survey software packages on the market: PinPoint 3 for Windows. The author chose this software package, because it requires no coding knowledge on the part of the questionnaire designer, requires no local copy of PinPoint to run on the respondent's machine, lends itself to both email and web posting, and allows detailed analysis of responses.

Cambridge Software Publishing (2001) explains that when designing a questionnaire such as in Figure 5.4 using PinPoint 3 for Windows, a question dialogue system is used to develop the

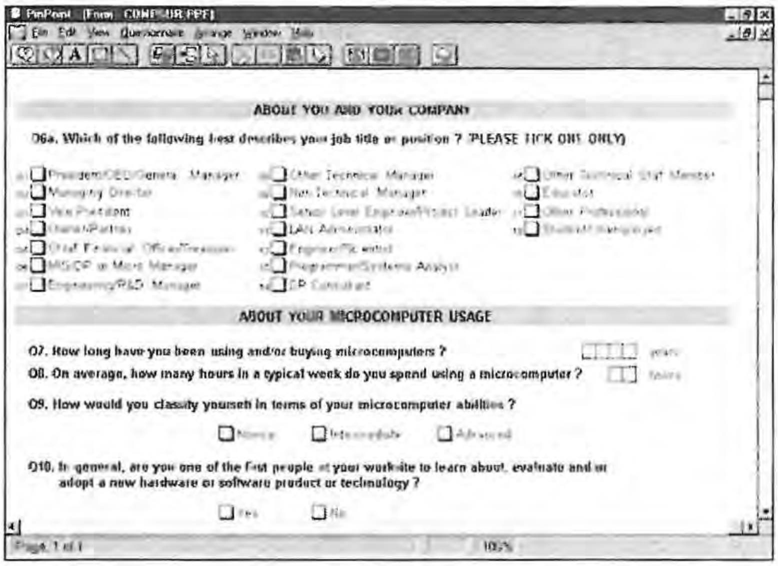

Figure 5.4: Sample Questionnaire Created Using PinPoint 3 for Windows *[Cambridge Software Publishing (2001)]*

underlying database structure behind the questions, the standard answers and the space to allow users to enter answers to more open ended questions. PinPoint allows several answer types to questions, including, free text, numeric, binary (yes/no), date, multiple choice (multiple or single response), ordered choice (ranked order of preference) and calculated. A sample questionnaire designed using PinPoint 3 for Windows is illustrated in Figure 5.5.

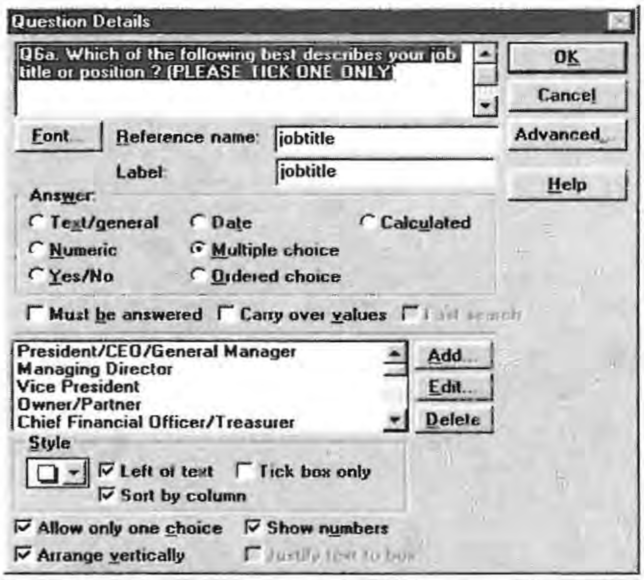

Figure 5.5: Question Dialogue used to Create Questions and Database Structure for Pinpoint 3 Electronic Questionnaire

From Figure 5.5, it can be seen that the questions can be constructed easily and intuitively using the question dialogue system. When designing the questionnaire using PinPoint, it is important to keep in mind the traditional questionnaire design guidelines. Other guidelines that can be considered are web page design guidelines. These are not discussed here, but there are a variety of useful textbooks on interactive system design which can be applied to web-based questionnaire design.

5.4.4 Implementation of the Electronic Questionnaire

As mentioned previously, there are two ways of implementing an electronic questionnaire: via email, or by posting it on the Internet. Once the questionnaire has been designed using PinPoint, it can be saved as a stand-alone file which is then attached to the email message to be sent to the respondent. Respondents are able to open up the file on their personal computers without needing a local copy of PinPoint 3 for Windows. They can then send the completed questionnaire back to the analyst. Similarly, when posting the questionnaire on the Internet, the stand-alone file is placed on a website. Respondents are informed of the URL link via e-mail. When they click on the URL, they are taken straight to the questionnaire through their web-browsers. In PinPoint, users are required to copy the finished survey back into an electronic mail message which they send back to the analyst, but other software packages allow the respondent to save questionnaire responses directly to a database, thus saving them the time of sending back an e-mail message.

Cambridge Software Publishing (2001) also describes how data from the questionnaires is collected.

- Respondents use simple manual data entry methods including mouse, keyboard, numeric keypad and Pen for Windows.
- Full range of routing options takes respondents to the next appropriate question based on previous answers.

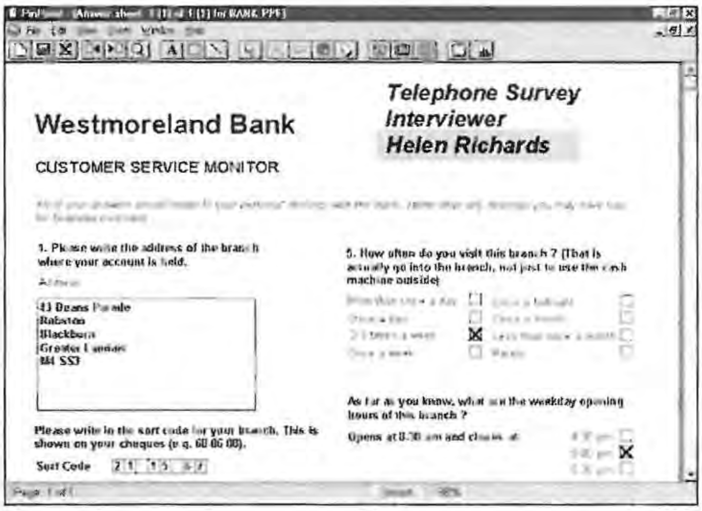

Figure 5.6: How Data is Entered into the Questionnaire *[Cambridge Software Publishing (2001)]*

- Automatic data checking with in-built valid range verification.
- Batch import facility for returned electronic forms.
- Scan in high volume surveys using compatible OMR software.
- Full data mapping tools for importing data from other survey databases

Figure 5.6 shows an example of how users enter data into the questionnaire.

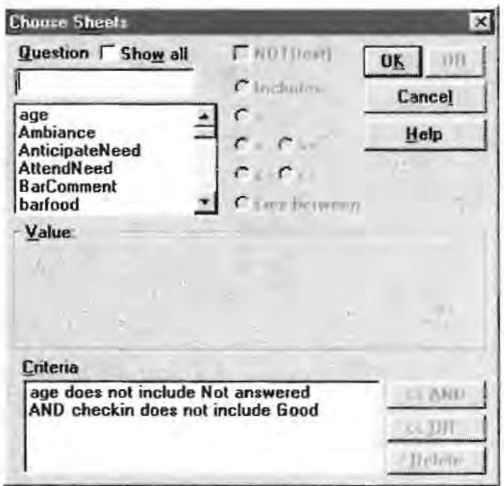

Figure 5.7: Dialogue System to Sort, Filter, Select Data *[Cambridge Software Publishing (2001)]*

As each questionnaire is returned, it is imported into a PinPoint data file where it is ready for analysis. As mentioned previously, a batch import facility is also provided. Cambridge Software Publishing (2001) explains that intuitive dialogue systems (See Figure 5.7) are used to sort, filter and select data. These criteria can be saved for future use (See Figure 5.8).

A respondent's original answer sheet can be located by double clicking on the selected row. PinPoint also possesses a range of statistical tools which can be used to perform numerical and statistical analyses. The PinPoint data files can also be transferred between other Windows applications such as Microsoft Excel. There are also various graphing and charting tools contained within the package which help the analyst to visualise data, draw meaningful conclusions and test hypotheses quickly and easily.

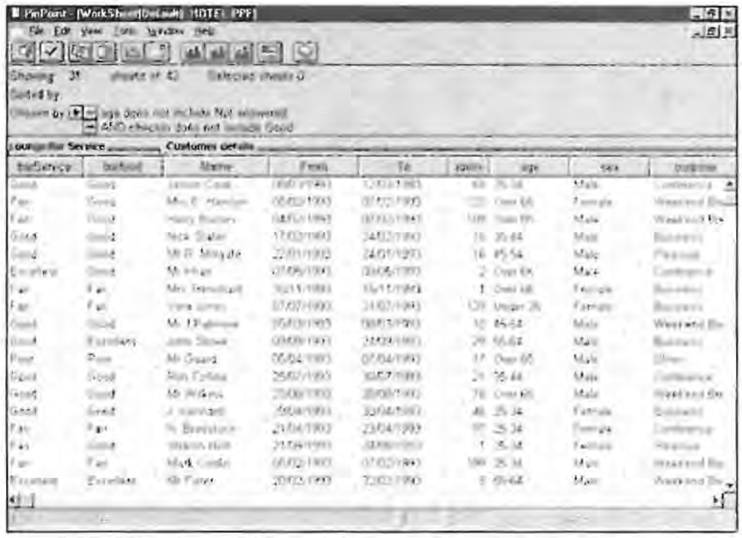

Figure 5.8: Results of Filter, Sort and/or Selection *[Cambridge Software Publishing (2001)]*

Despite the obvious advantages offered by a web survey software package such as PinPoint, there are also several drawbacks and points of caution to note when using such a package. These are discussed in the following section.

5.4.5 Points of Caution

Upcraft *et al* (2001) discuss several disadvantages of using web based questionnaires. Some respondents may not have access to the Internet, others may not be computer literate. This is generally not an issue when the questionnaire are used to aid in the RE process, because the process is conducted to determine requirements for a new system. The people to be questioned are the eventual users of the system, and therefore, it is unlikely that they would be completely computer illiterate. It is however, and important issue that analysts must be aware of when considering the implementation of a web-based questionnaire.

Upcraft *et al* (2001) also note that web based surveys require different time and expertise to traditional questionnaire design and implementation; for example, certain web survey software packages require the designer to possess HTML knowledge. If the analyst does not possess HTML knowledge, he or she will need to hire someone who does possess the knowledge, thus leading to higher costs. Electronic security, securing web-space and storage fees may also contribute to increased costs. These costs do depend on the nature of the software package and the level of support provided by the institution supplying the software.

Also, Kendall *et al* (1999:165) point out that respondents may question the confidentiality of their responses that are given electronically. Although web-based surveys can be structured to ensure anonymity of responses, respondents may not believe it, and may not respond. It must be noted, however, that this same problem exists with other data collection methods.

Finally, hardware, software and server malfunctions may occur. Storing questionnaires and their responses electronically does not make them immune to human error or other events that may destroy the data. The analyst must ensure that secure backups of the questionnaire and its responses are kept up to date and off site.

5.5 Other techniques of Virtual Requirements Elicitation

5.5.1 Electronic Document Review

In most organisations today, important reports and documents are stored electronically. This means that an analyst is able to review documentation that is relevant to the system and organisation under scrutiny without having to be physically present at the user site. Once the analyst has determined which documentation must be reviewed, he can gain access to this documentation by asking the people in charge of each document to send him an electronic copy (over electronic mail) for his perusal. One disadvantage is that security may become an issue where the document to be reviewed is of a sensitive nature. However, document review requires very little personal interaction with the user community, and can therefore be conducted electronically with very little difficulty or effort.

5.5.2 Observation

Whitten *et al* (1994:795) explain that there are five approaches to observation, each of which possesses its own advantages and disadvantages. To perform observation as a virtual RE technique, some of these approaches, such as action research and ethnographic field study, must be ruled out. However, video recording, concurrent verbal accounts and passive observation are approaches that can easily be adapted to the virtual environment. An individual could be video taped as he performs his tasks. He may or may not give a concurrent verbal account as he goes about his work. At the end of a particular sequence of events, or perhaps at the end of the day, this video can be sent to the analyst over the Internet. Unfortunately, a non-moving video camera has only a limited field of vision that can be captured on video, and therefore, this may only be suitable where the individual performs all his functions at one particular spot. An advantage of video taping is that it is far less obtrusive than the presence of an outsider, thus perhaps providing a more accurate picture of the individual's roles and functions. Also, setting up a video camera is easy and relatively inexpensive, especially compared to the set-up of a virtual JAD session. The desktop videoconferencing technology discussed previously could be adapted for use here.

5.5.3 Prototyping

Vat (2000:162) is of the opinion that prototyping is recognized internationally as a highly effective means of both RE and requirements validation. He further suggests that in a distributed environment, prototyping could be implemented as an interactive means of testing requirements. The users could be sent a copy of the prototype, which they then work through to determine if it satisfies the design requirements that were specified. Working through the prototype would also bring to light new requirements, which users can note and sent back to the developers via electronic mail. The prototype can also be used within the virtual JAD session, as the developers are then able to watch the users to gauge their initial reactions to the system in terms of its look and "feel."

5.5.4 Virtual Rapid Application Development (RAD)

RAD, as mentioned before, is a development lifecycle which gives faster development times and higher quality results than those obtained with the traditional systems development lifecycle. Because RAD brings together prototyping and JAD in order to elicit requirements, this lifecycle can be implemented within the virtual environment. Because RAD allows for smaller development teams, it is an excellent methodology to use when development teams are distributed, as co-ordination problems are greatly reduced as compared to when the development team consists of more people.

Also, virtual teams are specifically suited to the RAD methodology, which is designed to reduce development time. One of the major advantages of distributed development is that it reduces time to market for the system as a result of the ability of distributed team members in different time zones to work around the clock. More so, RAD and distributed teams complement each other in that RAD only works well for systems which can be produced quickly, and this is a major aim for distributed teams as well. Further, one of the disadvantages of RAD is that it requires heavy user involvement which might mean taking users away from their day to day work, however, this time is significantly reduced if they do not have to travel to meet with other users and system developers.

5.5.5 Virtual Technical Review

As the technical review normally takes place in a meeting situation, collaboration technologies such as electronic meeting systems or videoconferencing can be used to create the virtual environment for the technical review. Vat (2000:162) explains that the technological implementation for the technical review in a virtual environment would be the same as for any structured workshop (e.g. JAD).

5.6 Conclusion

This chapter explained how virtual teams conduct distributed RE. Several advantages and disadvantages of conducting RE in this way were mentioned, but the literature reviewed shows that traditional techniques of RE can be implemented in the virtual environment successfully. Because of the varying nature of each technique, it is apparent that some of these techniques are more suited than others to the virtual environment. It was also mentioned that although this phase of systems development can be carried out virtually, team members may experience problems with the implementation of virtual RE techniques (as discussed in the "Points of Caution" section for each technique). The next chapter summarises this category of problems, as well as the category discussed in the previous chapter; that is, problems experienced within the day-to-day interactions of the virtual team members, in order to develop solutions to these problems.

PART III

Building a Holistic Model of Virtual Requirements Elicitation

This section of the research aims to build a holistic model of virtual RE in order to overcome the problems identified in the previous section.

The problems within the implementation of the requirements elicitation techniques, and those regarding the general interactions of virtual team members are summarised for the sake of clarity.

Solutions to these problems are proposed based on an extensive literature survey and the author's own hypotheses and beliefs.

These solutions are incorporated into an integrated model of virtual RE, comprising three major frameworks, each of which relates to a principal component of the RE process. The frameworks detail the activities to be performed to prevent or overcome the problems to which virtual teams engaged in RE are prone.

The section concludes with the identification of some of the most crucial aspects of the model (the critical success factors).

Chapter 6

The Problems and Their Solutions

6.1 Introduction

This chapter builds on the preceding literature review in order to determine solutions to the problems experienced by virtual teams engaged in virtual RE. Chapter 4 discussed the concept of virtual teams, how they have evolved from traditional teams, the technology that they use for communication and task performance, and the reasons for using virtual teams. Chapter 4 also focused on the disadvantages of using such virtual teams, and it was noted that these disadvantages arise as a result of the difference in the nature of team members' interactions resulting from the need to use collaborative technology to interact both formally and informally. They are the general problems that any virtual team would experience when working in a virtual environment.

Chapter 5 focused on the adaptation of traditional RE techniques to the virtual environment. The chapter focused mainly on three key techniques of RE: JAD, interviews and questionnaires. It was shown that although traditional techniques of RE can be adapted successfully for use in the virtual environment, there are several issues, or problems that occur as a result of this adaptation. These problems were discussed in some depth in the "points of caution" sections for each major technique.

Therefore, it can be seen that two major categories of problems were examined within the literature review:

1. Problems within the implementation of the RE techniques.
2. General or day-to-day interaction problems experienced by virtual teams as a result of working within a virtual environment.

This chapter summarises these problems, with the aid of a literature review, determines several theoretical solutions to each problem. The solutions are used to build frameworks for the successful implementation of each RE technique, as well as a framework for the successful maintenance of the day-to-day interactions of the virtual team members. Each framework forms a sub-component of the overall model, as will be shown in the following chapter.

6.2 Problems within the Implementation of the Requirements Elicitation Techniques

Only the problems of the three main techniques of RE (JAD, interviews and questionnaires) are summarised here. It was shown in the previous chapter that other RE techniques can be used within the virtual environment, however, in order to scope the discussion, the model to be built, and the empirical study to follow, the author feels it sufficient to discuss only the three principal techniques, as the literature review found these to be the most commonly and frequently used techniques.

Technique	Technology	Problems with Technology
Virtual JAD	1. Full Video-conferencing	1.1 Requires technical expertise to set up. 1.2 Requires expensive high bandwidth and dedicated phone lines to run a "smooth" videoconference. 1.3 Prone to the same group related disadvantages as traditional JAD sessions. 1.4 Non-verbal communication is more difficult 1.4.1 Non verbal communication is more difficult to assess and understand 1.4.2 It is more difficult for facilitators to use non-verbal communication to control the participants. 1.4.3 It is more difficult to read people and their intentions 1.5 Back channels of conversation do not evolve naturally. 1.6 Different emphasis on facilitation skills. 1.7 Difficulty in building and maintaining effective group dynamics. 1.8 Reliance on remote personnel to perform facilitator planning duties at other sites.
	2. Group Support Systems	2.1 Power differences as a result of varying levels of computer literacy 2.2 Differences in typing skills may result in some people becoming frustrated. 2.3 Increased anxiety among users because of the need to use technology 2.4 Back channels of communication do not evolve naturally. 2.5 Difficulty in building and maintaining effective group dynamics. 2.6 Threatening spontaneity of dialogue 2.7 No visual or non-verbal cues.
Virtual Interviews	1. Desktop video-conferencing	1.1 Establishing trust and credibility is difficult over the technology barrier. 1.2 Cameras are zoomed into facial features, and therefore body language is difficult to read. 1.3 No direct eye-contact – people look at the monitor rather than the camera. 1.4 Audio Lag
	2. Chat Systems	2.1 Cannot see body language or hear varying tones of voice, therefore it is difficult to determine attitude. 2.2 Difficult to build trust 2.3 Security concerns of interviewee
	3. Telephone	3.1 Cannot observe body language, and therefore non-verbal cues are missed.
Electronic Questionnaires	1. Specialised Software Packages	1.1 Respondents may not have access to the Internet 1.2 Respondents may not be computer literate. 1.3 Electronic surveys require different time and expertise to traditional questionnaire design and implementation 1.4 Respondents may question the confidentiality of their answers. 1.5 Hardware, software and server malfunctions may occur.

Table 6.1: Problems within the Implementation of Virtual Requirements Elicitation Techniques

6.3 General Interaction Problems of Virtual Teams Engaged in Virtual Requirements Elicitation

The ultimate aim of RE is to produce a software requirements specification (SRS) document, which contains elicited requirements in the form of data models, activity models, etc. Therefore, team members must interact outside of RE techniques in order to produce the SRS at the end of the RE phase of the SDLC. In doing so, they may experience certain problems in their task-related interactions (task dimension) as well as in their social interactions (social dimension). Achieving each of the elements in the social and task dimension is a challenge for any team, but virtual teams experience additional problems as a result of their distributed membership. These problems are summarised in Table 6.2.

Dimension	Element		Problems
Social	Shared Understanding	Common Purpose	• Difficult to stay aligned with purpose – few ad hoc meetings and informal discussions. • Differing goals that may not be consistent with overall project goals, leading to undermining of project as a whole. • Difficulty in reaching consensus on project goals, tasks and deliverables. • Less of a feeling of "belonging" to the team.
		Team Culture	• Environment (social and physical contexts of team members) is difficult to communicate, as it must be communicated explicitly rather than implicitly as in co-located teams – leads to misunderstandings and miscommunications. • Varying geographic locations and organisations of team members make it difficult for the team to agree on and adhere to a set of norms for communication and task performance, often done implicitly in co-located teams. • Differing value systems and beliefs of members cannot easily be inserted into team culture as members usually only interact in terms of a task that must be performed. • Dynamic nature of virtual teams (varying membership and different cultures and physical work site and virtual team) make it difficult to share norms, values and beliefs. • Rituals and celebrations are impossible to conduct in a virtual environment – decreased motivation and satisfaction of team members. • Difficult to build up shared language because of little or no informal interaction within virtual team
		Mutual Trust	• Lack of shared social and physical context makes it difficult to develop trust. • No anticipation of future association, little or no informal interaction, lack of shared experiences makes it difficult to develop trust. • Geographical distribution makes reinforcement of social similarity more difficult, thus making it more difficult to develop trust. • Geographical distribution also reduces the immediacy of threats from failing to meet commitments, thus making it easier to slack, thereby destroying trust of team members. • Lack of awareness of team members' priorities lead to decision making based solely on individual priorities, thus breaking down trust.
	Social Bonding		• Lack of informal interaction makes social bonding difficult. • Lack of shared norms, beliefs, values and physical and social contexts makes social bonding difficult. • Absence of individuating cues about others.
	Roles and Responsibilities		• More difficult to ascertain where there are gaps and where it is appropriate to volunteer to do something. • Roles are more complex in distributed groups – more roles needed, some new and unfamiliar.
	Reward and recognition		• Non-monetary reward and recognition is difficult for virtual teams as they cannot celebrate in the traditional way, i.e. no virtual equivalent for partying.
Task	Project visibility		• Difficult to stay aligned with purpose – few ad hoc meetings and informal discussions. • Differing goals that may not be consistent with overall project goals, leading to undermining of project as a whole. • Difficulty in reaching consensus on project goals, tasks and deliverables.
	Task Co-ordination		• Time zone differences, physical distances, varying cultural and national holidays make scheduling difficult. • Need to agree explicitly on communication styles to be used, and which technology to be used for what.
	Task Support		• Varying task performance and communication technologies across the team may lead to problems of incompatibility and frustration. • Differing technology infrastructures (e.g. different operating systems, internet access speeds, etc.) may lead to frustration and in extreme cases, hostility.

Table 6.2: Interaction Problems Experienced by Virtual Teams in Requirements Elicitation

6.4 Solving Problems within the Implementation of the Virtual Requirements Elicitation Techniques

The ensuing sections address each problem within the implementation of each technique, categorized in terms of the varying technologies that can be used to implement each technique.

6.4.1 Virtual JAD

Virtual JAD is an attempt to replicate the traditional face-to-face JAD in a virtual environment. As a result, the current author believes that all the elements required for a traditional JAD (as discussed in Chapter 3) should be adhered to. It is important to ensure that the elements of a traditional JAD are taken into account, as the virtual JAD will fail (as would any JAD session) without the necessary preparation and design of the session. In addition, there are various other elements that must be considered when conducting a JAD in a virtual environment. It was previously determined in Chapter 5 that JAD can be conducted using videoconferencing and GSS. This section discusses the solutions to these problems within these categories.

6.4.1.1 Videoconferencing JAD

1. Prone to the same group related disadvantages as traditional JAD

This means that critical success factors for traditional JADs (discussed in Chapter 3) should not be ignored. They should be treated with as much importance as the implementation of the solutions and strategies to overcome virtual JAD problems. In particular, it has been stressed by various authors (Nunamaker *et al* (1995), Macaulay (1999), Koulikov (1999), Kimball (1997b) and Riggs (1997)) that virtual JAD facilitators require the same facilitation skills and techniques as those in traditional teams, although virtual JAD facilitators will need to place more emphasis on certain skills and techniques in order to ensure that the JAD process proceeds smoothly. Those skills and techniques which require more emphasis are discussed in later sections.

2. Non-verbal communication is more difficult

The virtual environment introduced a number of barriers to non-verbal facilitation, all of which were discussed in the preceding chapter. Therefore, it is necessary to develop and use a new model of non-verbal facilitation within the virtual environment. Based on the work of DeVito (1988), Harpur (1998:51) developed a set of emblems to be used for non-verbal facilitation in the virtual JAD environment. These are shown in the table below:

Name of Signal	Description	Use
The "thumbs-up" Signal	"The clenched hand is extended, with the thumb vertically erect." (Morris, Collet, Marsh and Shaugnessy (1979).	Recognised in most countries around the world to mean "O.K." (Morris *et al* (1979)). Can be used to reassure the participants and indicate to them that they are doing well.
The "Ring" Signal	"The hand is held up, with the palm facing away from the gesturer, and with the thumb and forefinger touching to form a circle." (Morris *et al* (1979))	Indicates that something is "good." Can be used by the facilitator to indicate to the participants that what they are doing or saying is a valid contribution to the session. This will help to encourage the participants, especially those that may be introverted, to actively participate within the session.
The "V-sign"	The hand is raised in front of the body, with the palm facing away from the gesturer, and the forefinger and middle finger extended to form a V-shape.	Indicates victory. The facilitator can use this signal at the conclusion of a discussion or when a decision has been made, to indicate that the group is victorious in achieving their goal.
The "Time-Out" signal	The hands are raised in front of the body with one hand positioned horizontally and the other vertically. The horizontal hand is placed above the vertical hand to form a T-shape.	Can be used by the facilitator to call a break or to indicate to one of the participants that it is time for them to give the other participants a chance to speak. Once the facilitator has given a time-out, the participant should be given a minute to complete what he or she is saying.

Table 6.3: Emblems for Non-Verbal Facilitation *[Adapted from Harpur (1998:52)]*

Harpur (1998:53) also proposes the use of coloured cards in addition to the emblems above as a method of non-verbal communication from the participants to the facilitator. Different coloured cards can be used to indicate that participants are: tired and want a break, wish to speak to the facilitator alone, do not have anything to add to the conversation, feel that the conversation is digressing from its intended point, feel satisfied with the session up to that point. In this last case, the card should be displayed from the start of the meeting. Harpur (1998:53) believes that by having each participant displaying a card from the start of the session, the participants will feel less embarrassed about changing the card colour. Displaying a different card colour will not be as noticeable as it would be if there were no other cards displayed. According to Harpur (1998:86), such cards and emblems can help to resolve the problems depicted in Table 6.4.

More explicit communication is required in the virtual JAD environment because the intentions of the participants within such an environment are more difficult to read. It is important that the facilitator set the tone of such explicit communication by explaining how he/she is feeling from the very beginning of the meeting. Other participants will then pick up on the need to communicate clearly and purposefully.

Problem	Solution
1. Participants may find it easier to become aggressive and raise their voices to other participants.	Use a time-out emblem to tell the participant that he/she has one minute left to speak. Call a break to give the participants a chance to calm down.
2. Lower level employees may take this opportunity to solve	Participants can display a coloured card when they believe that the

organisational issues that they feel strongly about, that they have not before had the opportunity to share with top management.	discussion is deviating from the original topic. Facilitator can call a time-out to end the discussion and allow the group to refocus.
3. Participants may feel frustrated with the technology because of its inability to transmit both non-verbal and verbal cues with the same quality as face-to-face interactions.	Facilitators and participants can use emblems and coloured cards to help compensate for the lack of cues transmitted.
4. Participants may feel frustrated with the Virtual JAD environment because it does not accurately fit in with the culture, structure and politics of the organisation for which they are working.	With the introduction of emblems that are specific to the virtual JAD environment and not culturally biased, the facilitator can help to neutralize the JAD session.
5. Participants may feel frustration at not being able to subtly communicate with the facilitator, e.g. a participant may need a break of wish to explain to the facilitator how they are feeling about the current discussion.	Participants can display different coloured cards that indicate different messages to the facilitator.
6. Participants may feel frustrated that they are not being given the same encouragement and motivation from the facilitator because his/her presence is not influential.	Using the emblems discussed above, the facilitator can help encourage and motivate participants.

Table 6.4: Situations that can be Resolved Using Cards and Emblems *[Adapted from Harpur (2000:53)]*

The coloured cards and emblems solve the problems of assessing and understanding non-verbal communication, using non-verbal facilitation to control participants and reading people and their intentions.

3. Back channels of Communication do not evolve naturally

Adkins (1999) discusses the importance of setting up a back-channel in a virtual JAD session. Back-channels allow informal conversations, usually outside of the JAD sessions themselves. Such informal conversations are important because they allow participants to express discontent, frustration or satisfaction, or to confirm meeting content and roles on a one-to-one basis with the facilitator. Back channels often evolve easily in the traditional JAD environment, but in a virtual JAD environment, facilitators must explicitly create back channels for communication. Adkins (1999) is of the opinion that the facilitator should be available to hold informal conversations with JAD participants outside of meeting times. Further, it is the responsibility of the facilitator to set up chat windows explicitly for the purpose of such informal conversation.

4. Different Emphasis on Facilitation Skills

Hanssen (2000:15), in consultation with various authors [Kimball (date unknown), Warihay (1992), Koulikov (1999), Wolf (1994), Nunamaker, Briggs and Mittleman (1995), Sandelin (1996), Briggs and Nunamaker (1997), Riggs (1997),Briggs, Crews and Mittleman (1998), Cantu (1998), Kelly and Bostrum (1998), Koufman-Frederick, Lillie, Pattison-Gordon, Lynn, Watt and Carter (1999), Sandelin (1998), Adkins (1999), Paul (1999), Macaulay (1999) and Vat (2000)] identified several important facilitator techniques and skills (discussed in earlier chapters). These skills are important for facilitators of any JAD session, but distributed facilitators should focus on certain aspects of these skills more closely. The skills are briefly discussed below in terms of their relevance to the distributed environment.

Planning is different for a virtual JAD session, as the facilitator needs to consider the physical and social environments of the team members, as well as the technological components to be managed during a videoconferencing JAD. These are discussed in Chapter 5 in Table 5.3 and Table 5.2 respectively.

Observation is a skill that is crucial to the facilitation in the virtual environment, particularly because of the difficulty of assessing non-verbal communication, as discussed previously. Sandelin (1998) as cited by Hanssen (2000:18) explains that it is more difficult to gauge the emotional atmosphere of a group when the facilitator is not in the same location as the other group members.

The awareness of self and others is also an important aspect of facilitation in the GDRE environment. Warihay (1992) as cited in Koulikov (1999) expresses the need for a facilitator to be continually in touch with the mood he or she is in and have the willingness to articulate this to the team. In this way, "openness" is created, and this can aid in closing the gap that is created in a distributed environment, especially when participants follow the facilitator's example of articulating clearly their feelings and emotions. This is also helped by the use of coloured cards and emblems as discussed previously. Awareness of others is also important in order to eliminate feelings of loneliness and isolation that may be experienced by distributed participants, and also to enhance commitment by these participants. Such awareness can come about through personal contact with the team members through the use of back-channels (discussed earlier). Awareness of others helps the facilitator to observe and react to interactions between participants.

According to Hanssen (2000:21) the instructional skill of the facilitator within the CDRE environment must be more explicit than in traditional team environments, because of the reduced effectiveness of non-verbal communication. Briggs *et al* (1998) assert that instructions should be unambiguous, specific and easily understandable by all participants, more so in a virtual environment because of the added challenge of eradicating outside noises, and trying to sustain a connected feeling while not being able to utilize all five senses.

Evaluation is crucial, as the facilitator and the participants learn through reviewing and evaluating their performances. It is easier to gain feedback (positive and negative) in a traditional environment, through non-verbal cues of participants (e.g. expressions, body language). In a virtual environment, such feedback should be more explicit, so the facilitator should encourage the participants to use the back channel of communication to give both the facilitator and fellow participants constructive feedback after the meeting. Encouraging the participants to state how they are feeling, and the use of coloured cards and emblems during the meeting, also help the facilitator to evaluate his performance and that of the participants during the meeting.

5. Reliance on remote personnel to perform facilitator planning duties at other sites.

As mentioned before, a video conferencing JAD requires the presence of several additional personnel: remote support managers at each site, a technical manager and communications flow manager at the facilitator site and technical personnel at each distributed site. The co-ordination of these personnel is an added issue that facilitators have to deal with. It would be beneficial if the remote support manager at each site also performed the technical duties and location co-ordination duties at the remote site, as this would reduce the number of personnel that the facilitator would have to deal with.

It is essential that the facilitator recruit and train the most competent personnel for the job. In addition, planning the JAD session should be done in close conjunction with these personnel in order to ensure that all staff are fully aware of their duties. Once again, a back channel should be set up for communication between these personnel so that they are able to keep the conference running smoothly. The back channel is also useful after the JAD session, as it gives personnel an opportunity to report back to the facilitator.

6. Difficulty in building and maintaining effective group dynamics

JAD is a very people-centered process, and as a result, it is important that effective group dynamics are maintained between the participants in the process. During the JAD sessions, it is important that members of the virtual systems development team and members of the user community work together to define complete and accurate system requirements. Therefore members of a virtual systems development team should see themselves as part of two groups – the JAD group (which includes the users) and their own RE team which works together on a day-to-day basis. Effective group dynamics are important for both groups, but they are only discussed briefly here, within the context of virtual JAD, leaving the more in-depth examination to the section which discusses the day-to-day interactions of the virtual team members.

Johnson and Johnson (1994), explain that the components of an effective group are:

1. High interpersonal effectiveness
2. Understanding, relevance and commitment to goals
3. Communication of ideas and feelings
4. Active participation and distribution of leadership
5. Flexible use of decision making procedures
6. Encouragement and constructive management of conflicts
7. Equality of power and influence
8. High group cohesion
9. High problem-solving strategies

The problems of achieving effective group dynamics in the videoconferencing environment were discussed in Chapter 5.

Traditionally, group dynamics can be improved in a number of ways. One of the major concepts that is perceived to improve group dynamics is team building. It has been mentioned by Stead (2000:74) that virtual team building should specifically be targeted at developing individual and group relationships in order to create the synergy necessary for an effective JAD session. Dyer (1987:2) as quoted by Hanssen (2000:43) explains that team building looks at how tasks can be achieved through improving relationships between people. More so, in a virtual environment, team building helps to make the participants of a JAD session feel closer to one another, thus aiding them to overcome the technological barrier of a virtual JAD session, and maintain the effective group dynamics necessary for a virtual JAD.

Team building is discussed in detail in the section discussing the solutions to the day-to-day problems experienced by virtual team members, and therefore is not examined in detail here. However, it is important to note that according to Kimball (1997), team building for the participants of the JAD process should be an ongoing exercise. Therefore, the author recommends that short team building exercises be conducted at the beginning of every JAD session. Stead (1998:88) shows how traditional team building exercises can be adapted for use within the virtual environment (discussed later). Most of these exercises require the use of additional technology – e.g. personal computers connected together on a network for each participant.

7. Costs

There is very little that can be done about the cost of performing a video conferencing JAD (with regard to the technical expertise required to set up the conference and the bandwidth and dedicated phone lines needed to run a smooth videoconference) except to state that videoconferencing JAD sessions should only be conducted when there are a few distributed sites (not more than three), with all the participants being distributed amongst these sites. When a number of team members are distributed across several sites, a GSS should be used for the JAD session.

6.4.1.2 GSS JAD

1. Power differences as a result of varying levels of computer literacy.

2. Increased anxiety among users because of the need to use technology.

3. Threatening spontaneity of dialogue.

Most of the problems caused by using GSS for JAD sessions can be overcome by sufficient training. In the current author's opinion, such training sessions should mimic the actual JAD as far as possible, as this will enable all the participants to become familiar with the context in which the GSS is to be used. Therefore, the author recommends that the facilitator for the JAD session should have not one but two or three pre-JAD session meetings. The first two pre-meetings should be aimed at getting the participants comfortable with using the GSS.

Initially, a short training session on the functions of the GSS should be provided. However, it is widely accepted that people learn fastest and most effectively when performing tasks in a hands-on manner. Therefore, the facilitator should develop a scenario in which all participants will play similar roles to those they will play in the actual JAD session. The users must communicate their requirements to the systems development team, and the development team must understand, negotiate and note down these requirements.

An example situation would be that of a plan for a house. The users could be given various roles as members of a family, each wanting a new house for the family, but with somewhat differing requirements. The development team possesses the task of eliciting these requirements from each user, negotiating them, and finally developing a plan for the house which all the users will be happy with. A variation on this could be to reverse the roles of the users and the developers to allow the users to elicit requirements from the developers. This would not only train them in the use of the technology, but would also allow them to view the situation from a reversed point of view, thereby promoting understanding between users and developers during the real JAD session.

In this way, participants in the JAD session will be aware of what is expected of them, and everyone will have a general idea of how the system will be used. Anxiety, power differences resulting from the varying levels of computer literacy, as well as the threat of reduced spontaneity in participant interactions will be reduced through the use of a simulation training exercise in which user become comfortable with using the system. It is also a valuable exercise for the facilitator, as, within the simulation he or she can easily note which areas to pay attention to when the actual JAD is implemented. In addition, the facilitator can identify the participants who seem least comfortable in the simulated JAD session, and with the use of the technology, thereby allowing him/her to pay special attention to ensuring that these people participate in the actual JAD session.

4. Differences in typing skills may result in some people becoming frustrated.

Differences in typing skills are more difficult to resolve, but once again, the training exercise will allow people to realise that there *are* differences in typing speeds, and they will be able to adjust more easily to these differences. Furthermore, it is recommended that participants be sent a copy of a typing tutor software package well before the initial training meeting, with a request to use it to improve their typing skills to the minimum level.

5. No visual or non-verbal cues.

An adaptation of the coloured card system discussed in the section on videoconferencing JAD can be used to allow the participants to express themselves in the meeting without having to type out their comments. Each participant's screen can have the pictures or names of all the other participants, as well as a number of different coloured icons that can be clicked depending on how a given participant feels that the JAD session is progressing. If, for example, participant A feels that the discussion is digressing from the topic, he can click on the blue icon. Following this, a blue icon will appear next to his name or picture on all the other participants' screens, thus allowing them all to see how he or she is feeling.

Unlike a videoconferencing or traditional JAD however, participants are able to directly communicate their frustrations to the facilitator, by sending him/her a private message during the JAD session. This is a definite advantage of using GSS for JAD sessions, but it can also be a disadvantage in that participants are also able to send private messages to one another, thus contributing to fragmentation of the team. A solution to this is to disable private message sending, unless the message is to be sent to the facilitator.

6. Back channels of Communication do not evolve naturally

As with the videoconferencing JAD, it is the facilitator's duty to ensure that an informal TeamRoom is set up to allow the participants to discuss issues outside of the actual JAD session. Also, the facilitator should remain open to emails from any participant at all times outside of the JAD session.

7. Difficulty in building and maintaining effective group dynamics

As with the videoconferencing JAD session, the technology barrier means that participants may see themselves as being removed or isolated from the others involved in the process. In fact, this feeling may be exaggerated in the GSS JAD because participants are only able to interact with each other by typing in their comments. Therefore, team building should be used during GSS JAD as well. Network games allow groups to team up against each other, and these can be used effectively as a team building exercise in the GSS JAD session. The informal chat room may even encourage participants to play against and with one another outside of the JAD session or team building exercises, thus contributing to more meaningful relationships.

As with any process, continuous feedback and monitoring is vitally important for both the videoconferencing and the GSS JAD sessions, and facilitators should allow time within the training sessions, the team building activities and the actual JAD sessions, to allow participants to express their feelings with regards to work progress and human interaction. Such feedback should be documented and distributed amongst the participants in order to ensure that that positive behaviours are re-inforced and negative behaviours are eliminated or reduced substantially in subsequent meetings.

6.4.2 Virtual Interviews

Virtual interviews can be conducted in three ways, each of which possesses various problems which were discussed in the previous chapter. Solutions and strategies are proposed below which eliminate or reduce the problems associated with each method. Once again, it is important to note that these solutions and strategies do not eliminate the need to prepare completely for the virtual interview as noted in Chapter 5.

6.4.2.1 Desktop Videoconferencing

1. Establishing Trust and Credibility is difficult over the technology barrier.

Establishing trust is an important issue in any interview, but it becomes even more difficult in the virtual environment as a result of the fact that the participants are not together in the same physical location. As a result of the need to use technology to communicate, the interviewee may feel removed from the interviewer, thus making trust even more difficult to establish. In addition, it is more difficult to make interviewees feel at ease when interviewing them through DVC, as the interviewee sees the interviewer as an image on the computer screen rather than as a "real" person. This situation is exacerbated by the fact that there may be no direct eye contact, because people look at the monitor rather than the camera when talking. All these issues mean that the interviewee may be less trusting, and therefore more reluctant to reveal information of a sensitive or personal nature to the interviewer. The following are guidelines which can be used to solve these problems.

1. Set up the location to achieve a clearer picture (Eastman Kodak Company (2001)). This will ensure that the interviewee sees the interviewer clearly, and will be able to read his/her facial expressions, thereby noting sincerity, warmth and trustworthiness. The Eastman Kodak Company (2001) has this to say about ensuring a clearer picture:
   1.1. Ensure that participants (interviewer(s) and interviewee) are well lit with a light source placed behind the camera – do not allow participants to sit in front of a light source.
   1.2. Wear solid, dark colours. When preparing the interviewee, ensure that he/she is aware of the need to wear solid, dark colours on the day of the interview. Solid areas of colour are easier for the camera, computer and network to photograph, process and send.
   1.3. If the background is not a plain wall, hang a pastel sheet in the background.
2. Adjust the camera options:
   2.1. Adjust camera's colour for flourescent, incandescent or natural light. (Make sure that both interviewer and interviewee have cameras that offer automatic adjustment for different lighting).
   2.2. Check sizes of images to find optimal size of image (depends on bandwith available on both ends).
   2.3. Choose optimal resolution – a higher resolution sends a clearer, sharper image, but because each frame contains more data, fewer frames can be sent per second. This makes motions appear blurry and choppy. Lower resolution makes the image appear less sharp, but movement appears smoother, and more realistic.

3. The interviewer should also ensure that the monitor and the camera are placed as close together as possible (the camera on top of the monitor) in order to simulate eye contact. Furthermore, it is recommended that the interviewer always look at the camera when speaking. It is believed that the interviewee would feel more at ease if he/she looked at the monitor while speaking, as this would simulate the traditional face-to-face type interview closely.

2. Cameras are zoomed into facial features and therefore, body language is difficult to read.

The interviewer should be fully aware of the fact that he/she is not receiving the full picture, and should thus concentrate more on clarifying the comments and answers of the interviewee in order to ensure that he or she receives correct and reliable information. Therefore, there should be more probing and clarifying questions in a DVC interview than in a traditional interview. A suitable picture quality (as discussed above) will also allow the interviewer to read facial expressions, and in this way, the reading of facial expressions, and the use of explicit probing and clarifying questions can substitute for the reading of body language.

3. Audio Lag

Often, there is an audio lag between the video and the audio being sent and received. This means that both interviewees and interviewers will have to get used to a new way of speaking. The Eastman Kodak Company (2001) provides the following guidelines for communication:

1. Minimise number of quick, sudden moves, as the system may have a difficult time keeping up with the participants' physical movements.
2. When using visual aids or graphs, place them on a table or easel instead of holding them – accidental movement will make them difficult to read.
3. Avoid using audio cues like "OK" and use visual cues (such as nodding) instead.
4. Firmly define the end of a sentence with a clear and appropriate change in voice inflection.
5. Whenever a participant begins to speak, he/she should finish his/her thoughts with one statement with a definite conclusion.
6. Give the other speaker a second or two after he/she has stopped talking to make sure that he/she has finished.

It is obvious that the need to familiarize the interviewee with the new way of communicating, and the need to set up the locations to be optimal for DVC require that a test run be implemented before the actual interview. This test run can be used to build trust with the interviewee, as the both interviewer and interviewee will be communicating about issues which are not directly related to the content of the interview itself. During the test run, the interviewer should concentrate on making sure that the interviewee is comfortable with the technology, the communication tips to be used, and the interviewer himself. The communication tips should be provided to the interviewee before the test run, as this will enable him/her to practice them during the test run. The test run will also allow the interviewer to ensure that the interviewee location is set up correctly, and will serve to familiarize the interviewee with the DVC technology. This is not, however, feasible if there are many interviewees from one site, as the location need only be set up once, and holding test runs with each interviewee may be seen as a waste of time. Rather, the interviewer should allocate time at the beginning of the interview to ensure that the interviewee understands the communication tips, and is comfortable with the technology.

6.4.2.2 Chat Systems

1. Lack of visual cues.

2. Fear of lack of security.

3. Difficult to build trust.

These problems are a direct result of the nature of the environment, and as such, cannot be solved without changing the environment. Therefore, the author recommends that chat systems be used only when the information to be gathered is of a non-sensitive and quantitative nature. Once again, it is important that a tutorial is held with all the interviewees in order to ensure that they are all aware of how the chat system works. Most chat systems are easy and intuitive to use, and therefore, the tutorial can be held with all interviewees online at one time. During the tutorial, the current author recommends that the interviewer does all in his/her power to lay the security concerns of the interviewees to rest.

6.4.2.3 Telephone

1. No non verbal cues.

Non-verbal cues are missed in a telephonic interview, but it is an easy and quick way of gathering non-sensitive, quantitative information. It is important to ensure that the telephone conversation is recorded, as the interviewee is unable to see the interviewer taking notes, and may therefore proceed too fast for the interviewer to keep up.

6.4.3 Electronic Questionnaires

1. Respondents may not have access to the Internet or email.

2. Respondents may not be computer literate.

In the event of the above situations, electronic questionnaires cannot be implemented. The time, effort and cost involved in ensuring internet access, and training people to use the internet is too great to make the implementation of electronic questionnaires feasible. In the specific case of RE for the development of a computer system, it is unlikely that the people at whom the questionnaire is targeted are computer illiterate, as it is probably that they have been using some form of computer information system in the past. Therefore, these are not major problems in this specific case. However, it is important that before proceeding with the design and implementation of the questionnaire, the analyst should check to ensure that internet access is available to the respondents and that they are computer literate.

Once respondents' internet access, electronic mail access and computer literacy has been confirmed, it should not be assumed that they will know exactly how to answer and navigate through the questionnaire. As a result, it is important that the questionnaire is designed to be simple, and easily and intuitively navigable. Furthermore, complete instructions should be provided as to how to answer the questionnaire.

2. Electronic questionnaires require different time and expertise to traditional questionnaire design and implementation.

There are various questionnaire design and implementation software packages on the market, many of which are easy to learn and use. However, for various reasons, if an analyst chooses a package that requires specific coding knowledge, he/she will also have to employ someone with the necessary skills. It is recommended that, in the interests of saving costs and time, the analyst should design the questionnaire himself.

4. Respondents may question the confidentiality of their responses.

When submitting responses over the internet, respondents may not be confident that the information that they provide will be kept confidential. This is especially so if they are asked to comment on sensitive information. In order to allay their fears with regard to confidentiality and anonymity, they should all be provided with a single password to access the web page containing the questionnaire, thus ensuring that responses cannot easily be traced back to the respondent. The analyst should also provide the respondents with a pledge of security and full details as to how that security will be maintained.

Finally, it is important to ensure that like the other RE techniques, the guidelines for the implementation of traditional questionnaire design and construction are adhered to carefully when designing and implementing an electronic questionnaire.

6.5 Solving General Interaction Problems of Virtual Teams

6.5.1 Achieving a Common Purpose/Project Visibility

Lipnack *et al* (1997:23) recommend that a common purpose should be clarified and adhered to from the start. This is supported by an exploratory study conducted by Lau *et al* (1999) who state that a high performance virtual team that they studied clearly demonstrated the development and maintenance of a common goal. In addition, DeSanctis *et al* (2001:81) affirm that successful teams convey a sense of team spirit in their everyday communications with one another. In one team that they studied, this was aided by team members using nicknames to refer to the team, thus building camaraderie on line, and team members posting public comments to openly express their positive feelings about one another. DeSanctis *et al* (2001:81) further clarify that a major challenge of distributed groups is to maintain a sense of "we" despite geographic separation and individual differences, and they maintain that successful teams take the time to visibly build a sense of positive group identity.

In order to do this, it is necessary, firstly, to *create an identity* for the team. A team's name is its smallest mental model and it is therefore important to use a name that clearly communicates what the team is about.

Lipnack *et al* (1997:23) also highlight the necessity of *writing a Statement of Purpose*. The act of writing a vision or mission statement and then hanging it on the wall has become an object of ridicule in many organisations. However, Lipnack *et al* (1997:23) believe that when the exercise of writing a purpose statement becomes the basis for the group's work, it becomes a powerful source of energy. They further assert that the importance of a virtual team going through a process to make its purpose tangible cannot be overstated. The team's mission (its top-most goal and motivation to actions) must be made explicit.

Next, teams must convert the high-level statement of purpose to concrete realisation by *naming the goals*. Cantu (1997) recommends naming the key goals of the team, keeping the major categories to a handful or two at the most. It is then necessary to assess whether the set of goals covers the statement of purpose and the overall result. Lipnack *et al* (1997) explain that well conceived goals become the major components of the team's work and the seeds around which sub-groups form to actually do the work.

For a virtual RE team, it is also necessary to *define the type of SRS structure to be used*, the *types of models to be used to represent requirements* gathered, and *who will be responsible for which sections* of the SRS. This is important, as many organisations have different ways of drawing up SRS documents, and as the virtual team could consist of people from various organisations and experiences, a common structure must be defined. It may be necessary for the team to first *set up a template* for the SRS which can then be expanded as RE proceeds. This ensures that every team member is aligned towards a common document, and disagreements with regards to the content of the document are minimised during the RE process, allowing it to proceed smoothly.

It is also important to maintain a clear idea of the common purpose throughout the project itself. Kimball (1997b) states that a virtual team may need more frequent and explicit check-ins about their purpose. This would involve having *regular update meetings*, where each team member could inform others of exactly what they have been doing with regards to achieving their common purpose of producing a complete, consistent and high quality SRS. This allows team members to be aware of what their colleagues are doing, and it also ensures that everyone will perform their tasks in a conscientious and complete manner, as they will have to inform the team of their progress regularly. Gould (1997) also recommends sending team members a copy of the *updated project schedule*, or providing an electronic view of the project schedule on line using the Internet. In this way, teams can see where they fit in, how their tasks depend on and are depended on by other tasks which together combine to make up the overall project goal of producing the SRS.

6.5.2 Developing a Team Culture

Virtual teams need to have physical and social contextual information about each other. Such contextual information can only be exchanged explicitly in virtual teams, and therefore, Lau *et al* (1999) state that it is important to encourage team members to share their thinking, beliefs, experience and value systems openly through mutual communication in order to develop a common frame of reference, and thereby, a common team culture.

This can be achieved by facilitating spontaneous and informal real-time interaction (Steinfeld *et al* (1999)). All teams should have access to a central chat room, or a more advanced

TeamRoom type application which will allow them to chat informally to each other. TeamRoom allows member photographs to be posted into the chat applet, thereby allowing people to put a face to a name.

Hanssen (2000:50) also believes that such an informal chat channel could amplify a team's energy by broadcasting personal happenings, such as birthdays, births and achievements. Team members could post special days onto their team calendaring tool, thus allowing them to keep track of each others' personal happenings. Simply providing the technology tools to allow informal interaction is not enough – team members should be encouraged to use it regularly, right from the inception of the team.

Kimball (1997) as quoted by Hanssen (2000:49) suggests a useful exercise for facilitating such informal interaction, by placing the responsibility on one team member a week to create a non-routine conversation for that week.

Kostner (19996:168) as quoted by Aristotelous (1999:68) suggests that perhaps an electronic yearbook that gives each team member accomplishments, backgrounds and favourite types of work would help in sharing knowledge about each other. Another suggestion mentioned by Kostner (1996:168) is to allow virtual partnering during the project, in which different team members pair up to work on aspects of the SRS together. Partners can be rotated, and in this way, team members will have a chance to get to know each other on a one-on-one basis.

Kimball (1997c) states that in order to create a strong and cohesive team culture, virtual team members must be consistently reminded about the team. Hanssen (2000:50) explains that in a traditional team, simply seeing a team member around the office constantly reminds one about the team and the team tasks. For an approximation of such a reminder, Kimball (1997c) and Hanssen (2000:50) suggest that each team member should keep a team photograph in a prominent position – e.g. on their mouse pads.

Virtual team members must also be able to define their social, task and communication norms and communicate these across the team. Qureshi *et al* (2001:85) believe that developing and communicating norms across remote and diverse units is imperative to the success of the virtual team. Defining and adhering to norms is an integral aspect of team culture. The current author believes that norms should be defined at the very first meeting of the virtual team. Knoll (1995) affirms that team members should develop as few or as many process rules as the team desires, but every team member should commit to using these rules or norms.

Teams should develop, at a minimum, the following social norms:

1. Interacting informally on a regular basis
2. Commit to providing as much contextual information as possible when communicating with each other.
3. Commit to updating their project calendar with personal special days (e.g. birthdays, etc.)

Task norms are those specific to the overall goal of the project. In the case of the RE virtual team, they would include such issues as:

1. Define and adhere to the structure of the SRS
2. Commit to performing tasks as quickly, completely and efficiently as possible.
3. Send updates to the project leader and the rest of the team as soon as a task is completed so that the project schedule can be updated if necessary, and dependent tasks can begin.

Communication norms are not given much importance in traditional teams, but they are essential in virtual teams as such teams depend entirely on communication technologies to interact.

Kimball (1997a) explains that a communication strategy should be developed. She states that in developing a communication strategy, team members should ask the following questions:

1. What, when and how much are we going to communicate?
2. Where and how will we communicate? (what media will we use?)
3. Who will play what roles in the team's communications?

In addition, Massey *et al* (2001:84) recommends that organisations should require virtual teams to develop explicit and mutually agreed upon guidelines for how the team will work. Such guidelines define how, when and which technologies will be used for communication. It is apparent that the views of Massey *et al* (2001:84) converge sharply with those of Kimball (1997a).

In light of these opinions, teams should define when they will have meetings, how they will communicate during these meetings (videoconferencing, group support systems, audio conferencing, etc.) and when they will send status updates to the team. Teams should also define norms for when and how shared documentation stored in the central repository should be updated – who has access to what? Gould (1997) also states that it is important to establish a code of conduct to avoid delays, for example, a principle of acknowledging a request for information within 24 hours.

In addition, Lau *et al* (1999) explain that virtual teams require the knowledge and skills to use all the communication technologies at their disposal. A training course on the use of the technology means that all team members possess the same knowledge and skills with regard to the technologies, thus allowing them to use collaborative technologies with comfort. When providing such training, Lau *et al* (1999) recommend emphasising the benefits and limitations of these technologies on effective team communication.

Further, Grundy *et al* (1997:2) as quoted by Harpur (1998:58) affirm that the difference between communicating on-line and communicating face-to-face is that during on-line interactions, one is missing 90% of the information present in face-to-face communication. Harpur (1998:58) goes on to explain that the psychological impact of this difference is that participants need to realise that important information will be exchanged on-line without the presence of messages signposting its importance. Therefore, participants must adjust their methods of listening in order to cope with the lack of certain communication cues. Harpur (1998:58) believes that the more exposure participants have to the technology, the easier it will be for them to adjust their message encoding and decoding to compensate for the lack of visual cues.

Therefore, the author believes that any training course regarding the technology to be used for communication should not only teach the virtual team members to use the technology, but also to be aware of the need to express their messages as clearly as possible, and to decipher received messages as carefully as possible, in order to avoid message misunderstandings (communications styles training in a virtual environment).

Finally, Knoll (1995) provides a few useful guidelines for communicating, which the current author believes should be incorporated into the communications training:

1. Use emoticons or capital letters to communicate the tone of message.
2. Remember it is the quality of the ideas that is of importance, not the quality of the language communicating the ideas.

3. Restate your team-mates' ideas to make sure that you interpreted their communications correctly.
4. Use humorous expressions that everyone can understand.
5. Use simple words and words representing real-life objects and events so that you are easier to understand.
6. Ask for team members' feedback.
7. Describe technical context so that team members will understand constraints.
8. Describe individual schedules so that team mates can understand each others' unavailability.

The communication strategy should include a project calendar (different to the project management schedule) which can be accessed and updated by all team members. This calendar should contain all team members' personally important dates. It should also contain the public holidays of the countries in which team members are located, so that there is no confusion as to why certain team members are unavailable on certain days. Team members should also ensure that the calendar is up to date with regard to their leave periods.

Other norms proposed by Knoll (1995) are those which refer to the technology used to facilitate communication. Norms need to be proposed to deal with technological problems with the collaborative technology itself. The technological problems strategy is discussed in the section on task support. In essence, it helps to reduce misunderstandings, thereby maintaining trust.

6.5.3 Mutual Trust

As mentioned before, trust within a team comes about through shared social norms (addressed above), repeated interactions and shared experiences. It is also enabled through informal interactions and the anticipation of future association. It was mentioned before that trust comes about when people rely on one another to complete tasks. Jarvenpaa *et al* (1998), in their definitive paper on trust in virtual teams state that the following should be done to build trust in the virtual environment:

1. Clearly define roles and responsibilities.
2. Develop a communications strategy which defines how often to communicate; this increases predictability and decreases the uncertainty of the team's co-ordination.
3. Ensure that the team members have a sense of complementary objectives and share in the overall aim of the team (a common sense of purpose).
4. Handle conflict as soon as it emerges.

5. Engage in an open and thoughtful exchange of messages at the beginning of the team's existence. Cavalier attitudes that the virtual environment is no more challenging than a face-to-face environment prove to have ephemeral effects on participant enthusiasm, and once difficulties arise, the team lacks a substantive foundation upon which to overcome the real challenges imposed by the virtual context.
6. Participants should have an awareness of the importance of their providing to the others timely and detailed accounts of the work they are doing.
7. Participants must be aware of the need to provide feedback on the contributions of the other members.
8. Participants should be aware that it is not the quantity, but the quality and predictability of their communication that is most critical to the effective functioning of their team.

These implications show that trust is an issue that encompasses all the challenges faced by virtual team members. Some of these, such as possessing a common purpose, and issues relating to communications, have been discussed previously – the rest (defining roles and responsibilities, handling conflict) are discussed later in this chapter.

Kostner (1996:88) and Carmel (1999:144) believe that an initial face-to-face meeting is essential for building trust. This view is reflected by several authors in the field of virtual teams, and if possible, an initial face-to-face meeting should be conducted. The current author recommends that such a meeting should be conducted at a neutral setting – away from all team members' offices, and the meeting should be used to engage in team building practices which facilitate trust.

An initial face-to-face meeting can go a long way to developing trust, as it allows team members to get to know each other on a personal level before they disperse to their separate geographic locations to work on the project. A drawback of this initial meeting is that it is extremely expensive to gather geographically distributed team members in one physical location. However, such an initial expense can be justified by the fact that this meeting can help to produce and promote trust and social bonding between team members, thus allowing them to interact better on a social level once they are dispersed again. As mentioned before, such interaction benefits the project greatly.

Carmel (1999:145) states that trust falls away as soon as all team members return to their respective sites, but the current author believes that this trust can be maintained if team members continuously communicate informally while providing contextual information about themselves. Aristotelous (1999:66) states that fallen trust should be re-established using milestone face-to-face meetings, but the current author believes that although there is no question that such meetings can be extremely useful, they are not of vital importance if team members adhere to their communications strategies.

6.5.4 Social Bonding

Social bonding comes about when team members engage in informal interaction with each other. The steps to be taken to encourage and maintain informal interaction were discussed in the section on team culture. A strong team culture that keeps the team members socially satisfied, as well as mutual trust are the foundation for social bonding between team members, and as such, it is believed that if such a team culture, founded on trust is maintained, social bonding will occur naturally. The preceding sections discussed how to increase and improve informal interaction, and how to ensure that norms, beliefs, values and physical and social contexts were shared across the team, thereby improving social bonding, and therefore, social bonding is not discussed on its own here.

6.5.5 Roles and Responsibilities

Virtual teams have to explicitly define roles early on in the project to ensure that there is no confusion as to who does what. Expectations can be managed more easily if everyone is aware of each others' responsibilities, and this in turn, leads to increased trust. Teams also need to define new roles that may be needed as a result of the team being distributed.

Kimball (1997d) expresses the need for virtual teams to spend more time being explicit about mutual expectations for facilitators, managers and members, because the patterns of behaviour and dynamics of interactions in the new environment are unfamiliar and it is easy to fall into misunderstandings and become frustrated with each other.

Therefore, team members should spend some time thinking about the roles that are needed. The current author believes that this would best be accomplished at the initial face-to-face meeting, or, if time does not permit, at the earliest possible virtual meeting thereafter. Kimball (1997d) lists four questions that should be asked when deciding on member roles:

1. What roles does our team need?
2. How will we define these roles?
3. How will we share the roles?
4. What is our strategy for re-evaluating roles and players as we go along?

6.5.6 Reward and Recognition

According to Schermerhorn, Hunt and Osborne (1994:278) as quoted by Aristotelous (1999:32), people are influenced by reward systems that are characteristic of their work environment. Well-designed reward systems influence team members' level of motivation, and therefore, virtual leaders can implement reward systems that motivate the virtual team members' level of interaction. An increased level of interaction leads to more social bonding, thereby helping to create a satisfying and motivational team culture. Carmel (1999:185) and Kimball (1997d) insist that it is important to reward teamwork in virtual teams rather than individual work, as a reward for working well together as a team encourages people to try even harder to foster a sense of team cohesion.

Further, George (1996) as quoted by Cantu (1998) explains that virtual work necessitates pay based on contribution to and completion of complex projects. Members should be measured on their ability to collaborate with each other, and solve problems with little direct supervision. Therefore, a reward and compensation system based on rewarding teamwork rather than the individual should be worked out, and, team members should be made aware of this system.

Cantu (1998) goes on to say that it is important to remember that team members need and deserve feedback from supervisors as well. Virtual team members do not have the benefit of receiving feedback from supervisors on a daily basis, and therefore, special times should be set aside during which supervisors can provide feedback. An ideal time for this is during the weekly update meeting mentioned previously, where members have the opportunity to let other team members know exactly what they are doing with regards to the overall project goal.

It was also mentioned in the previous chapter that team members cannot celebrate accomplishments and achievements as easily as co-located teams. Unfortunately, there is no feasible solution for this problem, unless team members are able to meet at a physical location (e.g. in a milestone meeting as mentioned previously). The lack of a celebration "party" when milestones are met make it all the more important that team members are given the rewards and recognition that they deserve.

To substitute for a celebration party, team members should be given something different that they can do together that signals celebration. Many software development team members may enjoy the newest network game which they can play together. As each milestone is reached, the project manager can buy copies of the game for each team member, and send it to them. The celebration is in getting to know the game and playing it together. This not only gives the team members something to look forward to, but also contributes to team building, as it is likely that they will play the game during the course of the project, at least until the next milestone, when a new game is provided.

6.5.7 Project Visibility

The need to maintain project visibility in the task dimension is exactly the same as maintaining a common purpose in the social dimension, and as this was discussed in preceding sections, it is not addressed again here.

6.5.8 Task Co-ordination

The major problems experienced by virtual software development team members with regard to task co-ordination are those due to time zone differences between team members. In order to overcome these difficulties, Lau *et al* (1999) advise the following:

1. Advise team members of any time and space differences that may exist, especially those that cross organisational and cultural boundaries. Explain the implications of these differences on how team members may overcome them.
2. Provide guidelines (norms) on appropriate behaviours when dealing with time and space differences among team members. For instance, make team members aware of time zone differences or provide education on foreign cultures.
3. Encourage team members to demonstrate sensitivities toward specific time and space differences such as openly acknowledging time and cultural differences to build social relationship with each other.
4. Monitor the pattern of interactions among team members to ensure that they are aware of and sensitive to time and space differences.

From the above, it can be seen that it is extremely important that time and space issues are considered within the communication strategy to be developed by the team. Firstly, in initial team setup meetings, team members should be asked to state time zone differences. A comprehensive schedule of time zone differences should be drawn up and each team members should possess an electronic copy of this schedule. It is further recommended that a specific Time Zone Room be set up in the GSS, where team members can go to check how far ahead or behind another colleague is in terms of time. This will prevent misunderstandings with regard to the time delay involved in sending and receiving a message. A simple applet will allow Team Member A to enter the room and type in his/her time, after which a list of team members and the differences in time specific to the time that Team Member A typed in will be displayed.

The importance of the communication strategy cannot be underestimated, as it also defines which types of technologies are used for which types of meetings. Where teams are widely distributed across many time zones, the focus should be mainly on asynchronous technologies, and where, as in South Africa, team members are located in the same time zone, synchronous technology should be used more often. DeSanctis *et al* (2001:80) believe that a mix of synchronous and asynchronous tools is vital to team success. Relatively speaking, asynchronous tools are more critical to team co-ordination, and are vital when cultural and geographic distances are great and worker mobility is high.

Team members should also be encouraged to update the team calendar with a comprehensive list of their public holidays and leave days. Once again, this will ensure that there are no misunderstandings caused by delays in message sending, and response receiving. It will also ensure that team members address important issues regarding tasks to be performed before their team mates go on leave or take a holiday, thus contributing to overall task performance efficiency, and once again, reducing misunderstandings and frustrations. Having a record of when people go on leave and take public holidays will also help to set realistic milestones for the project. Therefore, the calendar must be set up at the very beginning of the project, and team members should commit to updating it as soon as they become aware of the fact that they will not be working on a particular day for one reason or another.

If team members are from differing cultures, they can be encouraged to write a brief exposition on the core values, traditions and interesting aspects of their cultures. These articles can then be placed in the electronic yearbook discussed previously, and colleagues will be able to read up on each others' cultures, thus helping them to understand the cultural differences that may exist. In addition, each team member can write a short section on their own personal beliefs and values as this will also promote personal understanding between team members, and reduce the chances of people inadvertently offending one another's belief systems or values. The use of video clips, photographs, audio clips should be promoted, and team members should be encouraged to make their section of the yearbook as interesting as possible.

When team members are out of the office for any reason, they should also leave full details of how and where they can be contacted in case of emergencies.

6.5.9 Task Support

Every effort should be made to standardize the task performance and communication technology to be used at the conception of the team. If such standardization takes place during the life of the team, the need to change over to new and unfamiliar technologies and software may not be received well. The efficiency of the team will also be reduced as team members spend time trying to convert documentation and programs to bring them in line with the new specifications. However, if the technology and software specifications are defined at the very beginning, and all team members are given comprehensive training on their use, such resentments will not occur.

Standardised technology and software will ensure that team members can work across their virtual network easily and efficiently, without worrying about compatibility and conversion problems.

In addition, it is important that a technological problems process be created to deal quickly and efficiently with any technological problems that may arise. Such a strategy is critical to the success of a virtual team because of their reliance on technology for communication and task performance. Knoll (1995) recommends that the following be included in such a process:

1. Contact the system administrator (who may or may not be part of the team) when there seem to be long delays in receiving messages.
2. Contact the system administrator when there are other technical difficulties, such as slow chat servers.
3. Send log of messages received to date when there are questions about system reliability.
4. When there are technical problems with messages that you sent to your team-mates, explain the technical details in a follow-up message.
5. Send decoding instructions with coded documents.

Task support also encompasses the meetings of RE team members, and as such, it is important to determine when such meetings are held, and what media will be used. This was discussed with respect to the communications strategy, but is mentioned again here as it is a principal aspect of task support. Dube and Pare (2001:72) believe that because communication barriers are severe in an electronic context, a team may lose vital ideas and information, or take a wrong direction. They are of the opinion that virtual team meetings should be structured communication sessions directed by a formal speaker, which are able to give every team member the chance to speak. In addition, they extol the virtues of tolerance and empathy in order to encourage participation in this context, and recommend that writing minutes at the end of an oral communication session will help assure all participants understood the same message.

Finally, it is important that team members commit to doing all of the above in as comprehensive and complete a way as possible. A half-hearted effort will result in sure failure, but a coordinated and concentrated effort can bring many benefits in terms of understanding and satisfying social relationships and team culture.

6.6 Teambuilding

The above section is separated into a discussion of how each identified problem experienced by virtual team members can be solved. However, it is clear that many, if not all of these problems are closely interrelated, thus suggesting that the overcoming of one is a step towards overcoming one or more of the others. The first step toward overcoming many of these problems is through team building. Bateman (1990) as quoted by Hanssen (2000:43) defines team building as an effort in which a team studies its own processes of working together and acts to create a climate that encourages and values the contributions of team members. Hanssen (2000:43) goes on to cite Dyer (1987:20), who explains that team building originated from looking at the social interactions and relationships between members in an organisation, and aims to improve relationships between people so that tasks can be achieved. From this explanation, it can be seen that team building is therefore very relevant to primarily the social dimension problems experienced by virtual team members as discussed above, and secondarily to the task dimension problems.

Stead (1998:64), in consultation with various authors [Renede (1991), Belbin (1993:43), Woodcock (1989:6), Dearling (1991:41), Schermerhorn *et al* (1994:327) and Carrell *et al* (1997:637)] presents several steps for team building:

1. Select Team
2. Analyse needs of team
3. Determine objectives

4. Plan
5. Run exercises
6. Review

1. Select Team

The team is selected based on the required skills and expertise for the project. An advantage for virtual teams is that geographic location is not an issue to consider when selecting team members. Stead (1998:78) states that past experience with virtual work is an added advantage in team selection, and may allow the psychological barriers discussed above to be overcome more easily.

2. Analyse Needs

The needs of the virtual team can be closely related to the social and task dimension problems discussed above. Stead (1998:78), Schermerhorn *et al* (1994:332) and Cantu (1998:2) state that the primary needs of virtual teams include clarity concerning participation, goals (purpose), controls, relationships, processes, cultural differences, group dynamics (all of which fall into the category of team culture), expectations (roles and responsibilities), trust, co-ordination of work logistics, and leadership issues. In addition, the management of conflict and reward and recognition issues should be added to this list.

3. Determine Objectives

The needs of the virtual team must be translated into objectives. The aim of the team building process is to achieve these objectives. Translating the needs mentioned above into objectives, the following list can be drawn up:

1. Define a common purpose
2. Build a satisfying and rewarding team culture.
3. Build Trust
4. Clarify expectations by defining roles and responsibilities
5. Define reward and recognition structures
6. Determine work co-ordination
7. Determine conflict management procedures

As can be seen, these objectives tally precisely with the social and task dimension problems experienced by virtual team members.

4. Planning

An external facilitator should be recruited to guide the team during the team-building process. Kimball (1997b) explains that team building should not be a once-off activity, but one that continues throughout the life of the team. There should however, be specific team building meetings held at intervals throughout the team's existence. It is recommended by many authors that the first team-building meeting should be a face-to-face one. The need to have such a first face-to-face meeting was discussed in the section on building trust, and it was explained that such a meeting could help to establish trust in a virtual team more quickly. It was also argued that although milestone face-to-face meetings are also recommended, they are not an absolute necessity. The same is true in this case. Because team building is a process, the author believes that the kick start given by the first face to face team building meeting can be maintained at an acceptable level if team building activities and exercises are conducted and evaluated regularly when team members are dispersed.

The first team building meeting should be held at a neutral location away from all team members' workplaces, in order to ensure minimal interruptions. Dearling (1991:41) explains the importance of setting an informal atmosphere in order to level the playing field and minimise power dynamics. When conducting virtual team building meetings, it is obviously more difficult to create such an atmosphere, and Stead (1998:82) states that more directive efforts may be required to encourage team members to identify areas of commonality.

5. Team Building Exercises

There are a variety of traditional team building exercises that can be used for the first meeting, aand several more which can be adapted for successful use within the virtual environment. The first meeting should lay the foundation for the way in which the team members will interact in the virtual environment. Therefore, it is recommended that the team create its identity and write its statement of purpose during this first meeting. Thereafter, the exercises should be aimed at allowing the team members to get to know one another, and at allowing them to express their expectations and goals to other members of the team. Stead (1998:85) suggests contracting, team leadership questionnaires, value discussions, and intimacy exercises to be used during the first meeting. Following, this, teams should discuss and agree on their general group norms, the management of conflict, task co-ordination and reward and recognition structures. The author also recommends that the team participate in several physical team building exercises (e.g. building a raft).

6. Review

Finally, every team building meeting should be carefully reviewed with the whole team. Constant feedback encourages constant evaluation and adaptation, and this is extremely important to ensure that the team building meetings are always targeted at the specific needs of the virtual team members.

6.7 Conclusion

This chapter summarised the problems experienced by virtual team members engaged in virtual RE, within the two categories of problems within the implementation of three major RE techniques, and day-to-day interaction problems. The chapter then went on to detail possible solutions for each problem in both categories. When addressing the latter category of problem, it was found that team building was an important aspect of a virtual team, encompassing the solutions to many of the problems within both communication dimensions, in particular, within the social dimension. Therefore, team building was discussed separately with specific reference to how team building can be performed within a virtual environment.

The solutions examined in this chapter form the foundations for several frameworks which show how to successfully conduct each component of RE. As such, the next chapter builds frameworks for the successful implementation of each RE technique, as well as a framework for the implementation and maintenance of successful day–to-day interactions between virtual team members in both the social and task dimensions. Each framework forms a sub-component of the theoretical model for distributed RE by a virtual team, which aims to overcome all the problems experienced by virtual teams engaged in such RE.

Chapter 7

Virtual Requirements Elicitation Model

7.1 Introduction

This chapter presents a model of virtual RE, which overcomes the problems experienced by virtual teams engaged in distributed RE. The model is based on the literature review in the preceding chapters, and is intended as a holistic approach to virtual team formation and maintenance, which assures the success of the virtual RE process.

The literature review introduced the concept of RE and virtual teams, and discussed how traditional techniques of RE are adapted for use within the virtual environment. Subsequently, the problems experienced by virtual teams engaged in RE were examined and analysed. These problems were grouped into two major categories, namely, the problems experienced by virtual team members within the implementation of the RE techniques, and the problems experienced by virtual team members on a day-to-day interaction level. Following a careful analysis of the both categories of problems, detailed solutions to each problem were proposed. These proposed solutions were drawn from two sources. Firstly, an analysis of the literature on the subject revealed several solutions or partial solutions to the problems. These were combined with the author's own thoughts and hypotheses to present a complete set of solutions to the problems experienced by virtual teams engaged in RE.

This chapter draws on these solutions in order to build frameworks for the successful execution of each RE technique, as well as frameworks for the successful implementation and maintenance of day-to-day task and social interactions of team members. These frameworks collectively constitute the foundation upon which the holistic model of virtual RE presented in this chapter is based.

7.2 A Model of Requirements Elicitation

RE involves software development team members working together as a team in order to define requirements for the new system. Figure 7.1 illustrates the components involved in the RE process. The figure illustrates the aggregated views of authors reviewed in the foregoing literature survey regarding the elements of the requirements elicitation process.

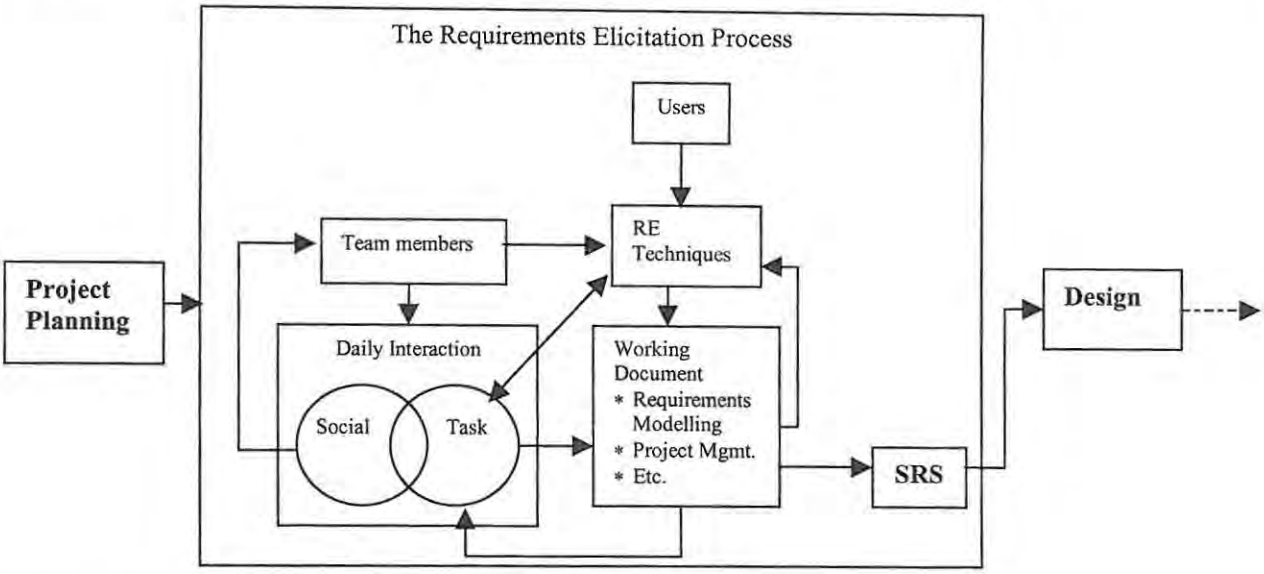

Figure 7.1: Requirements Elicitation Model

Various RE techniques are used during the RE process, and these include JAD, interviews and questionnaires. The implementation of these techniques requires the presence of the system users and the system developers in order to gain a complete and accurate set of requirements. It should be noted that no one technique is capable of gathering all the requirements in a complete and accurate manner, and therefore it is customary to use several techniques which complement and reinforce each other.

In addition to their communications within the implementation of the techniques, development team members also interact on a day-to-day basis. Such interaction consists of both social and task related interactions. The task related interactions are closely linked to the RE techniques, as the tasks that the developers are required to perform are concerned with the production of a system requirements specification based on the information gathered in the RE techniques. To this end, their task-related interactions center around modeling the requirements gathered in the RE meetings in a working document, which is eventually transformed into a complete, lucid and accurate SRS at the end of this phase of systems development. The SRS is used as an input to the design stage of the SDLC.

Social interactions between team members on a day-to-day basis are also known as informal interactions, and are considered to be important in helping team members to form cohesive relationships, mutual trust, shared understanding and a common team culture, thereby leading to more socially satisfied and motivated team members. Socially satisfied and motivated team members are usually more efficient and productive than those that are not, as they are constantly aware that they are members of a team that supports and nurtures them, resulting in a more intense feeling of responsibility and accountability towards the team.

7.3 A Model of Virtual Requirements Elicitation

In a virtual team, however, technology is required to facilitate both day-to-day interactions between team members and the RE techniques themselves. Technology is *the* enabling, all pervasive factor of a virtual team. Therefore, the model of RE shown in Figure 7.1 must be augmented to include the technology as shown below in Figure 7.2. All interactions and the implementation of the RE techniques take place through the use of collaborative technology.

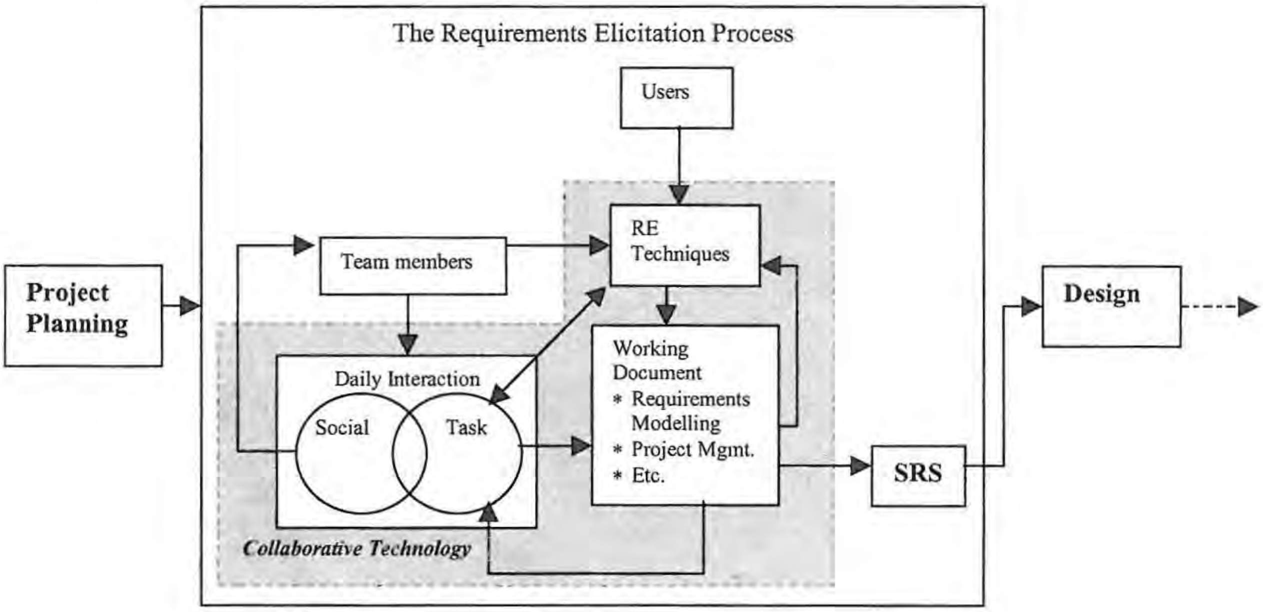

Figure 7.2: Virtual Requirements Elicitation Model

The reliance on technology for all virtual team interactions causes problems for the virtual team members. These problems are divided into:

1. problems within the implementation of the virtual RE techniques;
2. problems regarding the day-to-day interactions (task and social interactions) of the virtual team.

The problems in both categories were discussed in detail in the preceding chapter, and various solutions were proposed. These solutions were drawn from a review of the literature, and the author's own theories based on the knowledge gained from an extensive review of the area under study.

Each solution solves a problem experienced by virtual team members, thus contributing to the success of the team in some way. It follows that a virtual team that implements all the solutions should achieve optimal success levels. The aim of this chapter is to build a holistic model for virtual RE, which encompasses the solutions to all the problems experienced by virtual team members. The proposed solutions to these problems are predominantly preventative rather than reparative. Accordingly, the model prescribes actions to be taken to ensure the success of a virtual team through the avoidance of the problems to which such teams are prone. In this light, the model can be viewed as a holistic framework for virtual RE implementation.

This holistic model is composed of several sub-frameworks that target certain key areas in the RE process. The sub-frameworks address the problems to which virtual teams are prone in both a general sense, and in the specific context of RE.

Figure 7.3 illustrates how the virtual RE model in Figure 7.2 is adapted to include the various frameworks. The following section explains the model in detail.

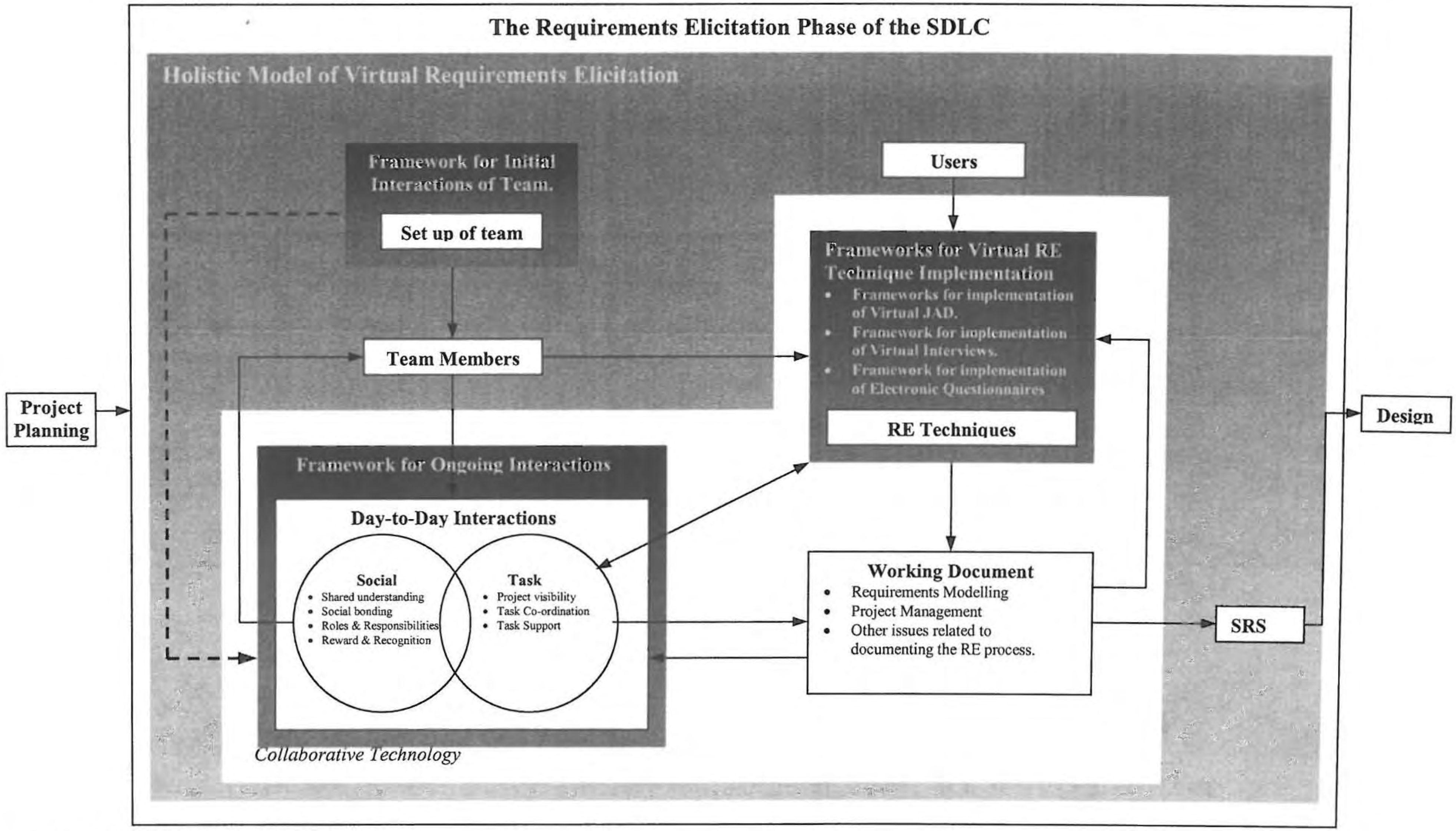

Figure 7.3: A Holistic Model of Virtual RE

7.3.1 Explanation of the Model

7.3.1.1 Model Overview

Figure 7.3 illustrates a holistic model of virtual RE. The model illustrates the components of RE as being users, team members, the daily interactions of the team members on a social and task related basis, the RE techniques, the working document, and the end result of any RE process: the Software Requirements Specification. In order to distinguish it as being a model of *virtual* RE, collaborative technology is also included as a component of the model. As portrayed in the diagram, the collaborative technology encompasses most aspects of the model (as shown by the inverted L-shaped area). Relationships between the components are indicated through the use of arrows. The holistic nature of the model is indicated by the way in which it encompasses all the components of the virtual RE process.

The diagram also shows the various frameworks that comprise the holistic model of RE. It is apparent that there are three major frameworks, each of which applies to a component of the virtual RE process. The following sections discuss and describe each framework in more detail.

7.3.1.2 Initial Interactions Framework

The initial step in the process of virtual RE is the set-up of the team. This phase encapsulates the selection of the team and the initial meetings of the team. This initial phase is governed by a framework which addresses the preliminary interactions of the team as well as various activities that must be performed in order to ensure that the team is organised, planned and implemented in such a manner as to promote the success of the team.

The framework is focused on laying a foundation for the successful ongoing interactions of the virtual team in both the social and task dimensions, as shown in the diagram. As such, this framework concentrates on setting up the appropriate channels to ensure that such interactions take place on an ongoing basis in an effective and efficient manner that is satisfying to all the members of the virtual team. This shows that the initial interactions framework is closely linked to the ongoing interactions framework.

The key points addressed within this framework are illustrated in Table 7.1. Appendix C details the specific activities to be performed in achieving each of these points.

1. Select Team
The team is selected on the basis of the skills and experience required for the project.
2. Select collaborative technology and software for the team
It is recommended that a comprehensive group support system such as TeamRoom is used as the foundational technology for team communications. In addition various support technologies and software for task performance must be selected. Technology and software must be standardised across the team in order to ensure that co-ordination and integration problems do not surface, thus providing a seamless environment over which team members are able to interact transparently.
3. Install software and hardware
The chosen technology and software must be implemented at each team member's physical site.
4. Provide training
All team members should be trained in the use of the technologies and software, thus ensuring that they are used with maximum efficiency and effectiveness. In addition, team members should be provided with communications styles training, as virtual interactions are different to face-to-face interactions as a result of the technology barrier. Such training ensures that the team will be able to communicate with minimal frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences, problems arising as a result of cultural differences and problems caused by general message misunderstandings.
5. Implement initial face-to-face team building session
An initial team building session helps to lay stronger foundations for trust and bonding within the team. In addition, the objectives of the team building session should be determined in conjunction with a careful analysis of the needs of the team. It is believed that the following objectives should be addressed in detail at the initial team building session in order to assure team success: • Clarity of participation • Clarity of goals • Social bonding and relationship building • Clarity of processes for task performance and communication • Definition of roles and responsibilities • Trust • Co-ordination of work logistics • Leadership issues • Management of conflict • Reward and recognition structures
6. Implement initial virtual meeting
The initial virtual meeting allows team members to become familiar with the use of the collaborative technology. During the virtual meeting, a process for dealing with technological problems and a communications strategy should be detailed. • Implementation of a process for dealing with technological problems A process for dealing with technological problems must be detailed in order to ensure that team members are able to perform their tasks with minimal frustration, misunderstandings and delays in task performance and co-ordination. • Implementation of a communications strategy: The communications strategy describes the frequency with which various meetings will take place, which media will be used for each type of meeting, when and how documentation will be updated, how team members will communicate regarding task performance. In this way team members are able to perform their tasks with minimal frustration, delays in task performance and task co-ordination, misunderstandings caused by language differences, problems arising as a result of cultural differences and problems caused by general message misunderstandings. It is recommended that team members engage in a weekly update meeting where they are able to educate others as to the status of their work.
7. Set up informal chat room for team members
Informal interaction is considered to be important in the development of a cohesive team culture, as this is the principal way in which team members share their values and beliefs with the team. A strongly bonded team is likely to be more effective than teams with few social ties, as bonded team members are more aware of their responsibilities towards their fellow team mates, and are able to work together towards a common purpose. Therefore, it is extremely important that a channel for informal interaction be set up.
8. Implement first weekly meeting
This is the first meeting where directly work related activities will be performed in the virtual environment. Team members will define the type of SRS structure and models to be used, and will also determine task performance norms for the team.
9. Develop of milestones
Deadlines should be developed by the project leader and the project schedule should be made available to all team members.

Table 7.1: Principal Aspects of Initial Interactions Framework

7.3.1.3 Ongoing Interactions Framework

The framework for ongoing interactions addresses all the issues necessary to ensure that effective interaction is maintained. Such interaction consists of social and task related interactions. The components of both types of interactions are shown in Figure 7.3. Social interaction promotes shared understanding, social bonding, a mutual understanding of roles and responsibilities and an understanding of reward and recognition structures. Similarly, effective task related interactions allow for project visibility, task co-ordination and task support. The problems that virtual teams experience with regards to achieving both the social and task dimension of interaction were discussed in detail in Chapter 6.

The ongoing interaction framework is composed of the solutions to these problems, which were identified in the same chapter, and therefore consists of activities to be performed to ensure that the dimensions of communications are maintained. The key points of this framework are described in Table 7.2, but the detailed processes which illustrate how to go about performing the key activities are addressed in Appendix C.

1. Implement ongoing team building meetings

Frequent team building meetings are important in reinforcing trust and relationships within the team. The needs of the team should be analysed and objectives for each team building meeting should be detailed based on these needs. It is believed that the following objectives should be addressed at the ongoing team building sessions in order to ensure team success:

- Clarity of participation
- Clarity of goals
- Social bonding and relationship building
- Clarity of processes for task performance and communication
- Definition of roles and responsibilities
- Trust
- Co-ordination of work logistics
- Leadership issues
- Management of conflict
- Reward and recognition structures

2. Implement weekly status meetings

Weekly status meetings provide team members with the chance to update the team regarding the status of their work. Such meetings ensure that project visibility is maintained by all team members, by ensuring that they are aware of the current state of the project, and allows people to give advice and support regarding the work of their colleagues.

3. Encourage informal interaction

Informal interactions should be encouraged as far as possible, as they help the team to develop a team culture. In addition, celebrations at the end of milestones should be encouraged, as this allows bonding and a sense of achievement.

4. Monitor adherence to Technological Problems Strategy

Team leaders should ensure that technological problem norms are being adhered to, and that technological problems are reported immediately and alleviated as soon as possible. Adherence to a technological strategy ensures that team members are able to perform their tasks with minimal frustration, delays and misunderstandings.

5. Monitor adherence to Communications Strategy

By monitoring the pattern of communications, it is possible to discern the level of adherence to the communications strategy. It is important that the strategy is adhered to and that team members use their communications styles training in all their virtual interactions.

7. Implement virtual RE techniques

The RE techniques should be implemented according to their respective frameworks.

Table 7.2: Principal Aspects of Ongoing Interactions Framework

7.3.1.4 Requirements Elicitation Techniques Frameworks

The specific work performed by the virtual team is encapsulated in the working document, which is used to document the entire RE process for the project. One of the major inputs into the working document is the information gathered in the RE meetings. As shown in Figure 7.3, these meetings require the presence of the system developers and the system users, working together to identify a complete and accurate set of requirements.

It was noted in Chapter 5 that virtual teams experience several problems within the implementation of the RE techniques. Solutions to these problems were identified in Chapter 6, and these solutions are used to build the frameworks for the RE techniques. As mentioned previously, although just about any traditional technique of RE can be adapted for use within the virtual environment, this research concentrates principally on the three most commonly used techniques: virtual JAD, virtual interviews and electronic questionnaires. Each technique has its own framework which describes how to plan, design and implement the virtual RE technique in such a way as to avoid the problems that they are prone to, thereby contributing to the success of the RE process.

Virtual JAD

When determining which virtual JAD technique to use, facilitators should consider the number of individual sites. If there are a large number of sites, videoconferencing JAD is unwieldy, and therefore it is unlikely that the JAD session will be successful. It is believed that three or fewer individual sites are the optimal number of sites for a room videoconferencing JAD session, as this allows a comfortable layout of projector screens, and makes the session easier to control. Where participants are distributed across a large number of sited, it is recommended that GSS or meeting system JAD sessions are used.

Tables 7.3 and 7.4 describe the key aspects of videoconferencing JAD and GSS JAD. Full details of the activities to be performed to implement successful virtual JAD sessions are illustrated in Appendix C.

Phase 1: Preparation
1. Select participants
2. Develop a web page for the project
3. Select all personnel
4. Select collaborative technology
5. Develop a template for working document
6. Determine analysis techniques to be used
7. Determine meeting locations
8. Develop and distribute of agenda
9. Prepare environment to ensure effective group and technology configurations
10. Determine of non-verbal cues to be used
11. Set up of back channel of communication
12. Determine team building exercises to be used
13. Implement initial meeting with all personnel
14. Implement pre-meeting with participants
15. Prepare back-up plan
16. Last minute check
17. Establish contact with other sites
Phase 2: Implementation
18. Open the session
19. Business Overview/Update
20. Familiarisation (for first JAD session)
21. Run team building exercise
22. Begin discussion, using all virtual facilitation skills to ensure that session is progressing satisfactorily
23. Close Session
Phase 3: Follow up
24. Review working document and place update copy on JAD session web page
25. Place minutes of JAD session on the web page
26. Consult with all personnel for feedback regarding technical implementation of JAD session
27. Check chat café (back channel) regularly to receive feedback regarding the JAD session

Table 7.3: Key Aspects of Framework for Videoconferencing JAD

Phase 1: Preparation
1. Select technology depending on needs
2. Select participants.
3. Distribute typing tutor packages to participants
4. Distribute copies of GSS application with instructions for installation.
5. Install central server.
6. Select and implement additional software for team building exercises if necessary.
7. Select and train scribe.
8. Develop a template for the working document and make it available to team members.
9. Determine analysis technique to be used.
10. Determine non-verbal cues to be used.
11. Set up training program.
12. Contact all JAD participants about initial test meeting.
13. Implement initial test meeting.
14. Contact participants regarding training session.
15. Implement training session.
16. Use feedback and observation of group dynamics to develop a guideline document for participants and distribute it.
17. Develop a JAD agenda and make it available to all participants.
18. Implement pre-meeting with participants
19. Prepare a back-up plan.
20. Last minute check and connection.
Phase 2: Implementation
21. Open the session
22. Business overview/update
23. Familiarisation (for first session)
24. Run team building exercise
25. Begin discussion, using all facilitation skills to ensure that session is progressing satisfactorily.
26. Close Session
Phase 3: Follow-up
27. Review working document and make it available to participants.
28. Distribute minutes of JAD session.
29. Check informal chat café (back channel) regularly to receive feedback regarding JAD session.

Table 7.4: Key Aspects of Framework for GSS JAD

Desktop Videoconferencing Interview

Table 7.5 shows the key aspects of the framework for the implementation of a desktop videoconferencing interview. Please refer to Appendix C for the fully detailed framework.

Phase 1: Preparation
1. Select participants 2. Use interview schedule to determine number of different interview locations 3. Contact department heads at all locations to organise interview venues. 4. Select conferencing technology. 5. Select conferencing software. 6. Send DVC software and hardware (if necessary) to all interviewee locations with installation instructions. 7. Read background material 8. Establish interview objectives 9. Set time and location for interviews. 10. Decide on question types and interview structure. 11. Prepare the interviewee. 12. Hold a test run to ensure correct lighting, low audio-video lag and high resolution of image. Also helps to set the interviewee at ease, and builds trust and credibility. 13. Prepare a back-up plan 14. Ensure technology is functioning correctly on the day of the interview.
Phase 2: Conducting the Interview
15. Introduce the interview, always ensuring that the interviewee receives an agreeable perception of the interviewer so that trust and rapport can be built. Eye contact is important. 16. Conduct body of interview 17. Close interview
Phase 3: Follow up Interview
18. Write up interview report. 19. Send interview report to interviewee for confirmations and modifications. 20. Ask interviewee to provide feedback on the use of DVC for interviews. 21. Use interview information to construct models of business processes discussed in interview. 22. Combine interviewee and interviewer reports to draw p a list of recommendations to make DVC interview more successful in the future if necessary.

Table 7.5: Key Aspects of Framework for Desktop Videoconferencing Interview

Electronic Questionnaire

Table 7.6 shows the key aspects of the framework for the design and implementation of an electronic questionnaire. Please refer to Appendix C for a more detailed framework.

Phase 1: Preparation
1. Select respondents 2. Check that all respondents are computer literate and have internet and email access. 3. Determine questions to be asked. 4. Choose software for questionnaire design and implementation. 5. Implement software package. 6. Implement technology for the software package. 7. Hire outside expertise if necessary. 8. Design questionnaire according to questionnaire design guidelines and HCI principles. 9. Test questionnaire.
Phase 2: Implementation of Questionnaire
10. Post final questionnaire on the web page or email it to the respondents 11. Send respondents passwords and instructions on questionnaire access. 12. Collect responses from server. 13. Check responses for invalid data and unusable responses. 14. Analyse data with the help of the software package.
Phase 3: Following up the Questionnaire
15. Send all respondents a "thank you" email. 16. Send respondents a summary of responses if necessary 17. Use responses to add to data model and determine which areas need further clarification.

Table 7.6: Key Aspects of Framework for Electronic Questionnaire

The information gathered from the implementation of the RE techniques is used to update the working document, which in turn is used to determine other areas that need to be examined within the next RE technique implementation. This cycle continues until all the requirements have been gathered, after which the working document is used to produce the Software Requirements Specification, which is signed off by the users and developers and used as the input into the next phase of systems development.

7.3 Critical Success Factors (CSFs)

The proposed frameworks in the previous section together constitute the holistic model of virtual RE. Each step in the frameworks plays a role in the overall success of the team, although there are certain critical areas which the solutions identified in Chapter 6 show not only contribute to the success of the team, but are in fact imperative to the overall success of the virtual team. This section is concerned with identifying these critical success factors.

There are critical success factors that apply to any traditional team engaged in RE. Many of these apply to virtual teams engaged in RE by default, as they are factors that are critical to the success of any team engaged in virtual RE. Only those factors that the author believes are critical to the success of a *virtual* team engaged in RE are mentioned here. It is important to note, however, that the team will not be successful if it adheres *only* to the virtual team critical success factors; traditional team critical success factors must be given due attention as well.

The factors that are critical to the success of a virtual team engaged in RE (excluding those that are critical to the success of any team engaged in RE) are listed below.

1. Hold frequent team building sessions in order to lay stronger foundations for trust and bonding within the team.
2. Hold an initial face-to-face team building meeting in order to lay stronger foundations for trust and bonding within the team.
3. Address the following issues in depth at the initial and ongoing team building sessions in order to ensure the success of the team: clarity of participation, clarity of goals, social bonding and relationship building, clarity of processes for task performance and communication, definition of roles and responsibilities, trust, co-ordination of work logistics, leadership issues, management of conflict, reward and recognition structures.

4. Standardise communication and task performance software and technology in order to minimise co-ordination and integration problems.
5. Ensure that adequate training is provided for communication and task performance software and technologies.
6. Implement a formal process for dealing with technological problems in order to minimise frustration, general misunderstandings, delays in task performance and delays in task co-ordination.
7. Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences, problems arising as a result of cultural differences and problems caused by general message misunderstandings.
8. Provide training in communications styles in a virtual environment in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences, problems arising as a result of cultural differences and problems caused by general message misunderstandings.
9. Ensure informal interaction takes place between team members in order to promote trust, social bonding, a sense of "belonging" to the team, social satisfaction regarding relationships within the team, motivation and responsibility.
10. Ensure that the following are maintained in a videoconferencing JAD session in order to promote success: three or fewer individual sites, an explicit form of non-verbal communication, different emphasis on facilitation skills, maintenance of effective group dynamics, explicit back channel of communication.
11. Ensure that the following are maintained in a GSS JAD session in order to promote success: similar typing speeds of all participants, no anxiety from less technical users, maintenance of effective group dynamics, spontaneity of dialogue, non-verbal cues, explicit back channel of communication.
12. Ensure that the following are maintained in a DVC Interview in order to promote success: sufficient lighting, high resolution of image on screen, low audio-video lag, eye contact, ability to read body language, trust, credibility of interviewer.

It is clear that these CSFs relate to many of the key aspects of the frameworks identified in the preceding section. There are no CSFs for the framework for the implementation of an electronic questionnaire, as the activities critical to its success focus mainly on the design of the questionnaire in terms of the types of questions asked, as with the implementation of a traditional questionnaire.

7.4 Conclusion

This chapter proposed a model for virtual RE. The model is composed of several frameworks, each of which address a certain aspect of virtual teams who are engaged in RE. The frameworks were described in detail, and it was noted that they were composed of various steps and processed which needed to be executed in order to prevent common problems experienced by virtual teams engaged in RE.

A higher level view of the frameworks identified several critical success factors. It is believed that these factors are imperative to the success of a virtual team engaged in RE. These factors do not include factors that are critical to the success of any team engaged in RE, but reflect only those that are important to such teams as are engaged in virtual RE. Succeeding chapters detail an empirical study conducted to confirm the proposed model's critical success factors and by implication the model itself.

PART IV

The Empirical Study

This section describes the planning, organisation, implementation and results of the empirical study.

The empirical study is designed to verify the critical success factors of the holistic model of virtual RE identified in Part III, thereby implying verification for the model itself. In order to achieve this objective, the opinions of various IS professionals currently or recently involved in virtual teams were polled as to the importance of these CSFs.

The research was designed carefully according to its primarily quantitative and secondarily qualitative focus. Each CSF was converted into one or more hypotheses, each of which could then be tested using quantitative methods. A questionnaire was used as the survey instrument of choice, and the design of the questionnaire and the rationale for its design are discussed within this section.

The results obtained from the questionnaire are presented, and various descriptive and inferential statistical techniques are applied to the data in order to glean meaningful information regarding the confirmation or rejection of the hypotheses relating to the CSFs.

Chapter 8

Design of the Empirical Study

8.1 Introduction

This chapter presents an empirical study that was designed to test the theoretical model of RE that was introduced in the previous chapter. The model is comprised of several frameworks, each of which addresses a specific component of the RE process. The frameworks prescribe certain actions to be taken and processes to be put in place for the successful operation of a virtual team engaged in distributed RE. A high level view of the frameworks enabled the identification of 12 critical success factors which are believed to be imperative to the success of the virtual team.

The importance of these critical success factors is as yet theoretical. It was determined that their validity should be tested through the use of an empirical study in order to provide them with some foundation in practicality. As these CSFs are seen to be the most important aspects of the model of virtual RE, the confirmation or rejection of the CSFs implies the subsequent confirmation or rejection of certain aspects of the model. Consequently, the empirical study aims to probe the opinions of people within the software industry in South Africa who have engaged in virtual RE to determine whether or not their opinions regarding the importance of the CSFs concur with the literature surveyed, and the subsequent model developed. Where the opinions of the respondents coincide with a given CSF, that CSF can be determined to be confirmed.

8.1.1 Overview of the Research Process

The research process had to be carefully designed and delineated in order to ensure that it achieved the objective of the research study. The principle objective of the study was to determine the validity of the CSFs identified in Chapter 7. The secondary objective was to gather data about the sample population from which conclusions relating to the area under study could be drawn regarding the total population represented by the sample.

In order to achieve these objectives the following process was implemented:

- Each critical success factor was converted into a hypothesis set (made up of one or more null hypotheses and their related alternate hypotheses) which would allow the null hypotheses to be tested, and accepted or rejected based on the test.
- The research focus was identified.
- A research design was identified that would support the research focus.
- A research methodology that reflected the research focus and design were identified.
- A data collection tool (electronic questionnaire) was identified.
- An appropriate sample population of respondents was identified.
- The questionnaire was designed in such a way as to ensure quick and accurate data collection that would allow the hypotheses to be tested.
- The data was collected through the implementation of the data collection tool.
- The statistical tests to be applied to the data were determined.
- Tests were applied and results were calculated from the data.
- The results were analysed in order to draw conclusions to reject or accept each null hypothesis and to describe certain characteristics about the population which could be used to supplement the theoretical model and/or the literature review in this research.
- Based on the results of the hypotheses tests, the CSFs were confirmed, rejected or confirmed subject to modifications.

Each element (save the final three) of the process described above is discussed in detail in the following sections. The final three steps of the process are described in Chapters 9 and 10.

8.2 Hypotheses

The CSFs introduced in the previous chapter describe important activities to be implemented or maintained in order to ensure the success of a virtual team engaged in distributed RE. As mentioned previously, the principal objective of the empirical study is to test the importance of these CSFs by probing the opinions of people who are engaged in virtual RE regarding the importance of the CSFs. If such people are of the opinion that the CSFs are in fact necessary for the success of a virtual team, they are confirmed. As these CSFs are the most important aspect of the proposed model, their confirmation implies confirmation of the model. It must be noted however, that the model cannot be considered to be totally valid until all aspects of it are tested through the actual implementation of such a model. CSF testing merely implies that the reasoning behind the model is sound and valid.

In order to test the CSFs, they must first be converted into hypotheses. According to Diamatopoulos and Schlegelmich (1997:65), the aim of hypothesis testing is to test specific propositions concerning the variables of interest, and use the evidence provided by the sample in order to draw conclusions regarding these propositions for the population as a whole. As a rule, all tests should be designed to disprove hypotheses, as the aim of research is to show that an idea is untenable as it leads to an unsatisfactorily small probability.

Consequently, each hypothesis relating to a CSF must also be accompanied by a null hypothesis, which together with the hypothesis under examination (the alternative hypothesis), should constitute mutually exclusive and collectively exhaustive descriptions of all possible situations in the population relating to the variable under scrutiny. It is the null hypotheses that are tested. If no evidence at can be found to support a null hypothesis, this is taken to signify support for the alternative hypothesis.

The hypotheses are categorised in terms of hypothesis sets, each of which relate to a CSF. Instead of conceiving one hypothesis for each CSF, it was decided that each variable to be verified within any given CSF should relate to a hypothesis. Although this results in a large number of hypotheses, it is believed that testing each variable individually provides a clearer picture for the confirmation or rejection of any given CSF. Each hypothesis set consists of one or more alternate hypotheses and their corresponding null hypotheses. The null hypotheses are represented by H_x, where x is an even number, and the alternate hypotheses are represented by H_y, where y is an odd number.

Hypothesis Set 1: Frequency of Team Building Sessions

H_0: More frequent team building sessions do not reinforce trust and relationships within the virtual team.
H_1: More frequent team building sessions reinforce trust and relationships within the team

Hypothesis Set 2: Initial face-to-face team building session

H_2: An initial face-to-face team building session does not allow for greater trust and bonding compared to no face-to-face meeting.
H_3: An initial face-to-face team building session allows for greater trust and bonding compared to no face-to-face meeting.

Hypothesis Set 3: Issues to be addressed at team building sessions

H_4: The adequacy with which clarity of participation is addressed at team building sessions does not contribute to the overall success of the team.
H_5: The adequacy with which clarity of participation is addressed at team building sessions contributes to the overall success of the team.

H_6: The adequacy with which clarity of goals is addressed at team building sessions does not contribute to the overall success of the team.
H_7: The adequacy with which clarity of goals is addressed at team building sessions contributes to the overall success of the team.

H_8: The adequacy with which social bonding and relationship building is addressed at team building sessions does not contribute to the overall success of the team.
H_9: The adequacy with which social bonding and relationship building is addressed at team building sessions contributes to the overall success of the team.

H_{10}: The adequacy with which clarity of processes for task performance and communication is addressed at team building sessions does not contribute to the overall success of the team.
H_{11}: The adequacy with which clarity of processes for task performance and communication is addressed at team building sessions contributes to the overall success of the team.

H_{12}: The adequacy with which the definition of roles and responsibilities is addressed at team building sessions does not contribute to the overall success of the team.
H_{13}: The adequacy with which the definition of roles and responsibilities is addressed at team building sessions contributes to the overall success of the team.

H_{14}: The adequacy with which trust is addressed at team building sessions does not contribute to the overall success of the team.
H_{15}: The adequacy with which trust is addressed at team building sessions contributes to the overall success of the team.

H_{16}: The adequacy with which the co-ordination of work logistics is addressed at team building sessions does not contribute to the overall success of the team.
H_{17}: The adequacy with which the co-ordination of work logistics is addressed at team building sessions contributes to the overall success of the team.

H_{18}: The adequacy with which leadership issues are addressed at team building sessions does not contribute to the overall success of the team.
H_{19}: The adequacy with which leadership issues are addressed at team building sessions contributes to the overall success of the team.

H_{20}: The adequacy with which the management of conflict is addressed at team building sessions does not contribute to the overall success of the team.
H_{21}: The adequacy with which the management of conflict is addressed at team building sessions contributes to the overall success of the team.

H_{22}: The adequacy with which reward and recognition structures are addressed at team building sessions does not contribute to the overall success of the team.
H_{23}: The adequacy with which reward and recognition structures are addressed at team building sessions contributes to the overall success of the team.

Hypothesis Set 4: Standardisation of technology and software

H_{24}: The standardisation of communication technology and software across the team does not minimise communication-related co-ordination and integration problems.
H_{25}: The standardisation of communication technology and software across the team minimises communication-related co-ordination and integration problems.

H_{26}: The standardisation of task performance technology and software across the team does not minimise task-related co-ordination and integration problems.
H_{27}: The standardisation of task performance technology and software across the team minimises task-related co-ordination and integration problems.

Hypothesis Set 5: Training

H_{28}: Adequate or more than adequate training is provided for the use of task performance technology and software.
H_{29}: Inadequate training is provided for the use of task performance technology and software.

H_{30}: Adequate or more than adequate training is provided for the use of communications technology and software,
H_{31}: Inadequate training is provided for the use of communications technology and software.

Hypothesis Set 6: Process for dealing with technological problems

H_{32}: A formal process for dealing with technological problems does not minimise frustration.
H_{33}: A formal process for dealing with technological problems minimises frustration.

H_{34}: A formal process for dealing with technological problems does not minimise general message misunderstandings.
H_{35}: A formal process for dealing with technological problems minimises general message misunderstandings.

H_{36}: A formal process for dealing with technological problems does not minimise delays in task performance.
H_{37}: A formal process for dealing with technological problems minimises delays in task performance.

H_{38}: A formal process for dealing with technological problems does not minimise delays in task co-ordination.
H_{39}: A formal process for dealing with technological problems minimises delays in task co-ordination.

Hypothesis Set 7: Communications Strategy

H_{40}: A communications strategy does not minimise frustration.
H_{41}: A communications strategy minimises frustration.

H_{42}: A communications strategy does not minimise delays in task performance.
H_{43}: A communications strategy minimises delays in task performance.

H_{44}: A communications strategy does not minimise delays in task co-ordination.
H_{45}: A communications strategy minimises delays in task co-ordination.

H_{46}: A communications strategy does not minimise misunderstandings arising as a result of language differences.
H_{47}: A communications strategy minimises misunderstandings arising as a result of language differences.

H_{48}: A communications strategy does not minimise problems arising as a result of cultural differences.
H_{49}: A communications strategy reduces problems arising as a result of cultural differences.

H_{50}: A communications strategy does not minimise general message misunderstandings.
H_{51}: A communications strategy minimises general message misunderstandings.

Hypothesis Set 8: Communications Styles Training

H_{52}: Training in communications styles in a virtual environment does not minimise frustration.
H_{53}: Training in communications styles in a virtual environment minimises frustration.

H_{54}: Training in communications styles in a virtual environment does not minimise delays in task performance.
H_{55}: Training in communications styles in a virtual environment minimises delays in task performance.

H_{56}: Training in communications styles in a virtual environment does not minimise delays in task co-ordination.
H_{57}: Training in communications styles in a virtual environment minimises delays in task co-ordination.

H_{58}: Training in communications styles in a virtual environment does not minimise misunderstandings arising as a result of language differences.
H_{59}: Training in communications styles in a virtual environment minimises misunderstandings arising as a result of language differences.

H_{60}: Training in communications styles in a virtual environment does not minimise problems arising as a result of cultural differences.
H_{61}: Training in communications styles in a virtual environment minimises problems arising as a result of cultural differences.

H_{62}: Training in communications styles in a virtual environment does not minimise general message misunderstandings.
H_{63}: Training in communications styles in a virtual environment minimises general message misunderstandings.

Hypothesis Set 9: Informal Interaction

H_{64}: The frequency of informal interaction is not related or is negatively related to trust levels between team members.
H_{65}: The frequency of informal interaction is positively related to trust levels between team members.

H_{66}: The frequency of informal interaction is not related or is negatively related to the level of social bonding between team members.
H_{67}: The frequency of informal interaction is positively related to the level of social bonding between team members.

H_{68}: The frequency of informal interaction is not related or is negatively related to a sense of "belonging" to the team.
H_{69}: The frequency of informal interaction is positively related to a sense of "belonging" to the team.

H_{70}: The frequency of informal interaction is not related or is negatively related to the level of social satisfaction regarding the relationships within the team.
H_{71}: The frequency of informal interaction is positively related to the level of social satisfaction regarding the relationships within the team.

H_{72}: The frequency of informal interaction is not related or is negatively related to the level of motivation to perform tasks more efficiently for the team.
H_{73}: The frequency of informal interaction is positively related to the level of motivation to perform tasks more efficiently for the team.

H_{74}: The frequency of informal interaction is not related or is negatively related to a responsibility to not let other team members down.
H_{75}: The frequency of informal interaction is positively related to not let other team members down

Hypothesis Set 10: Videoconferencing JAD Session

H_{76}: The presence of three or fewer individual sites at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{77}: The presence of three or fewer individual sites at the videoconferencing JAD session contributes to the overall success of the JAD session.

H_{78}: An explicit form of non-verbal communication at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{79}: An explicit form of non-verbal communication at the videoconferencing JAD session contributes to the overall success of the JAD session.

H_{80}: A different emphasis on facilitation skills at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{81}: A different emphasis on facilitation skills at the videoconferencing JAD session contributes to the overall success of the JAD session.

H_{82}: The maintenance of effective group dynamics at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{83}: The maintenance of effective group dynamics at the videoconferencing JAD session contributes to the overall success of the JAD session.

H_{84}: An explicit back channel of communication at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{85}: An explicit back channel of communication at the videoconferencing JAD session contributes to the overall success of the JAD session.

Hypothesis Set 11: GSS JAD Session

H_{86}: The absence of domination of the GSS/meeting system JAD session by participants with higher typing speeds does not contribute to the overall success of the JAD session.
H_{87}: The absence of domination of the GSS/meeting system JAD session by participants with higher typing speeds contributes to the overall success of the JAD session.

H_{88}: The absence of reduced participation in the GSS/meeting system JAD session by participants with lower typing speeds does not contribute to the overall success of the JAD session.
H_{89}: The absence of reduced participation in the GSS/meeting system JAD session by participants with lower typing speeds contributes to the overall success of the JAD session.

H_{90}: The absence of frustration arising from being unable to keep up with the typing speed at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session.
H_{91}: The absence of frustration arising from being unable to keep up with the typing speed at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.

H_{92}: The absence of anxiety as a result of having to use technology at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session.
H_{93}: The absence of anxiety as a result of having to use technology at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.

H_{94}: The maintenance of effective group dynamics at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session.
H_{95}: The maintenance of effective group dynamics at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.

H_{96}: The presence of spontaneity of dialogue at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session.
H_{97}: The presence of spontaneity of dialogue at the GSS/meeting system JAD session contributes to the overall success of the JAD session.

H_{98}: The presence of non-verbal cues at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session.
H_{99}: The presence of non-verbal cues at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.

H_{100}: The presence of an explicit back channel of communication at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session.
H_{101}: The presence of an explicit back channel of communication at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.

Hypothesis Set 12: Desktop Videoconferencing Interview

H_{102}: Sufficient lighting does not contribute to the overall success of the desktop videoconferencing interview.
H_{103}: Sufficient lighting contributes to the overall success of the desktop videoconferencing interview.

H_{104}: A high image resolution does not contribute to the overall success of the desktop videoconferencing interview.
H_{105}: A high image resolution contributes to the overall success of the desktop videoconferencing interview.

H_{106}: The absence of audio-video lag does not contribute to the overall success of the desktop videoconferencing interview.
H_{107}: The absence of audio-video lag contributes to the overall success of the desktop videoconferencing interview.

H_{108}: Simulated eye contact by looking at the camera rather than the monitor when speaking does not contribute to the overall success of the desktop videoconferencing interview.
H_{109}: Simulated eye contact by looking at camera rather than the monitor when speaking contributes to the overall success of the desktop videoconferencing interview.

H_{110}: Ability to read body language clearly does not contribute to the overall success of the desktop videoconferencing interview.
H_{111}: Ability to read body language clearly contributes to the overall success of the desktop videoconferencing interview.

H_{112}: Trusting the interviewer enough to disclose sensitive information does not contribute to the overall success of the desktop videoconferencing interview.
H_{113}: Trusting the interviewer enough to disclose sensitive information contributes to the overall success of the desktop videoconferencing interview.

H_{114}: The credibility of the interviewer does not contribute to the overall success of the desktop videoconferencing interview.
H_{115}: The credibility of the interviewer contributes to the overall success of the desktop videoconferencing interview.

8.3 Research Focus

Before commencing an empirical study, it is important to determine the focus of the intended data analysis in order to ensure that the data gathered from the study supports this focus. Diamantopoulos *et al* (1997:64) discuss several possible research foci. This research study focuses primarily on hypothesis testing (quantitative focus), which answers questions about relationships and differences between variables in order to determine whether generalisations hold true, thereby allowing the acceptance or rejection of the hypotheses. In this case, the sample is used to make inferences about the population as a whole, so inferential statistical techniques are used for this purpose.

The secondary focus of the study is descriptive (qualitative approach), and aims to describe the sample population holistically in terms of specific variables in order to develop a hypothesis about that which was observed. This is done by using descriptive statistics.

The two approaches are complementary, and are therefore used to support and reinforce each other, thus allowing for a complete and accurate picture of the sample population.

8.4 Research Design

The design of the research is critical in ensuring that the focus of the research can be achieved with a high degree of accuracy and completeness. As such, the research design is the blueprint to be used in identifying the respondents, the data to be collected, the survey instrument and the tests to be performed on the data in order to meet the research focus. Baard (2001:77) mentions four types of research design, namely: experimental research, quasi-experimental research, non-experimental research and qualitative research. This research employs a non-experimental research design, best suited to the primarily quantitative and secondarily qualitative research focus for the following reasons:

- The primarily quantitative nature of the research rules out a purely qualitative research design.
- Experimental and quasi experimental research designs must also be ruled out, as the research does not focus on the manipulation of variables so as to determine the effect of this manipulation on two or more groups.
- The research is being carried out in a natural environment (the workplace) where the researcher does not have control over the variables.
- The design enables conclusions to be drawn about relationships between variables at a high degree of confidence, which allows the null hypotheses to be accepted or rejected.

8.5 Methodology

Baard (2001:78) defines methodology as the systematic and orderly approach taken toward the collection of data so that information can be obtained from this data. This definition shows that the methodology to be chosen should reflect and support the research focus and should be structured according to the research design. For these reasons, the analytical survey methodology was chosen. This methodology allows for the statistical testing of hypotheses through the use of inferential statistical techniques (quantitative focus) and also allows descriptions of variables relating to the population's opinions, beliefs and feelings (qualitative focus).

The collection of data using this method is obtained from interviews and/or questionnaires. The researcher has chosen to focus specifically on the questionnaire as the instrument of data collection. The following sections outline the methodology used to identify a suitable sample from which to collect data, the instrument used to collect the data, and the collection of the data in terms of how it relates to the hypotheses mentioned in preceding sections of this chapter. The analytical survey methodology also determines how the data will be tested and analysed, but the discussion of these issues is reserved for following chapters.

8.5.1 Respondents

Identifying the correct respondents who can provide the researcher with the relevant data is the first step towards ensuring that accurate conclusions about the overall population can be drawn from an analysis of the data. Therefore, it is necessary first, to define the population parameters.

8.5.1.1 The Population Parameters

The overall population under scrutiny is made up of South African software development team members who are currently involved in, or who have recently been involved in virtual RE. This is the overall population about which conclusions are drawn from the data collected. Members of this population have the following characteristics:

- They are based in South Africa.
- They are employed in a software development company or department.
- They have a software development/information technology background.
- They are members of virtual teams currently involved in, or who have recently been involved in distributed RE for a software development project.
- They have used a wide variety of virtual RE techniques (especially videoconferencing JAD, DVC interviews and electronic questionnaires).

8.5.1.2 The Sample Population

A large number of software development companies in South Africa were contacted in order to draw a sample population with the same characteristics as the overall population described above. However, it was found that although several of these companies do engage in the RE techniques discussed in the literature review, very few of them use virtual teams, and of these, even fewer use virtual teams throughout the lifecycle of a software project. A major problem was that virtual teams were hardly used at all during the RE phase of the project.

Therefore, the scope of respondents had to be expanded. The final profile of eligible respondents includes those who:

- are based in South Africa;

- have a software development/information technology background;
- are currently or have recently been involved in virtual teams;
- have used a variety of collaborative technologies for informal interaction, meetings (RE or otherwise) and general communication;
- have engaged in meetings (RE or otherwise) through a virtual medium;
- are prepared to complete an electronic questionnaire.

This profile meant that most of the questionnaire could be completed by the respondents, but the sections relating to desktop videoconferencing and group support systems were not answered at all, hence no practical conclusions can be drawn regarding these areas. Despite the new respondent profile, it was determined that the data gathered from them could still be used to generalise about the overall population, as the majority of the questionnaire applies to just about any virtual team, not necessarily a RE based virtual team. The sections relating to virtual RE meetings were also answered by those who had engaged in non-RE meetings using specified virtual technologies. Once again, generalisations can be drawn about the population of those who engage in RE meetings using these virtual technologies, as the majority of the issues are relevant to all virtual meetings.

The final list of possible respondents was drawn up, and each respondent was contacted via electronic mail. Respondents were asked if they would be willing to participate in the study, and the purpose and nature of the study was explained. They were also offered the results of the completed study as an incentive for answering the questionnaire. Respondents who indicated their willingness to participate in the study were then sent unique ids and passwords along with the url to the questionnaire.

8.5.2 The Survey Instrument

A questionnaire was used as the principal technique of data collection for the survey. It has already been stated that the questionnaire is used widely in the execution of the analytical survey as a data collection instrument. It was further decided that the questionnaire should be administered electronically for the following reasons:

- The participants can complete the questions easily in the absence of the researcher.
- The questionnaire can easily be distributed to the correct respondents.
- The target population consists of people in the information technology industry, meaning that all the respondents should have access to email and the internet.

- Because of the nature of the target population it can safely be assumed that all respondents are computer literate and able to answer an electronic questionnaire.
- Individual user ids and passwords can be assigned in order to allow the researcher to check that respondents have answered the questionnaire and follow up accordingly.
- Response rates are faster – as soon as the questionnaire is completed, the researcher has access to the responses.
- It is more convenient for the respondents – they do not have to concern themselves with posting the questionnaire back to the researcher.
- Qualitative and quantitative data can be gathered through the implementation of the questionnaire as the primary survey tool.
- Recording errors would be non existent, as the responses are transferred directly to the questionnaire database.
- The focus of this research is on virtual RE techniques, with an examination of electronic questionnaires forming a large section of the literature review. It was therefore decided that the researcher should use the knowledge gained from an in depth examination of the administration of an electronic questionnaire in order to construct and administer the questionnaire. In addition, the knowledge gained from the practical application of the electronic questionnaire can be used to supplement and reinforce the literature review.

A copy of the questionnaire that was administered to the respondents is contained in Appendix B.

8.5.2.1 Questionnaire Design

The questionnaire was designed to gather data regarding the hypotheses identified in preceding sections. The large number of hypotheses for which data had to be gathered meant that the questionnaire was relatively long. To compensate for the length of the questionnaire, it was designed to be as simple as possible to complete. Consequently, simplicity and lucidity were the key factors that were considered in determining the format and the layout of the questionnaire.

8.5.2.2 Questionnaire Format

The questionnaire contains a brief description of the purpose of the study and the reasons for selecting the respondents as participants in the study. The questionnaire was divided into six sections, with the fifth section containing three sub-sections. Each section or subsection was presented in a single browser window in order to ensure that respondents were not overwhelmed with too much information at one time. It was also believed that presenting each section one at a time would help the respondents to concentrate on one section at a time. Each section relates to one aspect of virtual teams and/or virtual RE, and therefore also relates to the major categories within which the critical success factors and the hypothesis sets are organised. Respondents move to the next section by clicking a "Continue" button at the end of each section, and are free to move between sections using the "Back" and "Forward" buttons in their browsers.

The questionnaire was fully structured in that the content of the questionnaire and the sequencing of the questions was determined in advance, however the format of the questionnaire is semi-structured as a combination of response formats was used.

The multiple choice format. Respondents are asked to choose one option from a variety of alternatives presented in the questionnaire.

The multiple response format. Respondents are asked to choose one or more options from a variety of alternatives presented in the questionnaire.

The selection or rating format. Respondents are asked to rate the success, extent or adequacy of a specific issue. Varying rating scales were used, ranging from four point rating scales to six point rating scales, depending on the nature of the issue to be rated.

The opinion format. Respondents are asked whether, in their opinion, a certain variable increased or decreased the level of certain factors or issues. These questions were presented as straightforward "yes", "no" and "not sure" type questions, as in these cases, the researcher was not concerned with the degree to which something was reduced or increased, but simply whether it was increased or decreased. The "not sure" option was provided in order to ensure that respondents were not forced into selecting an answer that does not reflect their true position.

The free response format. Respondents are asked to answer questions in their own words. Such questions were kept to a minimum, as responding to them is tiring and tedious for the respondent, and analysing them is difficult for the researcher, as he/she has to wade through varying writing styles and communication competency to gain an idea of what the respondent is trying to say.

8.5.2.3 The Layout of the Questionnaire

As mentioned previously, simplicity and lucidity were considered to be key features in the design of the questionnaire. The layout was designed to allow respondents to answer the questions as quickly and accurately as possible by presenting a logical and easy to read questionnaire layout. Because the questionnaire was administered as an electronic questionnaire, various Human Computer Interaction issues were also taken into account.

The following points show how the layout of the questionnaire was designed to ensure clarity, accuracy and quick completion rates.

- Respondents who indicated their willingness to participate in the study were sent unique individual ids and passwords along with the url to the questionnaire via email.
- The introductory section of the questionnaire briefly explains the purpose of the questionnaire, and also provides the respondent with general instructions as to how to answer the questionnaire.
- Respondents were permitted only one questionnaire session at a time in order to ensure that only the selected respondent would answer the questionnaire. Respondents were notified that additional sessions could be assigned by contacting the researcher.
- The questionnaire was divided into nine separate blocks, with one block being presented in a browser window at a time. It was believed that such a system would ensure that the respondent concentrated on one section at a time. Such a system is also less daunting for the respondent – especially in a situation such as this, where the questionnaire is relatively long. Respondents move on to the next section by clicking the "Continue" button at the end of each section. The demarcated sections also help to enhance the perception that the survey is organised and professional.
- Each section had a brief introductory sentence to explain what the section was about, and what would be expected of the respondent.
- The use of free response questions was limited as far as possible in order to ensure quicker completion rates.
- Most of the questions allowed users to simply point and click at the relevant option(s).
- The language used was clear, basic and pre-tested through the use of a pilot study (discussed later).
- Graphics were not used at all in order to ensure that the pages would load quickly, and to ensure minimal distraction.

- A large, clear font was used throughout the questionnaire, with bold letters and size changes being used for emphasis rather than changing the appearance of the font itself.
- The questionnaire concludes with thanks for answering the questionnaire, and an invitation to contact the researcher for the results of the study.

8.5.2.4 Materials and Equipment

The materials and equipment used in the execution of the analytical survey are described below:

- The questionnaire was designed and implemented electronically using QuestionMark Perception, a software tool for designing and administering questionnaires over the internet or via electronic mail.
- The questionnaire itself and the responses received were housed on the Perception server at the Department of Information Systems, Rhodes University.
- Statisca (99 edition) was used to perform statistical tests on the data.

8.5.3 Response Rates and Confidentiality

As mentioned previously, the total number of respondents contacted was small as a result of the low level of virtual RE being practiced in South Africa. After months of searching for suitable respondents, 30 were contacted, but of these 30, 8 did not access the questionnaire at all, and 4 did not complete the questionnaire. This meant that a total of 18 useable responses were received; 60% of the respondents contacted. This percentage is significantly higher than the general average percentage of responses received (Dennis *et al* (2000:126) state that on average only 5% to 30% of web based questionnaires and only 30% to 50% of paper based questionnaires are returned).

A probable reason for the high response rate is that the small sample size, and the assigning of individual user ids and passwords for questionnaire access allowed the researcher to regularly check whether or not the respondents had answered, and to follow up with them accordingly via telephone or email. Secondly, the researcher made personal contact with all the respondents via electronic mail or telephone. It was found that where some respondents found it easy to ignore email requests to answer the questionnaire, they were less able to ignore telephone requests, and answered very soon after a telephonic reminder. Finally, respondents were also offered the results of the study as an incentive to answer the questionnaire, and most respondents indicated an interest in obtaining a copy of these results. This "reward" plays an important part in the quality of the responses, as it is highly unlikely that anyone who is interested in the results of the study would jeopardise its validity by responding half heartedly.

It was acknowledged that respondents would have had much higher concerns about answering an electronic questionnaire than they would have answering a paper based questionnaire. This is especially true for people with a computing background, who are aware of how easy it is to determine locations and identities of people over the internet. For these reasons, several steps were taken to set respondents' minds at ease regarding confidentiality issues. Confidentiality was maintained firstly through the researcher's assurance in the initial email that the responses would remain highly confidential. Secondly, although the respondents were issued with unique user ids and passwords, these were not associated directly with the respondent or his/her company in any way. The user ids all had the prefix "Virtual" and were followed by a randomly generated number. Finally, respondents were not asked to provide information about themselves or their companies in the questionnaire. Any demographic information was gathered from the initial emails received from the respondents. Although this is not usual practice when administering the analytical survey method, it was done firstly to promote confidentiality, and secondly because respondents' names, companies and employment positions were not directly relevant to the study. It was far more important to, for example, determine respondents' roles within the RE meetings.

8.5.4 Preparation of Respondents

Respondents were briefed about the questionnaire to be answered over email or in certain cases, by telephone. The purpose of the briefing was to inform the respondents of the aims and the nature of the study, and the degree of their involvement in the study, including the amount of time that would be taken to complete the questionnaire. Respondents were also offered the results of the study (when completed) as an incentive to participate in the questionnaire. During this briefing, basic demographic information was collected from the respondents, and they were provided with their unique user ids and passwords.

8.5.5 Trial Run

A trial run of the data collection was conducted using seven trial respondents from the Department of Information Systems, Rhodes University. This was useful in assessing and evaluating the design of the questionnaire, and the way in which answers would be presented using the QuestionMark software package. The trial run also helped to provide the author with some experience regarding data collection. The feedback from the trial run was used to modify certain aspects of the questionnaire, in particular the wording of certain questions in order to make them clearer to the respondent. In addition, it was suggested that some of the rating scales should be modified to exclude percentages and numbers, rather using descriptive words which the respondent can relate to more easily.

8.6 Statistical Techniques and Tests

The choice of statistical tests to be used is highly dependent on the research focus, and should generally be considered in consultation with the research methodology used. The research focus is primarily on quantitative (hypothesis testing), and secondarily on qualitative data (description of population in terms of a certain characteristic). In addition, the research methodology chosen was the analytical survey, so the statistical tests must allow the data gathered from the questionnaire to be analysed so that the hypotheses can be tested at a high degree of confidence, and so that the population can be described in terms of certain interesting characteristics.

It was stated in preceding sections that inferential statistics are applied to the variables relating to the hypotheses in order to draw conclusions about these variables that will allow the hypotheses to be accepted or rejected. Descriptive statistics are used to describe variables that are of interest to the study in order to create hypotheses about these variables. Both types of statistics are used in the analysis of the data. The specific tests and techniques applied in this research are described in the following sections.

8.6.1 Descriptive Statistics

Data description is an important first step in any data analysis project. Diamantopoulos *et al* (1997:73) explain that in addition to being an important, self-standing activity when a description focus characterises the analysis objectives, descriptive analysis provides a very useful initial examination of the data, even when the ultimate concern of the investigator is inferential in nature. For this reason, all the data collected in the empirical study is described using descriptive statistics.

Diamantopoulos *et al* (1997:73) explain that the purpose of descriptive analysis is to:

- Provide preliminary insights as to the nature of the responses obtained, as reflected in the distribution of values for each variable of interest.

- Help detect errors in the coding process.
- Provide a means for presenting the data in a digestible manner through the use of tables and graphs.
- Provide summary means of "typical" or "average" responses as well as the extent of variation in responses for a given variable.
- Provide an early opportunity for checking whether the distributional assumptions of subsequent statistical tests are likely to be satisfied.

8.6.1.1 Frequency Distribution

The starting point of descriptive statistics is the construction of frequency distributions for each variable. The frequency distribution shows, in absolute and relative terms, how often the different values of the variable are encountered among the units of analysis. Several important characteristics of frequency distributions are noted below:

- A frequency can never be negative, as a value cannot be encountered less than zero times.
- The sum of absolute frequencies must equal the total number of observations.
- The sum of relative frequencies must equal 100%.
- Frequency tables can be set up for any variable.

Cumulative frequency distributions show in absolute or relative terms how many observations take values greater than or less than a specified value.

Frequency distributions are often represented graphically as histograms. The graphical representation of data is often far quicker and easier to grasp than tabulated data, and for this reason, histograms have been produced for the frequency distributions for each question.

8.6.1.2 Measures of Central Location

Summary measures are used to capture the essential characteristics of different distributions. Summary measures allow the information contained in the individual values to be condensed in order to allow for more manageable comparison and interpretation of data.

Measures of central location are a type of summary measure, and they reflect "middle points" in that they are near the centre of a frequency distribution. According to Diamantopoulos *et al* (1997:90), all measures of central location are called averages. A measure of central location computes a single value which is in some way representative of the entire set of observations for the variable concerned. Two such measures are used in the analysis of the data gathered in this empirical study. It was determined that in order to promote cross checking, two measures would be better than one in giving the researcher an idea of the average value of the frequency distribution.

The Mode

The simplest measure of central location is the mode, which is defined as the most frequently occurring value in a frequency distribution. The mode is generally noted in statistics as M. When there are two modes, they are notated as M_1 and M_2.

When there is only one mode, the distribution is classified as a unimodal distribution. When there are two modes, the distribution is called a bi-modal distribution. When there are three or more modes (multimodal distribution), it would be misleading to talk about the mode as a measure of central location. Diamantopoulos *et al* (1997:94) state that in addition, even in a unimodal distribution, the mode may not be very informative of the structure of the data because the most frequently occurring value may not, in fact occur very often. For these reasons, the mode should be used to describe central location in conjunction with another measure of central location.

The Mean

The mean is the familiar arithmetic average, and is defined as the sum of a set of values divided by their number. It is represented in statistical notations as 0, where 0 is a specific value within the distribution. Diamantopoulos *et al* (1997:97) state that as the computation of the mean involves algebraic manipulation of the individual data values, the mean is an appropriate measure of central location for metric data only. However, the mean can be used to compare nominal data, as shown in the example below.

The frequency distribution below shows the responses of questionnaire participants regarding the level of success of the virtual team as a result of the addressing of the issue of co-ordination of work logistics.

	Count	Cumulative Count	Percentage	Cumulative Percentage
Not successful	3	3	25.00	25.00
Quite successful	6	9	50.00	75.00
Successful	2	11	16.67	91.67
Extremely successful	1	12	8.33	100.00
Totals	**12**	**12**	**100.00**	**100.00**

Table 8.1: Frequency Distribution for Level of Success of Virtual Team

In this case, there are four options from which the respondents could choose. The options can be enumerated from one to four, with one reflecting "not successful", and four reflecting "extremely successful". The mean value for this distribution is 2.08. Clearly this mean value, being a fractional value, does not correspond directly to any of the levels of success. However, it can be observed that the mean value is closer to the integer 2 than it is to any other integer value. 2 in this case corresponds to the "quite successful" option in the frequency distribution. The mode for this distribution is also the second option. In this way, the mean can be used in conjunction with the mode to provide the researcher with a solid idea of the summary measure of central location.

In the application of these descriptive statistics to the data collected from the questionnaire, the following must be borne in mind:

- Where the measures of central location are being determined for a variable with specific options, the options should be enumerated from one to z, where z = the number of the final option.
- The closest integer value to the calculated mean should be correlated to its enumerated option in order to determine the average option chosen.
- The mode value is correlated to its enumerated option to determine the most common option chosen.
- The shortcomings of both measures mean that both should be calculated in order to derive a valid measure of central location.

8.6.2 Inferential Statistics

The aim of hypothesis testing is to test specific propositions concerning the variables of interest, and use the evidence provided to draw conclusions regarding these propositions for the population as a whole. This means that the sample population is used to make inferences about the population as a whole. In order to ensure that the inferences are correct, significance tests are used in conjunction with inferential statistical tests. The significance level indicates the maximum level of risk that the researcher is willing to take in rejecting a null hypothesis. Typical significance levels are 0.10, 0.05 and 0.01. The researcher has chosen 0.05 as the overall significance level for the tests applied in this research. Therefore, if the result of the statistical test is such that the value obtained has a probability of occurrence (p) less than or equal to 0.05, the test result is significant, and the null hypothesis can be rejected.

The application of the tests is relatively straightforward, however, the researcher is conscious of the fact that the limited size of the sample population in this study means that any results drawn from the application of inferential statistical tests requires that the researcher be circumspect in the analysis of these results.

Cramer's V

Cramer's V allows the researcher to determine the strength of a relationship between two variables. The values of Cramer's V always fall between 0 and 1, and thus can be interpreted as reflecting relationships of different magnitudes. The two variables must be cross tabulated against one another, and when Cramer's V is applied, the strength of the relationship can be determined by how close the test statistic is to one. As Cramer's V is based on the chi square statistic, the chi square is always reported along with the test statistic. If the chi square statistic is not significant, it is an early indication that Cramer's V statistic will not prove a strong, significant relationship.

Spearman's Rank Order Correlation

Spearman's rank-order correlation co-efficient allows the researcher to determine the strength and direction of a relationship between two variables. It ranges from –1 to +1, with values close to zero indicating little or no correlation, values close to –1 indicating a negative relationship and values close to +1 indicating a positive relationship. Once again, the two variables must be cross-tabulated against one another. The test also allows the researcher to test for significance.

The two tests are used together to prove or disprove the existence of relationships between variables.

Fisher's Exact Test

This test is applied to 2X2 cross tabulations to determine whether significant differences exist between groups. The test produces probabilities (one tailed and two tailed), which are examined for significance. If the probabilities are not significant, it points to a conclusion that the two groups do not differ in terms of a particular variable.

8.7 Conclusion

This chapter was concerned with a detailed description of the empirical study to be undertaken. The purpose of the study was determined as the validation of the critical success factors. The hypotheses were introduced, and it was noted that each hypothesis or set of hypotheses related to a specific critical success factor identified in the previous chapter. The nature of the research was described in detail, and the research focus, design and methodology were examined in order to elucidate the rationale behind each aspect of the empirical research to be undertaken.

The research focus was determined to be primarily quantitative, and secondarily qualitative. The analytical survey methodology was noted to be the most suitable research methodology, and the research design indicated a non-experimental approach. This chapter showed that the empirical study was organised and carefully planned before the data was collected in order to ensure that the research would accomplish its intended purposes. The following chapter presents the detailed results of the empirical study.

Chapter 9

Results of the Empirical Study

9.1 Introduction

This chapter presents the results of the statistical tests performed on the data gathered in the empirical study. The results are presented as tables and graphs, and their presentation is organised in terms of the various hypothesis sets and hypotheses to which they relate. The results of the tests indicate a tendency towards acceptance or rejection of the null hypotheses set out in the preceding chapter. Various tests that do not relate directly to the hypotheses are also performed within this chapter, as it was believed that these results would be of interest to the study as a whole. This chapter is concerned only with presenting the results of the statistical tests and showing how they are used to accept or reject the hypotheses. The discussion of these results and their interpretation is reserved for the following chapter.

All the tests that are performed on the data were described in the preceding chapter. All the variables in the study have been tabulated using frequency distributions, in order to provide the reader with a high level view of the data. These frequency distributions can be found in Appendix E.

It is important to be attentive to the fact that most inferential statistical tests (for example Cramer's V and Spearman's Rank Correlation) rely on a large sample size in order to produce accurate results that conclusively reject or accept the null hypotheses. In this case, the overall sample size is fairly small, and therefore the results obtained have limited value, although it must be noted that they do provide an *indication* as to whether or not the null hypotheses should be rejected or accepted. Consequently, where it is stated in this chapter that a null hypothesis can be rejected or accepted, it must be borne in mind that this is merely an indication towards the tendency for such rejection or acceptance rather than the more conclusive acceptance or rejection that a larger sample size could have produced.

The chapter is organised as follows:

- Presentation and brief discussion of demographic data.
- Hypothesis testing.
- Other tests applied to variables in the questionnaire which do not directly relate to the hypotheses.

9.2 Demographics

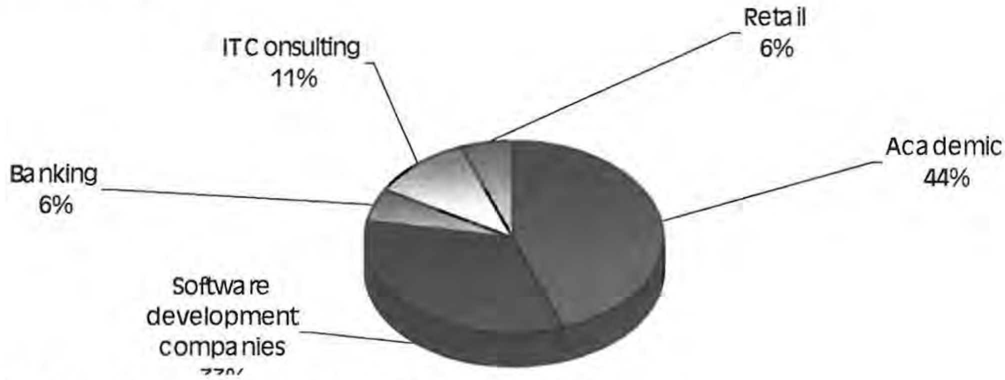

Figure 9.1: Industries represented by sample group

Figure 9.1 shows that of the 18 respondents, 44% come from academic IT departments, 33% come from software development companies, 11% come from IT consulting companies, 6% come from IT divisions in the banking sector, and 6% come from IT divisions within the retail industry.

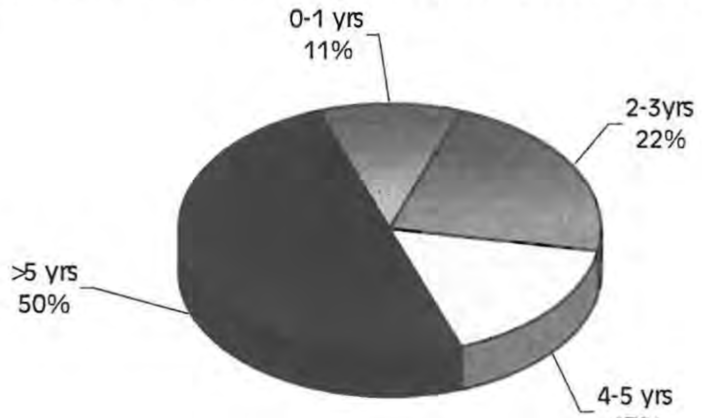

Figure 9.2: Years of experience in Requirements Elicitation

Figure 9.2 shows that of the 18 respondents, 50% had more than five years experience in requirements elicitation, 22% had between 2 and 3 years experience in requirements elicitation, 17% had between 4 and 5 years experience in requirements elicitation and 11% had between 0 and 1 years experience in requirements elicitation.

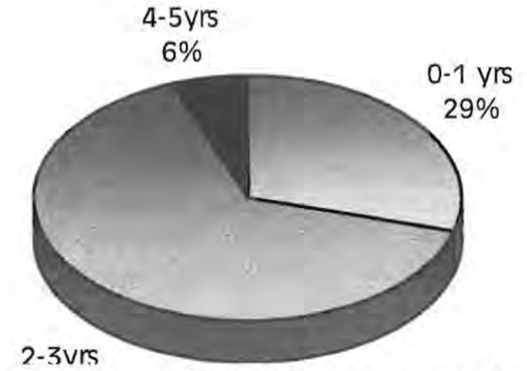

Figure 9.3: Years of experience in Virtual Requirements Elicitation

Figure 9.3 shows that of the 18 respondents, 6% had between 4-5 years experience in virtual requirements elicitation, 65% had between 2-3 years experience in virtual requirements elicitation and 29% had between 0 and 1 years experience in virtual requirements elicitation.

9.3 Team Building

9.3.1 Hypothesis Set 1: Frequency of Team building Sessions

H_0: More frequent team building sessions do not reinforce trust and relationships within the virtual team.
H_1: More frequent team building sessions reinforce trust and relationships within the team

Question 3: How often did you have team building sessions?

Question 4: Do you feel that more frequent team building sessions would have reinforced trust and relationships within the team?

Appendix E shows the frequency distributions for the responses to Questions 3 and 4. Measures of central location (mean and mode) were calculated for these frequency distributions in order to determine the average and the most common response to each question. The responses to both questions were then cross tabulated against each other (Table 9.1) in order to perform relationship tests to determine the existence of a correlation between the two variables. The results of the relationship tests are shown in Table 9.2.

The "N/A" responses to Question 4 were ignored in the calculation of the measures of central location, as the question is not relevant to those people who did not engage in team building at all. The inclusion of the response would therefore have produced results that would bias the determination of the measures of central location in such a way as to invalidate the results in terms of the testing of the relevant hypotheses. Similarly, the "Not at all" responses to Question 3 and the "N/A" responses to Question 4 were ignored in performing the relationship tests for much the same reason.

For the frequency distribution for the frequency of team building sessions (Question 3), x=3.071 and M=4. For the frequency distribution for respondents' beliefs as to whether or not more frequent team building sessions would have reinforced trust and relationships within the team, x=1.170 and M=1.

		Reinforcement of Trust and Relationships			
		Yes	No	N/A	Totals
Frequency of Team Building Sessions	Once a week	3	0	0	3
	Once every fortnight	2	0	0	2
	Once a month	2	0	0	2
	Less than once a month	3	2	0	5
	Not at all	0	0	2	2
	Totals	10	2	2	14 12

Table 9.1: Frequency of Team building sessions Vs. Reinforcement of Trust and Relationships

Note that only those people who engaged in team building sessions less than once a month believed that more frequent team building sessions would not reinforce trust and relationships within the team.

	Chi-Square	Df	P
Pearson Chi-square	1.714	df=1	p=0.190
Cramer's V	0.529		
Spearman Rank R	0.476	t=1.709	p=0.118

Table 9.2: Results of Relationship Tests Performed on Table 9.1

The relationship tests show that there is no relationship between the frequency with which respondents engaged in team building sessions and their beliefs regarding the reinforcement of trust and relationships within the team. The measures of central location show that most people believed that more frequent team building sessions would have reinforced trust and relationships within the team. These tests indicate that the null hypothesis can be rejected.

9.3.2 Hypothesis Set 2: Initial Face-to-Face Team Building Session

H_2: An initial face-to-face team building session does not allow for greater trust and bonding compared to no face-to-face meeting.
H_3: An initial face-to-face team building session allows for greater trust and bonding compared to no face-to-face meeting.

Question 5: Was your first team building session face-to-face?

Question 6: Do you feel that having an initial face-to-face team building sessions allowed/would have allowed for greater trust and bonding compared to no face-to-face meeting?

Appendix E shows the frequency distribution for the responses to Questions 5 and 6. Measures of central location were calculated for each frequency distribution in order to determine the average and the most common response to each question. The responses to both questions were then cross tabulated against each other (Table 9.3) in order to perform relationship tests to determine the existence of a correlation between the variables. The results of the relationship tests are shown in Table 9.4.

Once again, the "N/A" responses to both questions were ignored in the calculation of the measures of central location and in the application of relationship tests in order to ensure that results that are valid in terms of hypothesis testing are obtained.

For the frequency distribution for responses regarding whether or not the first team building session was face-to-face (Question 5), x=1.250 and M=1. For the frequency distribution for responses regarding whether or not an initial face-to-face meeting allowed/would have allowed for greater trust and bonding compared to no face-to-face meeting (Question 6), x=1.182 and M=1.

		Greater trust and bonding?				
		Yes	No	N/A	Totals	
Face to Face team building session?	Yes	9	0	0	9	
	No	2	1	0	3	
	N/A	0	0	2	2	
	Totals	11	1	2	14	12

Table 9.3: Implementation of Face-to-face team building session Vs. Trust and Bonding

Note that the only person who did not believe that an initial face-to-face meeting would lead to greater trust and bonding was one of the two people who did not engage in an initial face-to-face team building session.

	Chi-square	Df	P
Pearson Chi-square	3.273	df=1	P=0.070
Yates Chi-square	0.364	df=1	P=0.546
Fisher exact one-tailed two-tailed			 p=0.250 p=0.250
Spearman Rank R	0.522	t=1.936	P=0.082

Table 9.4: Results of Relationship Tests Performed on Table 9.3

The results of the relationship tests show that both groups of people who engaged in an initial face-to-face team building session, and those who did not do not differ in their beliefs regarding whether or not an initial face-to-face team building session leads to greater trust and bonding than if there were no team building session. In addition, the measures of central location for the frequency distribution show that most people felt that an initial face-to-face team building session allowed for greater trust and bonding than if there had been no face-to-face team building session. Consequently, the results indicate that the null hypothesis can be rejected.

9.3.3 Hypothesis Set 3: Addressing of Issues & Success of Team

Question 7: Please rate the extent to which the following issues were addressed at the initial team building session.

Question 8: Please rate the extent to which the following issues were addressed at the ongoing team building sessions.

Question 9: Please rate the overall success of the team as a result of each issue mentioned below.

Table 9.5 shows the measures of central location for the frequency distribution of each issue at the initial and ongoing team building sessions, as well as the measures of central location for the overall success of the team as a result of each issue.

	Initial		Ongoing		Overall Success	
	Mean	Mode	Mean	Mode	Mean	Mode
Clarity of Participation	2.75	3	2.83	3	2.00	2
Clarity of goals	3.17	3	3.17	3	2.50	$M_1=2, M_2=3$
Social bonding and relationship building	2.83	$M_1=2, M_2=3$	3.58	4	3.08	4
Clarity of processes for task performance and communication	3.00	3	3.17		2.25	$M_1=2, M_2=3$
Defining roles and responsibilities	3.42	3	3.08	$M_1=3, M_2=4$	2.17	2
Trust	2.75	1	3.00	2	2.75	$M_1=2, M_2=3$
Co-ordination of work logistics	2.42	1	2.92	$M_1=2, M_2=3$	2.08	2
Leadership issues	2.92	4	2.92	4	2.33	2
Management of conflict	2.58	4	2.67	$M_1=2, M_2=4$	2.00	
Reward and recognition structures	1.83	1	2.17	1	2.00	1

Table 9.5: Measures of Central Location for the Frequency Distributions of Each Issue for Questions 7, 8 and 9

$x=2.77$ for the means for all the issues at the initial team building meeting, $x=2.95$ for the means for all the issues at the ongoing team building sessions and $x=2.32$ for the means for the overall success of the team as a result of each issue.

Cross tabulating the adequacy level responses for each issue at the initial and ongoing team building sessions with the success levels for the overall success of the team as a result of each issue allows the application of Spearman's rank correlation to determine if a relationship exists between the variables, and if so, the direction of the relationship. The cross tabulations are not shown here, but the results of the statistical tests are shown in Table 9.6 below.

	Initial X Success			OngoingX Success		
	Spearman's Rank R			Spearman's Rank R		
	Chi-Square	Df	P	Chi-Square	Df	P
Clarity of participation	0.76	t=3.66	0.004	0.72	t=3.29	0.008
Clarity of goals	0.40	t=1.39	0.195	0.43	t=1.51	0.161
Social bonding and relationship building	0.67	t=2.86	0.017	0.83	t=4.67	0.001
Clarity of processes for task performance and communication	0.59	t=2.30	0.044	0.43	t=1.49	0.167
Defining roles and responsibilities	0.70	t=3.11	0.011	0.40	t=1.40	0.191
Trust	0.76	t=3.69	0.004	0.73	t=3.42	0.006
Co-ordination of work logistics	0.70	t=3.07	0.011	0.74	t=3.50	0.006
Leadership issues	0.89	t=6.14	0.000	0.81	t=4.35	0.001
Management of conflict	0.54	t=2.00	0.073	0.45	t=1.58	0.144
Reward and recognition structures	0.62	t=2.51	0.031	0.85	t=5.02	0.000

Table 9.6: Results of Statistical Tests on Cross tabulations (Initial X Success and Ongoing X Success)

The results of the statistical tests show that in general, there is a strong positive relationship between each issue addressed at the initial and ongoing team building sessions and the overall success of the team as a result of each issue.

9.3.3.1 Clarity of Participation

H_4: The adequacy with which clarity of participation is addressed at team building sessions does not contribute to the overall success of the team. H_5: The adequacy with which clarity of participation is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a significant, strong positive correlation between the adequacy with which this issue was addressed at both the initial and ongoing team building sessions, and the level of success of the team as a result of this issue. In light of these results, the null hypothesis can be rejected.

9.3.3.2 Clarity of Goals

H_6: The adequacy with which clarity of goals is addressed at team building sessions does not contribute to the overall success of the team. H_7: The adequacy with which clarity of goals is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate no significant relationship between the adequacy with which this issue was addressed at either the initial or the ongoing team building sessions, and the level of success of the team as a result of this issue. In light of these results, the null hypothesis cannot be rejected.

9.3.3.3 Social bonding and relationship building

H_8: The adequacy with which social bonding and relationship building is addressed at team building sessions does not contribute to the overall success of the team. H_9: The adequacy with which social bonding and relationship building is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a positive relationship between the adequacy with which this issue was addressed at both the initial and ongoing team building sessions, and the level of success of the team as a result of this issue. The tests also show that this correlation is much stronger for the ongoing team building sessions, thus providing evidence that ongoing team building sessions contribute more to building and maintaining social bonds and relationships than the initial team building sessions. In light of these observations, the null hypothesis can be rejected.

9.3.3.4 Clarity of Processes for task performance and communication

H_{10}: The adequacy with which clarity of processes for task performance and communication is addressed at team building sessions does not contribute to the overall success of the team.
H_{11}: The adequacy with which clarity of processes for task performance and communication is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a moderate positive relationship between the adequacy with which this issue was addressed at the initial team building session and the level of success of the team as a result of this issue, but no significant relationship between the adequacy with which the issue was addressed at ongoing team building sessions and the level of success of the team as a result of this issue. In addition, the positive relationship between the initial team building session and the level of success of the team is not extremely strong, and is only just significant ($p=0.044$). In light of these observations, the null hypothesis cannot be rejected.

9.3.3.5 Defining Roles and Responsibilities

H_{12}: The adequacy with which the definition of roles and responsibilities is addressed at team building sessions does not contribute to the overall success of the team.
H_{13}: The adequacy with which the definition of roles and responsibilities is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a strong positive relationship between the adequacy with which the issue was addressed at the initial team building session and the level of success of the team, but there is no significant relationship between the adequacy with which the issue was addressed at the ongoing team building sessions and the level of success of the team. In light of these observations, the null hypothesis cannot be rejected.

9.3.3.6 Trust

H_{14}: The adequacy with which trust is addressed at team building sessions does not contribute to the overall success of the team.
H_{15}: The adequacy with which trust is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a strong positive relationship between the adequacy with which the issue was addressed at both the initial and the ongoing team building sessions, and the level of success of the team as a result of this issue. In light of these observations, the null hypothesis can be rejected.

9.3.3.7 Co-ordination of Work Logistics

H_{16}: The adequacy with which the co-ordination of work logistics is addressed at team building sessions does not contribute to the overall success of the team.
H_{17}: The adequacy with which the co-ordination of work logistics is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a strong relationship between the adequacy with which the issue was addressed at both the initial and ongoing team building sessions, and the level of success of the team as a result of this issue. In light of these observations, the null hypothesis can be rejected.

9.3.3.8 Leadership Issues

H_{18}: The adequacy with which leadership issues are addressed at team building sessions does not contribute to the overall success of the team.
H_{19}: The adequacy with which leadership issues are addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests indicate that there is a strong positive relationship between the adequacy with which the issue was addressed at both the initial and ongoing team building sessions, and the level of success of the team as a result of this issue. In light of these observations, the null hypothesis can be rejected.

9.3.3.9 Management of Conflict

H_{20}: The adequacy with which the management of conflict is addressed at team building sessions does not contribute to the overall success of the team.
H_{21}: The adequacy with which the management of conflict is addressed at team building sessions contributes to the overall success of the team.

The results of the relationship tests do not indicate a significant relationship between the adequacy with which this issue was addressed at the initial and ongoing team building sessions, and the level of success of the team as a result of this issue. In light of these observations, the null hypothesis cannot be rejected.

9.3.3.10 Reward and Recognition Structures

H_{22}: The adequacy with which reward and recognition structures are addressed at team building sessions does not contribute to the overall success of the team.
H_{23}: The adequacy with which reward and recognition structures are addressed at team building sessions contributes to the overall success of the team

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The results of the relationship tests indicate a positive relationship between the adequacy with which this issue was addressed at the initial and ongoing team building sessions, and the level of success of the team as a result of this issue. It must be noted that the relationship is much stronger and more significant for the adequacy with which the issue was addressed at *ongoing team building sessions. In light of these observations, the null hypothesis can be rejected.*

9.4 Technology

9.4.1 Hypothesis Set 4: Standardisation of technology and Software

9.4.1.1 Communication Technology and Software

H_{24}: The standardisation of communication technology and software across the team does not minimise communication-related co-ordination and integration problems.
H_{25}: The standardisation of communication technology and software across the team minimises communication-related co-ordination and integration problems.

Question 11: Was/is the communication technology and software standardised across the team?

Question 12: Please state whether you experienced communication related co-ordination and integration problems.

Table 9.7 shows the cross tabulation for the responses to Questions 11 and 12.

		Co-ordination & Integration Problems		
		Yes	No	Totals
Standardised communication technology & software	Yes	0	10	10
	No	6	2	8
	Totals	6	12	18

Table 9.7: Cross Tabulation of Responses to Questions 11 and 12

Table 9.8 shows the results of the relationship tests performed on the above cross tabulation.

	Chi-square	df	p
Pearson Chi-square	11.250	df=1	p=0.001
Fisher exact one-tailed two-tailed			p=0.002 p=0.002
Contingency coefficient	0.620		
Spearman Rank R	-0.791	t=-5.164	p=0.001

Table 9.8: Results of Relationship Tests Performed on Table 9.7

The high significance of both the one tailed and two tailed probabilities associated with Fisher's exact test show that the two groups (those who had standardized communication technology and software and those who did not) differ a great deal in their experience of communication-related co-ordination and integration problems. In addition, Spearman's rank correlation coefficient is very close to –1 and highly significant, showing that the observed correlation between the two variables is unlikely to have come about if there was no association between the two variables in the population. Consequently, there is a strong negative relationship between the two variables, and the null hypothesis can be rejected.

9.4.1.2 Task Performance Technology and Software

H_{26}: The standardisation of task performance technology and software across the team does not minimise task-related co-ordination and integration problems
H_{27}: The standardisation of task performance technology and software across the team minimises task-related co-ordination and integration problems

Question 13: Was/is the task performance technology and software standardised across the team?

Question 14: Please state whether you experienced task related co-ordination and integration problems.

Table 9.9 shows the cross tabulation for the responses to Questions 13 and 14.

		Co-ordination & Integration Problems		
		Yes	No	Totals
Standardised task performance technology & software	Yes	0	10	10
	No	7	1	8
	Totals	7	11	18

Table 9.9: Cross Tabulation for Responses to Questions 13 and 14

Performing the Fisher's exact test and Spearman's rank correlation on the above cross tabulation:

	Chi-square	Df	P
Pearson Chi-square	14.318	df=1	P=0.000
Yates Chi-square	10.873	df=1	P=0.001
Fisher exact			
one-tailed			p=0.000
two-tailed			p=0.000
Spearman Rank R	-0.892	t=-7.888	P=0.000

Table 9.10: Results of Relationship Tests on Cross Tabulation in Table 9.9

The high significance of both the one tailed and two tailed probabilities associated with Fisher's exact test show that the two groups (those who had standardized task performance technology and software and those who did not) differ a great deal in their experience of task related co-ordination and integration problems. In addition, Spearman's rank correlation coefficient is very close to –1 and highly significant, showing that the observed correlation between the two variables is unlikely to have come about if there was no association between the two variables in the population. Consequently, there is a strong negative relationship between the two variables and the null hypothesis can be rejected.

9.4.2 Hypothesis Set 5: Level of Training for Technology and Software

H_{28}: Adequate or more than adequate training is provided for the use of task performance technology and software.
H_{29}: Inadequate training is provided for the use of task performance technology and software.

H_{30}: Adequate or more than adequate training is provided for the use of communications technology and software,
H_{31}: Inadequate training is provided for the use of communications technology and software.

Table 9.11 shows the frequency distributions for the levels of training received in the use of communications and task performance technology and software.

		Technology and Software			
		Communications		Task Performance	
		No	%	No	%
Level of Training received	No Training	11	61.11%	11	61.11%
	Completely inadequate training	2	11.11%	2	11.11%
	Adequate Training	4	22.22%	4	22.22%
	Extremely Adequate training	1	5.56%	1	5.56%
	Totals	18	100%	18	100%

Table 9.11: Levels of Training Received for Technology and Software

M=1 and x=1.72 for both communications technology and software training and task performance technology and software training. Further, it can be seen that 72.22% of the respondents received no training or completely inadequate training, with only 27.78% of the respondents receiving adequate or extremely adequate training. In light of these observations, it is possible to reject the null hypothesis for both communications technology and software and task performance technology and software.

9.4.3 Hypothesis Set 6: Process for Dealing with Technological Problems

Question 17: Was there a formal process for dealing with technological problems?

Question 19: Did the process/could the process have minimised any of the following problems?

In performing analyses on the data, it was determined that the responses of those who answered positively as to the existence of a strategy for dealing with technological problems should be weighted higher in this case than the responses of those who answered negatively. The reason for this is that when people who had a technological problems process answer questions about whether the process minimised certain problems, they are able to answer from experience rather than from speculation (as would be the answers of those who did not have a technological problems process).

The data gathered regarding each problem is described and tested under the heading of each problem. As such, the responses for Question 17 are cross tabulated against the responses regarding the minimisation of each problem. Subsequently, frequency distributions are drawn up for opinions regarding the minimisation of each problem for those who had a process for dealing with technological problems. The measures of central location for each of these frequency distributions is then calculated in order to determine the most common opinion regarding the minimisation of each problem through the implementation of a process for dealing with technological problems.

9.4.3.1 Frustration

H_{32}: A formal process for dealing with technological problems does not minimise frustration
H_{33}: A formal process for dealing with technological problems minimise s frustration

		Minimising Frustration							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Technological Problems Process	Yes	4	22.22	2	11.11	0	0.00	6	33.33
	No	9	50.00	0	0.00	3	16.67	12	66.67
	Totals	13	72.22	2	11.11	3	16.67	18	100%

Table 9.12: Existence of Technological Problems Process vs. Minimisation of Frustration

	Count	Cumul. Count	Percent	Cumul. Percent
Yes	4	4	66.67	66.67
No	2	6	33.33	100.00
Not Sure	0	6	0.00	100.00
Totals	6	6	100.00	100.00

Table 9.13: Respondents who had a Technological Problems Process and their beliefs as to whether such a process minimised frustration.

M=1 and x=1.33 for the frequency distribution in Table 9.13. A total of 72.22% of the respondents believed that a process for dealing with technological problems minimised or could have minimised the problem of frustration. In addition, of the people who had such a process, 66.67% felt that it minimised this particular problem, as is proven by the measures of central location. This indicates that the null hypothesis can be rejected.

9.4.3.2 Misunderstandings

H_{34}: A formal process for dealing with technological problems does not minimise general message misunderstandings
H_{35}: A formal process for dealing with technological problems minimises general message misunderstandings

		Minimising Misunderstandings							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Technological Problems Process	Yes	5	27.78	1	5.56	0	0.00	6	33.33
	No	5	27.78	2	11.11	5	27.78	12	66.67
	Totals	10	55.56	3	16.67	5	27.78	18	100

Table 9.14: Existence of Technological Problems Process vs. Minimisation of General Message Misunderstandings

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	5	5	83.33	83.33
No (2)	1	6	16.67	100.00
Not Sure (3)	0	6	0.00	100.00
Totals	6	6	100.00	100.00

Table 9.15: Respondents who had a Technological Problems Process and their beliefs as to whether such a process minimised General Message Misunderstandings.

M=1 and x=1.17 for the frequency distribution in Table 9.15. Only 55.56% of the total population believed that the existence of a process for dealing with technological problems minimised or could have minimised the problem of general misunderstandings. However, of the people who had such a process, 83.33% felt that it minimised this particular problem, as is proven by the measures of central location for this particular frequency distribution. Although a high percentage of the total population (27.78%) answered that they were "not *sure," these were all people who did not have such a strategy, and as such, their responses are not considered to be as important as the responses of those who possessed a strategy for dealing with technological problems. In light of these observations, the null hypothesis can be rejected.*

9.4.3.3 Delays in Task Performance

H_{36}: A formal process for dealing with technological problems does not minimise delays in task performance H_{37}: A formal process for dealing with technological problems minimises delays in task performance

		Delays in Task Performance							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Technological Problems Process	Yes	1	5.56	3	16.67	2	11.11	6	33.33
	No	8	44.44	0	0.00	4	22.22	12	66.67
	Totals	9	50.00	3	16.67	6	33.33	18	100 %

Table 9.16: Existence of Technological Problems Process vs. Minimisation of delays in task performance

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	1	1	16.67%	16.67%
No (2)	3	4	50.00%	66.67%
Not Sure (3)	2	6	33.33%	100.00%
Totals	6	6	100.00%	100.00%

Table 9.17: Respondents who had a Technological Problems Process and their beliefs as to whether such a process minimised Delays in Task performance.

M=2 and x=2.17 for the frequency distribution in Table 9.17. Only 50% of the total population believed that a process for dealing with technological problems minimised or could have minimised the problem of delays in task performance. In addition, only 16.67% of the people who had such a strategy believed that it did minimise this particular problem, while 33.33% of them believed that it did not, as is proven by the measures of central location for this particular frequency distribution. This indicates that the null hypothesis cannot be rejected.

9.4.3.4 Delays in Task Co-ordination

H_{38}: A formal process for dealing with technological problems does not minimise delays in task co-ordination H_{39}: A formal process for dealing with technological problems minimises delays in task co-ordination

		Delays in Task Co-ordination							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Technological Problems Process	Yes	2	11.11	3	16.67	1	5.56	6	33.33
	No	6	33.33	0	0.00	6	33.33	12	66.67
	Totals	8	44.44	3	16.67	7	38.89	18	100 %

Table 9.18: Existence of Technological Problems Process vs. Minimisation of delays in task co-ordination

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	2	2	33.33	33.33
No (2)	3	5	50.00	83.33
Not Sure (3)	1	6	16.67	100.00
Totals	6	6	100.00	100.00

Table 9.19: Respondents who had a Technological Problems Process and their beliefs as to whether such a process minimised Delays in Task Co-ordination.

M=2 and x=1.83 for the frequency distribution in Table 9.19. A total of 44.44% of the respondents believed that a process for dealing with technological problems minimised or could have minimised the problem of delays in task co-ordination. In addition, only 33.33% of the respondents who had such a strategy believed that it did minimise this particular problem, while 50% of these respondents believed that it did not, as is proven by the measures of central location for this particular frequency distribution. This indicates that the null hypothesis cannot be rejected.

9.5 Communication

9.5.1 Hypothesis Set 8: Communications Strategy and Problems

Question 20: Was/is there a communications strategy to which team members adhered/adhere?
Question 21: Did the strategy/could the strategy have minimised any of the following problems?

In performing analyses on the data, it was determined that the responses of those who answered positively as to the existence of a communications strategy should be weighted higher in this case than the responses of those who answered negatively. The reason for this is that when people who had such a strategy answer questions about whether it minimised certain problems, they are able to answer from experience rather than from speculation (as would be the answers of those who did not have a communications strategy).

The data gathered regarding each problem is described and tested under the heading of each problem. As such, the responses for Question 20 are cross tabulated against the responses regarding the minimisation of each problem. Subsequently, frequency distributions are drawn up for opinions regarding the minimisation of each problem for those who had a communications strategy. The measures of central location for each of these frequency distributions is then calculated in order to determine the most common opinion regarding the minimisation of each problem through the implementation of a communications strategy.

9.5.1.1 Frustration

H_{40}: A communications strategy does not minimise frustration
H_{41}: A communications strategy minimises frustration

		Minimising Frustration							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communications Strategy	Yes	8	44.44	2	11.11	0	0.00	10	55.56
	No	6	33.33	1	5.56	1	5.56	8	44.44
	Totals	14	77.77	3	16.67	1	5.56	18	100

Table 9.20: Existence of Communication Strategy vs. Minimisation of Frustration

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	8	8	80.00	80.00
No (2)	2	10	20.00	100.00
Not Sure (3)	0	10	0.00	100.00
Totals	10	10	100.00	100.00

Table 9.21: Respondents who had a Communications Strategy and their beliefs as to whether such a strategy minimised Frustration.

M=1 and x=1.20 for the frequency distribution in Table 9.21. A total of 77.77% of the respondents believed that a communications strategy minimised or could have minimised the problem of frustration. In addition, of the people who had such a process, 80% believed that it did minimise this particular problem, as is indicated by the measures of central location for this particular frequency distribution. This indicates that the null hypothesis can be rejected.

9.5.1.2 Delays in Task Performance

H_{42}: A communications strategy does not minimise delays in task performance
H_{43}: A communications strategy minimises delays in task performance

		Minimising delays in task performance							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communications Strategy	Yes	7	38.89	2	11.11	1	5.56	10	55.56
	No	5	27.78	1	5.56	2	11.11	8	44.44
	Totals	12	66.67	3	16.67	3	16.67	18	100.

Table 9.22: Existence of Communication Strategy vs. Minimisation of Delays in Task Performance

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	7	7	70%	70%
No (2)	2	9	20%	90%
Not Sure (3)	1	10	10%	100%
Totals	10	10	100%	100%

Table 9.23: Respondents who had a Communications Strategy and their beliefs as to whether such a strategy minimised Delays in Task Performance.

M=1 and x=1.40 for the frequency distribution in Table 9.21.A total of 66.67% of the respondents believed that a communications strategy minimised or could have minimised the problem of delays in task performance. In addition, of the people who had such a strategy, 70% believed that it did minimise this particular problem, as indicated by the measures of central location for this particular frequency distribution. This indicates that the null hypothesis can be rejected.

9.5.1.3 Delays in Task Co-ordination

H_{44}: A communications strategy does not minimise delays in task co-ordination
H_{45}: A communications strategy minimises delays in task co-ordination

		Minimising delays in task co-ordination							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communications Strategy	Yes	7	38.89	2	11.11	1	5.56	10	55.56
	No	4	22.22	2	11.11	2	11.11	8	44.44
	Totals	11	61.11	4	22.22	3	16.67	18	100

Table 9.24: Existence of Communication Strategy vs. Minimisation of Delays in Task Co-ordination

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	7	7	70%	70%
No (2)	2	9	20%	90%
Not Sure (3)	1	10	10%	100%
Totals	10	10	100%	100%

Table 9.25: Respondents who had a Communications Strategy and their beliefs as to whether such a strategy minimised Delays in Task Co-ordination.

M=1 and x=1.40 for the frequency distribution in Table 9.25. A total of 61.11% of the respondents believed that a communications strategy minimised or could have minimised the problem of delays in task co-ordination. In addition, of the people who had such a strategy, 70% believed that it did minimise this particular problem, as indicated by the measures of central location for this particular frequency distribution. This indicates that the null hypothesis can be rejected.

9.5.1.4 Misunderstandings Caused by Language Differences

H_{46}: A communications strategy does not minimise misunderstandings arising as a result of language differences
H_{47}: A communications strategy minimises misunderstandings arising as a result of language differences

		Minimising misunderstandings caused by language differences							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communications Strategy	Yes	5	27.77	3	16.67	2	11.11	10	55.56
	No	1	5.56	3	16.67	4	22.22	8	44.44
	Totals	6	33.33	6	33.33	6	33.33	18	100.

Table 9.26: Existence of Communication Strategy vs. Minimisation of Misunderstandings Caused by Language Differences

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	5	5	50%	50%
No (2)	3	8	30%	80%
Not Sure (3)	2	10	20%	100%
Totals	10	10	100%	100%

Table 9.27: Respondents who had a Communications Strategy and their beliefs as to whether such a strategy minimised Misunderstandings Caused by Language Differences.

M=1 and x=1.70 for the frequency distribution in Table 9.27. Only 33.33% of the total population believed that a communications strategy minimised or could have minimised the problem of misunderstandings arising as a result of language differences. Of the people who had such a strategy, 50% felt that it did minimise this particular problem, while 30% felt that it did not, and 20% were unsure. Although the mean value for this frequency distribution does not indicate a strong tendency towards the positive, the mode shows that most people who had *such a strategy believe that the problem of misunderstandings arising as a result of language differences was minimised. In light of these observations, the null hypothesis can be rejected.*

9.5.1.5 Problems Arising as a Result of Cultural Differences

H_{48}: A communications strategy does not minimise problems arising as a result of cultural differences
H_{49}: A communications strategy minimises problems arising as a result of cultural differences

		Minimising problems arising as a result of cultural differences							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communications Strategy	Yes	4	22.22	4	22.22	2	11.11	10	55.56
	No	1	5.56	4	22.22	3	16.67	8	44.44
	Totals	5	27.78	8	44.44	5	27.78	18	100.

Table 9.28: Existence of Communication Strategy vs. Minimisation of Problems arising as a result of Cultural Differences

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	4	4	40%	40%
No (2)	4	8	40%	80%
Not Sure (3)	2	10	20%	100%
Totals	10	10	100%	100%

Table 9.29 Respondents who had a Communications Strategy and their beliefs as to whether such a strategy minimised Problems arising as a result of Cultural Differences.

$M_1=1$, $M_2=2$ and $x=1.80$ for the frequency distribution in Table 9.27. A total of 27.78% of the total population believed that a communications strategy minimised or could have minimised problems arising as a result of cultural differences, with most people (44.44%) believing that it did not or would not have done so. In addition, of the people who had such a strategy, only 40% believed that it did minimise this particular problem, with an equal percentage of people believing that it did not. The mean value of 1.8 for this particular frequency distribution indicates a tendency towards the negative, and when examined in tandem with the modes, shows that the null hypothesis cannot be rejected.

9.5.1.6 Problems Caused by General Message Misunderstandings

H_{50}: A communications strategy does not minimise general message misunderstandings
H_{51}: A communications strategy minimises general message misunderstandings

		Minimising Problems caused by General Message Misunderstandings							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communications Strategy	Yes	5	27.78	3	16.67	2	11.11	10	55.56
	No	4	22.22	3	16.67	1	5.56	8	44.44
	Totals	9	50.00	6	33.33	3	16.67	18	100.

Table 9.30: Existence of Communication Strategy vs. Minimisation of Problems caused by General Message Misunderstandings

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	5	5	50%	50%
No (2)	3	8	30%	80%
Not Sure (3)	2	10	20%	100%
Totals	10	10	100%	100%

Table 9.31: Respondents who had a Communications Strategy and their beliefs as to whether such a strategy minimised Problems caused by General Message Misunderstandings.

$M=1$ and $x=1.70$ for the frequency distribution in table 9.31. A total of 50% of the total population believed that a communications strategy minimised or could have minimised the problem of general message misunderstandings. Of the people who had such a strategy, 50% felt that it did minimise this particular problem, with 30% believing that it did not, and 20% being unsure. The mean value of 1.70 for this particular frequency distribution does not indicate a strong tendency to the positive, however, the mode value shows that most people believed that a communications strategy minimised this problem. In light of these observations, the null hypothesis can be rejected.

9.5.2 Hypothesis Set 9: Training in Communications Styles

Question 22: Was training in communications styles in a virtual environment provided?
Question 23: Did this training/could this training have minimised any of the following problems?

As before, in performing analyses on the data, it was determined that the responses of those who received communications styles training should be weighted higher in this case than the responses of those who did not receive such training. The reason for this is that people who had received training are able to answer questions about whether it minimised certain problems from experience rather than from speculation (as would be the answers of those who did not receive training). However, in this particular case, only three people received training in communications styles. Very few useful statistical observations can be drawn from the analysis of a sample size of three, so in the examination of this set of hypotheses, it is necessary to rely to a large extent on the speculation of those who did not receive communications style training. It is believed that although this is a "second best" option, it is, by no means a bad one. If the specified problems were experienced by the respondents, and they believe that training in communications styles in a virtual environment would have helped to reduce any of these problems, this is a very valid reason for implementing such a training programme.

The data gathered regarding each problem is described and tested under the heading of each problem. As such, the responses for Question 22 are cross tabulated against the responses regarding the minimisation of each problem. Frequency distributions for the responses to Question 23 are also produced here. The measures of central location for each of these frequency distributions is then calculated in order to determine the most common opinion regarding the minimisation of each problem through the implementation of communications style training.

9.5.2.1 Frustration

H_{52}: Training in communications styles in a virtual environment does not minimise frustration.
H_{53}: Training in communications styles in a virtual environment minimises frustration.

		Minimising Frustration							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communication Styles Training	Yes	3	16.67	0	0.00	0	0.00	3	16.67
	No	9	50.00	2	11.11	4	22.22	15	83.33
	Totals	12	66.67	2	11.11	4	22.22	18	100

Table 9.32: Existence of Communications Styles Training vs. Minimisation of Frustration

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	12	12	66.67%	66.67%
No (2)	2	14	11.11%	77.78%
Not Sure (3)	4	18	22.22%	100%
Totals	18	18	100.00%	100%

Table 9.33: Frequency Distribution for Respondents' opinions regarding minimisation of Frustration through Communications Styles Training.

M=1 and x=1.56 for the frequency distribution in Table 9.33. A total of 66.67 % of the population believed that training in communications styles in the virtual environment minimised or would have minimised the problem of frustration. Although the mean value of 1.56 is not close enough to 1 to state conclusively that the null hypothesis should be rejected, it must be noted that of the people who did receive such training, all believed that it did minimised this particular problem. This fact, combined with the high percentage of the overall population who believed that such training could have minimised the problem (as shown by the mode) points to the fact that the null hypothesis should be rejected.

9.5.2.2 Delays in Task Performance

H_{54}: Training in communications styles in a virtual environment does not minimise delays in task performance.
H_{55}: Training in communications styles in a virtual environment minimises delays in task performance.

		Minimising Delays in Task Performance							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communication Styles Training	Yes	3	16.67	0	0.00	0	0.00	3	16.67
	No	8	44.44	2	11.11	5	27.67	15	83.33
	Totals	11	61.11	2	11.11	5	27.67	18	100

Table 9.34: Existence of Communications Styles Training vs. Minimisation of Delays in Task Performance

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	11	11	61.11%	61.11%
No (2)	2	13	11.11%	72.22%
Not Sure (3)	5	18	27.67%	100.00%
Totals	18	18	100.00%	100%

Table 9.35: Frequency Distribution for Respondents' opinions regarding minimisation of Delays in Task Performance through Communications Styles Training.

M=1 and x=1.67 for the frequency distribution in table 9.35. A total of 66.67 % of the population believed that training in communications styles in the virtual environment minimised or would have minimised the problem of frustration. Although the mean value of

1.56 is not close enough to 1 to state conclusively that the null hypothesis should be rejected, it must be noted that of the people who did receive such training, all believed that it did minimised this particular problem. This fact, combined with the high percentage of the overall population who believed that such training could have minimised the problem (as shown by the mode) points to the fact that the null hypothesis should be rejected.

9.5.2.3 Delays in Task Co-ordination

H_{56}: Training in communications styles in a virtual environment does not minimise delays in task co-ordination.
H_{57}: Training in communications styles in a virtual environment minimises delays in task co-ordination.

		Minimising delays in task co-ordination							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communication Styles Training	Yes	2	11.11	1	5.56	0	0.00	3	16.67
	No	7	38.89	2	11.11	6	33.33	15	83.33
	Totals	9	50.00	3	16.67	6	33.33	18	100

Table 9.36: Existence of Communications Styles Training vs. Minimisation of Delays in Task Co-ordination

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	9	9	50.00%	50.00%
No (2)	3	12	16.67%	66.67%
Not Sure (3)	6	18	33.33%	100%
Totals	18	18	100.00%	100%

Table 9.37: Frequency Distribution for Respondents' opinions regarding minimisation of Delays in Task Co-ordination through Communications Styles Training.

M=1 and x=1.83 for the frequency distribution in Table 9.37. 50% of the overall population believed that training in communications styles in a virtual environment minimised or could have minimised the problem of delays in task co-ordination. In addition, of the people who had such training, 66.67% believed that it minimised this particular problem and 33.33% were unsure as to whether such training minimised or could have minimised this problem. Although the mean value for the distribution does not indicate a strong tendency towards the positive, the mode shows that the most common response was positive, indicating that the null hypothesis can be rejected.

9.5.2.4 Misunderstandings arising as a result of Language Differences

H_{58}: Training in communications styles in a virtual environment does not minimise misunderstandings arising as a result of language differences.
H_{59}: Training in communications styles in a virtual environment minimises misunderstandings arising as a result of language differences.

		Minimising misunderstandings caused by language differences							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communication Styles Training	Yes	2	11.11	1	5.56	0	0.00	3	16.67
	No	4	22.22	3	16.67	8	44.44	15	83.33
	Totals	6	33.33	4	22.22	8	44.44	18	100

Table 9.38: Existence of Communications Styles Training vs. Minimisation of Misunderstandings arising as a result of Language Differences

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	6	6	33.33	33.33%
No (2)	4	10	22.22	55.55%
Not Sure (3)	8	18	44.44	100%
Totals	18	18	100.00%	100%

Table 9.39: Frequency Distribution for Respondents' opinions regarding minimisation of Misunderstandings arising as a result of language differences through Communications Styles Training.

M=3 and x=2.11 for the frequency distribution in Table 9.39. Only 33.33% of the overall population believed that training in communications styles in a virtual environment minimised or could have minimised the problem of misunderstandings caused by language differences. In addition, the mean value for the frequency distribution is 2.11, and of the people who had such training, only 66.67% believed that it minimised this particular problem. In addition, as supported by the mode, the majority of people (44.44%) were unsure as to whether such training minimised or could have minimised this problem, thereby making it difficult to conclusively reject the null hypothesis. In light of these observations, the null hypothesis cannot be rejected.

9.5.2.5 Problems arising as a result of Cultural Differences

H_{60}: Training in communications styles in a virtual environment does not minimise problems arising as a result of cultural differences.
H_{61}: Training in communications styles in a virtual environment minimises problems arising as a result of cultural differences.

		Minimising problems arising from cultural differences							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communication Styles Training	Yes	2	11.11	1	5.56	0	0.00	3	16.67
	No	3	16.67	4	22.22	8	44.44	15	83.33
	Totals	5	27.78	5	27.78	8	44.44	18	100

Table 9.40: Existence of Communications Styles Training vs. Minimisation of Problems arising from Cultural Differences

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	5	5	27.78%	27.78%
No (2)	5	10	27.78%	55.56%
Not Sure (3)	8	18	44.44%	100.00%
Totals	18	18	100%	100%

Table 9.41: Frequency Distribution for Respondents' opinions regarding minimisation of Problems arising from Cultureal Differences through Communications Styles Training.

M=3 and x=2.17 for the frequency distribution in Table 9.41. Only 27.78% of the overall population believed that training in communications styles in a virtual environment minimised or could have minimised problems arising as a result of cultural differences. In addition, the mean value for the frequency distribution is 2.17, and of the people who had such training, only 66.67% believed that it minimised this particular problem. Further, as supported by the mode, the majority of people (44.44%) were unsure as to whether such training minimised or could have minimised this problem, thereby making it difficult to conclusively reject the null hypothesis. Consequently, the null hypothesis cannot be rejected.

9.5.2.6 Problems caused by General Message Misunderstandings

H_{62}: Training in communications styles in a virtual environment does not minimise general message misunderstandings.
H_{63}: Training in communications styles in a virtual environment minimises general message misunderstandings.

		Minimising problems caused by General Message Misunderstanding							
		Yes		No		Not Sure		Totals	
		No.	%	No.	%	No.	%	No.	%
Communication Styles Training	Yes	3	16.67	0	0.00	0	0.00	3	16.67
	No	6	33.33	2	11.11	7	38.89	15	83.33
	Totals	9	50.00	2	11.11	7	38.89	18	100

Table 9.42: Existence of Communications Styles Training vs. Minimisation of Problems caused by General Message Misunderstandings

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	9	9	50.00%	50.00%
No (2)	2	11	11.11%	61.11%
Not Sure (3)	7	18	38.89%	100.00%
Totals	18	18	100.00%	100%

Table 9.43: Frequency Distribution for Respondents' opinions regarding minimisation of Problems caused by General Message Misunderstandings through Communications Styles Training.

M=1 and x=1.89 for the frequency distribution in Table 9.43. 50.00% of the overall population believed that training in communications styles in a virtual environment minimised or could have minimised problems arising as a result of general message misunderstandings. A large percentage of the population was unsure as to whether such training could have minimised this problem. Of the people who had such training, all believed that it minimised this particular problem and the mode indicates that the most common response was "yes." Thus, the null hypothesis can be rejected.

9.6 Informal Interaction

9.6.1 Hypothesis Set 9: Increasing Bonding and Trust

Question 24: How often does your team engage in informal interaction?

Question 27: Do you feel that engaging in informal interaction more frequently allowed/could have allowed increased levels of any of the following?

The data regarding each issue is examined and tested separately under the heading of the issue. For each issue, the responses to Question 24 are cross tabulated against respondents' beliefs as to whether or not more frequency informal interaction could have allowed increased levels of the issue under scrutiny. Relationship tests (Cramer's V and Spearman's Rank correlation) are applied to each cross tabulation to determine the existence of a relationship between the two variables. In addition, for each issue, frequency distributions are drawn up for respondents' beliefs as to whether or not more frequent informal interaction could have allowed increased levels of the issue under scrutiny. Measures of central location for each such frequency distribution are calculated in order to determine the average and the most common opinion regarding increased levels of each issue through more frequent informal interaction.

9.6.1.1 Trust between team members

H_{64}: The frequency of informal interaction is not related or is negatively related to trust levels between team members.
H_{65}: The frequency of informal interaction is positively related to trust levels between team members.

		Higher levels of Trust between Team Members		
		Yes	No	Totals
Frequency of Informal Interaction	Between twice and five times a week	5	0	5
	Once a week	2	0	2
	Once every fortnight	7	1	8
	Less than once every fortnight	3	0	3
	Totals	17	1	18

Table 9.44: Frequency of Informal Interaction Vs. Levels of Trust

	Chi-Square	df	p
Pearson Chi-Square	1.323	df = 3	0.724
Cramer's V	0.271		
Spearman's Rank R	0.099	t = 0.399	p = 0.695

Table 9.45: Results of Relationship Tests on Cross Tabulation in Table 9.44

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	17	17	94.44	94.44
No (2)	1	18	5.56	100.00
Not Sure (3)	0	18	0.00	100.00
Totals	18	18	100.00%	100.00%

Table 9.46: Respondents' Opinions regarding Increase of Trust Levels through Informal Interaction

M=1 and x=1.06 for the frequency distribution in Table 9.46. The relationship tests showed there is no relationship between how frequently team members engage in informal interaction and their belief that informal interaction allows increased trust between team members. In addition, the measures of central location show that the null hypothesis can be rejected.

9.6.1.2 Social bonding between team members

H_{64}: The frequency of informal interaction is not related or is negatively related to trust levels between team members.
H_{65}: The frequency of informal interaction is positively related to trust levels between team members.

		Higher levels of Social Bonding between Team Members			
		Yes	No	Not Sure	Totals
Frequency of Informal Interaction	Between twice and five times a week	5	0	0	5
	Once a week	2	0	0	2
	Once every fortnight	0	0	0	0
	Less than once every fortnight	7	1	0	8
	Not at all	3	0	0	3
	Totals	17	1	0	18

Table 9.47: Frequency of Informal Interaction Vs. Levels of Social Bonding

	Chi-Square	df	p
Pearson Chi-Square	1.323	df = 3	0.724
Cramer's V	0.271		
Spearman's Rank R	0.099	t = 0.399	p = 0.695

Table 9.48: Results of Relationship Tests on Cross Tabulation in Table 9.47

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	17	17	94.44	94.44
No (2)	1	18	5.56	100.00
Not Sure (3)	0	18	0.00	100.00
Totals	18	18	100.00%	100.00%

Table 9.49: Respondents' Opinions regarding Increase of Social Bonding Levels through Informal Interaction

M=1 and x=1.06 for the frequency distribution in Table 9.49. The relationship tests showed that there is no relationship between how frequently team members engage in informal interaction and their belief that informal interaction allows increased social bonding between team members. In addition, the measures of central location indicate that the null hypothesis can be rejected.

9.6.1.3 A sense of "belonging" to the team

H_{68}: The frequency of informal interaction is not related or is negatively related to a sense of "belonging" to the team.
H_{69}: The frequency of informal interaction is positively related to a sense of "belonging" to the team.

		More intense feeling of belonging to the team			
		Yes	No	Not Sure	Totals
Frequency of Informal Interaction	Between twice and five times a week	5	0	0	5
	Once a week	2	0	0	2
	Once every fortnight	0	0	0	0
	Less than once every fortnight	7	1	0	8
	Not at all	3	0	0	3
	Totals	17	1	0	18

Table 9.50: Frequency of Informal Interaction Vs. Intensity of feeling of "belonging" to the team

	Chi-Square	df	p
Pearson Chi-Square	1.323	df = 3	0.724
Cramer's V	0.271		
Spearman's Rank R	0.099	t = 0.399	p = 0.695

Table 9.51: Results of Relationship Tests on Cross Tabulation in Table 9.50

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	17	17	94.44	94.44
No (2)	1	18	5.56	100.00
Not Sure (3)	0	18	0.00	100.00
Totals	18	18	100.00%	100.00%

Table 9.52: Respondents' Opinions regarding Increased Intensity of feeling of "belonging" through Informal Interaction

M=1 and x=1.06 for the frequency distribution in Table 9.52. The relationship tests showed that there is no relationship between how frequently team members engage in informal interaction and their belief that informal interaction allows an increased sense of belonging to the team. In addition, the measures of central location point to the fact that the null hypothesis cannot be rejected.

9.6.1.4 Social satisfaction regarding relationships within the team

H_{70}: The frequency of informal interaction is not related or is negatively related to the level of social satisfaction regarding the relationships within the team.
H_{71}: The frequency of informal interaction is positively related to the level of social satisfaction regarding the relationships within the team.

		Higher levels of Satisfaction with regards to the social relationships within the team			
		Yes	No	Not Sure	Totals
Frequency of Informal Interaction	Between twice and five times a week	5	0	0	5
	Once a week	2	0	0	2
	Once every fortnight	0	0	0	0
	Less than once every fortnight	6	1	1	8
	Not at all	3	0	0	3
	Totals	17	1	0	18

Table 9.53: Frequency of Informal Interaction Vs. Level of Social Satisfaction regarding Intra-team Relationships

	Chi-Square	df	p
Pearson Chi-Square	2.812	df = 6	0.832
Cramer's V	0.279		
Spearman's Rank R	0.144	t = 0.584	p = 0.567

Table 9.54: Results of Relationship Tests on Cross Tabulation in Table 9.53

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	17	17	94.44	94.44
No (2)	1	18	5.56	100.00
Not Sure (3)	0	18	0.00	100.00
Totals	18	18	100.00%	100.00%

Table 9.55: Respondents' Opinions regarding higher level of social satisfaction regarding relationships within the team through Informal Interaction

M=1 and x=1.17 for the frequency distribution in Table 9.55. The relationship tests showed that there is no relationship between how frequently team members engage in informal interaction and their belief that informal interaction allows a higher level of social satisfaction regarding the relationships within the team. In addition, the measures of central location point to the fact that the null hypothesis cannot be rejected.

9.6.1.5 Motivation to perform tasks more efficiently for the team

H_{72}: The frequency of informal interaction is not related or is negatively related to the level of motivation to perform tasks more efficiently for the team.
H_{73}: The frequency of informal interaction is positively related to the level of motivation to perform tasks more efficiently for the team.

		Increased Motivation to perform tasks more efficiently for the team			
		Yes	No	Not Sure	Totals
Frequency of Informal Interaction	Between twice and five times a week	4	0	1	5
	Once a week	2	0	0	2
	Once every fortnight	0	0	0	0
	Less than once every fortnight	6	2	0	8
	Not at all	3	0	0	3
	Totals	15	2	1	18

Table 9.56: Frequency of Informal Interaction Vs. Level of Motivation to perform tasks more efficiently for the team

	Chi-Square	df	P
Pearson Chi-Square	5.340	df = 6	0.501
Cramer's V	0.385		
Spearman's Rank R	-0.105	t = -0.421	p = 0.679

Table 9.57: Results of Relationship Tests on Cross Tabulation in Table 9.56

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	15	15	83.33	83.33
No (2)	2	17	11.11	94.44
Not Sure (3)	1	18	5.56	100.00
Totals	18	18	100.00%	100.00%

Table 9.58: Respondents' Opinions regarding higher level of motivation to perform tasks efficiently for the team through Informal Interaction

M=1 and x=1.22 for the frequency distribution in Table 9.58. The relationship tests showed that there is no relationship between how frequently team members engage in informal interaction and their belief that informal interaction allows a higher level of motivation to perform tasks more efficiently for the team. In addition, the measures of central location point to the fact that the null hypothesis can be rejected.

9.6.1.6 Responsibility to not let your team mates down

H_{74}: The frequency of informal interaction is not related or is negatively related to a responsibility to not let other team members down.
H_{75}: The frequency of informal interaction is positively related to not let other team members down.

		Promotion of Feeling of Responsibility to not let fellow team mates down			
		Yes	No	Not Sure	Totals
Frequency of Informal Interaction	Between twice and five times a week	5	0	0	5
	Once a week	2	0	0	2
	Once every fortnight	0	0	0	0
	Less than once every fortnight	6	1	1	8
	Not at all	2	0	1	3
	Totals	15	1	2	18

Table 9.59: Frequency of Informal Interaction Vs. Level Responsibility to not let your team mates down

	Chi-Square	df	p
Pearson Chi-Square	3.775	df = 6	0.707
Cramer's V	0.324		
Spearman's Rank R	0.359	t = 1.537	p = 0.144

Table 9.60: Results of Relationship Tests on Cross Tabulation in Table 9.59

	Count	Cumul. Count	Percent	Cumul. Percent
Yes (1)	15	15	83.33	83.33
No (2)	1	16	5.56	88.89
Not Sure (3)	2	18	11.11	100.00
Totals	18	18	100.00%	100.00%

Table 9.61: Respondents' Opinions regarding higher level of responsibility to not let your team mates down through Informal Interaction

M=1 and x=1.28 for the frequency distribution in Table 9.61. The relationship tests showed that there is no relationship between how frequently team members engage in informal interaction and their belief that informal interaction allows an increased responsibility to not let the team members in the team down. In addition, the measures of central location point to the fact that the null hypothesis can be rejected.

9.7 Requirements Elicitation Techniques

9.7.1 Hypothesis Set 10: Factors related to Success of Videoconferencing JAD

Question 32: Please indicate whether the following factors were present or absent form the videoconferencing JAD session.

Question 33: Please indicate the level of success of the videoconferencing JAD session as a direct result of the absence/presence of the following factors as noted by you in the previous question.

The data regarding each factor is examined and tested separately under the heading of the factor. For each factor, the presence or absence of the factor (Question 32) is cross tabulated against the success of the JAD session as a result of the factor (Question 33). Relationship tests are applied to determine if there are correlations between the absence/presence of the factor and the success of the JAD session.

For each factor, two separate frequency distribution tables are drawn up. The first shows the frequency distribution for the success of the JAD session when the factor was present, while the second shows the frequency distribution for the success of the JAD session when the factor was absent. The measures of central location for the two distributions are calculated in order to compare the level of success of the JAD session when the factor was present with the level of success of the JAD session when it was absent.

9.7.1.1 Three or Fewer Individual Sites

H_{76}: The presence of three or fewer individual sites at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{77}: The presence of three or fewer individual sites at the videoconferencing JAD session contributes to the overall success of the JAD session.

		Level of Success				
		Not Successful	Quite Successful	Successful	Extremely Successful	Totals
Three or Fewer Individual Sites	Present	0	2	9	0	11
	Absent	0	0	1	0	1
	Totals	0	2	10	0	12

Table 9.62: Success of JAD session as a result of presence/absence of three or fewer individual sites

	Chi-Square	Df	P
Pearson Chi-Square	0.218	df = 1	0.640
Cramer's V	0.135		
Spearman's Rank R	0.135	t = 0.430	p = 0.676

Table 9.63: Results of Relationship Tests on Cross Tabulation in Table 9.61

	Count	Cumul. Count	Percent	Cumul. Percent
Not Successful (1)	0	0	0.00	0.00
Quite successful (2)	2	2	16.67	16.67
Successful (3)	9	11	83.33%	100.00%
Extremely Successful (4)	0	11	100.00%	100.00%
Total	11	11	100.00%	100.00%

Table 9.64: Frequency Distribution for Success of JAD session when there were three or fewer individual sites.

	Count	Cumul. Count	Percent	Cumul. Percent
Not Successful (1)	0	0	0.00	0.00
Quite successful (2)	0	0	0.00%	0.00%
Successful (3)	1	1	100.00%	100.00%
Extremely Successful (4)	0	1	100.00%	100.00%
Total	1	1	100.00%	100.00%

Table 9.65: Frequency Distribution for Success of JAD session when there were more than three individual sites.

M=3 and x=2.83 for the "present" frequency distribution, and M=3 and x=3 for the "absent" frequency distribution. The relationship tests applied to the cross tabulation do not indicate a relationship between the variables. A probable reason for this is that most people did have three or fewer individual sites at their JAD session, with only one person having an absence of this factor, thus meaning that although a pattern can be observed for those people who had three or fewer individual sites, this is not true for those who did not. The measures of central location for the "present" distribution indicate that most people who had three or fewer sites in their JAD sessions believed that the JAD session was successful as a result of this factor. The one person had more than three sites at his/her JAD session indicates that the JAD session was successful, although a sample size of one is not an adequate one from which to draw conclusions regarding the level of success of the JAD session.

It can however be deduced from the "present" frequency distribution and the corresponding measures of central location quoted above, that the JAD session was successful because there were three or fewer individual sites,indicating the null hypothesis can be rejected.

9.7.1.2 Explicit form of Non-Verbal Communication

H_{78}: An explicit form of non-verbal communication at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{79}: An explicit form of non-verbal communication at the videoconferencing JAD session contributes to the overall success of the JAD session.

		Level of Success				
		Not Successful (1)	Quite Successful (2)	Successful (3)	Extremely Successful (4)	Totals
Explicit form of non verbal communication	Present (1)	0	1	2	0	3
	Absent (2)	6	3	0	0	9
	Totals	6	4	2	0	12

Table 9.66: Success of JAD session as a result of presence/absence of explicit form of non verbal communication

	Chi-Square	df	P
Pearson Chi-Square	8.000	df = 2	p = 0.018
Cramer's V	0.816		
Spearman's Rank R	-0.730	t = -3.381	p = 0.007

Table 9.67: Results of Relationship Tests on Cross Tabulation in Table 9.66

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	0	0	0.00	0.00
Quite successful (2)	1	1	33.33%	22.22%
Successful (3)	2	3	66.67%	100.00%
Extremely Successful (4)	0	3	100.00%	100.00%
Total	3	3	100.00%	100.00%

Table 9.68: Frequency Distribution for Success of JAD session when there was an explicit form of non verbal communication.

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	6	6	66.67%	66.67%
Quite successful (2)	3	9	33.33%	100.00%
Successful (3)	0	9	100.00%	100.00%
Extremely Successful (4)	0	9	100.00%	100.00%
Total	9	9	100.00%	100.00%

Table 9.69: Frequency Distribution for Success of JAD session when there was no explicit form of non verbal communication.

M=3 and x=2.67 for the "present" frequency distribution, and M=1 and x=1.33 for the "absent" frequency distribution. The relationships tests applied confirm a strong negative relationship between the two variables, thereby indicating a tendency towards rejecting the null hypothesis. In addition, the mean value for the "present" distribution is 2.67, indicating that most people who had an explicit form of non verbal communication in their JAD sessions believed that the JAD session was successful as a result of this factor. However, the number of people who had an explicit form of non verbal communication at their JAD sessions is very low (3), and this is too small a sample size to draw valid conclusions from. In contrast, the number of people who did not have an explicit form of non verbal communication is quite high, and the mean value for this frequency distribution is 1.33, indicating that these people in general did not find the JAD session at all successful as a result of the absence of an explicit form of non verbal communication. In light of these observations, the null hypothesis can be rejected.

9.7.1.3 Different Emphasis on Facilitation Skills

H_{80}: A different emphasis on facilitation skills at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{81}: A different emphasis on facilitation skills at the videoconferencing JAD session contributes to the overall success of the JAD session.

		Level of Success				
		Not at all Successful (1)	Quite Successful (2)	Successful (3)	Extremely Successful (4)	Totals
Different Emphasis on Facilitation Skills	Present (1)	0	5	1	0	6
	Absent (2)	4	2	0	0	6
	Totals	4	7	1	0	12

Table 9.70: Success of JAD session as a result of presence/absence of a different emphasis on facilitation skills.

	Chi-Square	df	p
Pearson Chi-Square	6.286	df = 2	p = 0.043
Cramer's V	0.724		
Spearman's Rank R	-0.716	t = -3.240	p = 0.009

Table 9.71: Results of Relationship Tests on Cross Tabulation in Table 9.70

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	0	0	0.00	0.00
Quite successful (2)	5	5	83.33%	83.33%
Successful (3)	1	6	16.67%	100.00%
Extremely Successful (4)	0	6	100.00%	100.00%
Total	6	6	100.00%	100.00%

Table 9.72: Frequency Distribution for Success of JAD session when there was a different emphasis on Facilitation Skills

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	4	4	66.67%	66.67%
Quite successful (2)	2	6	33.33%	100.00%
Successful (3)	0	6	100.00%	100.00%
Extremely Successful (4)	0	6	100.00%	100.00%
Total	6	6	100.00%	100.00%

Table 9.73: Frequency Distribution for Success of JAD session when there was no different emphasis on Facilitation Skills

M=2 and x=2.17 for the "present" frequency distribution, and M=1 and x=1.33 for the "absent" frequency distribution. The relationship tests applied confirm a strong negative relationship between the two variables, thereby indicating a tendency towards rejecting the null hypothesis. In addition, the measures of central location indicate that most people who had a different emphasis on facilitation skills in their JAD sessions believed that the JAD session was quite successful as a result of this factor. The measures of central location for the "absent" frequency indicate that these people in general did not find the JAD session at all successful as a result of the absence of a different emphasis on facilitation skills. In light of these observations, the null hypothesis can be rejected.

9.7.1.4 Maintenance of Effective Group Dynamics

H_{82}: The maintenance of effective group dynamics at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{83}: The maintenance of effective group dynamics at the videoconferencing JAD session contributes to the overall success of the JAD session.

		Level of Success				
		Not at all Successful (1)	Quite Successful (2)	Successfu l (3)	Extremely Successful (4)	Totals
Maintenance of effective group dynamics	Present (1)	0	1	0	0	1
	Absent (2)	10	0	0	1	11
	Totals	10	1	0	1	12

Table 9.74: Success of JAD session as a result of presence/absence of the maintenance of effective group dynamics

	Chi-Square	Df	P
Pearson Chi-Square	12.000	df = 2	p = 0.002
Cramer's V	1.000		
Spearman's Rank R	-0.604	t = -2.398	p = 0.034

Table 9.75: Results of Relationship Tests on Cross Tabulation in Table 9.74

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	0	0	0.00	0.00
Quite successful (2)	1	1	100.00%	100.00%
Successful (3)	0	1	100.00%	100.00%
Extremely Successful (4)	0	1	100.00%	100.00%
Total	1	1	100.00%	100.00%

Table 9.76: Frequency Distribution for Success of JAD session when Effective Group Dynamics were Maintained

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	10	10	90.91%	90.91%
Quite successful (2)	0	10	90.91%	100.00%
Successful (3)	0	10	90.91%	100.00%
Extremely Successful (4)	1	11	100.00%	100.00%
Total	11	11	100.00%	100.00%

Table 9.77: Frequency Distribution for Success of JAD session when Effective Group Dynamics were not Maintained

M=2 and x=2 for the "present" frequency distribution, and M=1 and x=1.18 for the "absent" frequency distribution. The relationships tests applied confirm a strong negative relationship between the two variables, thereby indicating a tendency towards rejecting the null hypothesis. Only one person experienced the maintenance of effective group dynamics in the virtual JAD session, and this is too small a sample from which to drawn conclusions. However, 11 people did not experience the maintenance of effective group dynamics, and the measures of central location for this distribution indicate that these people felt that the JAD session was unsuccessful because this factor was missing. *In light of these observations, the null hypothesis can be rejected.*

9.7.1.5 Explicit Back Channel of Communication

H_{84}: An explicit back channel of communication at the videoconferencing JAD session does not contribute to the overall success of the JAD session.
H_{85}: An explicit back channel of communication at the videoconferencing JAD session contributes to the overall success of the JAD session.

		Level of Success				
		Not at all Successful (1)	Quite Successful (2)	Successfu l (3)	Extremely Successful (4)	Totals
Explicit Back Channel of Communication	Present (1)	0	1	2	0	3
	Absent (2)	6	3	0	0	9
	Totals	6	3	2	0	12

Table 9.78: Success of JAD session as a result of presence/absence of an Explicit Back Channel of Communication

	Chi-Square	df	p
Pearson Chi-Square	8.000	df = 2	p = 0.018
Cramer's V	0.816		
Spearman's Rank R	-0.730	t = -3.381	p = 0.007

Table 9.79: Results of Relationship Tests on Cross Tabulation in Table 9.78

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	0	0	0.00%	0.00%
Quite successful (2)	1	1	33.33%	33.33%
Successful (3)	2	3	66.67%	100.00%
Extremely Successful (4)	0	3	100.00%	100.00%
Total	3	3	100.00%	100.00%

Table 9.80: Frequency Distribution for Success of JAD session when there was an Explicit Back Channel of Communication

	Count	Cumul. Count	Percent	Cumul. Percent
Not at all Successful (1)	6	6	66.67%	66.67%
Quite successful (2)	3	9	33.33%	100.00%
Successful (3)	0	9	100.00%	100.00%
Extremely Successful (4)	0	9	100.00%	100.00%
Total	9	9	100.00%	100.00%

Table 9.80: Frequency Distribution for Success of JAD session when there was no Explicit Back Channel of Communication

M=3 and x=2.67 for the "present" distribution, and M=1 and x=1.33 for the "absent" distribution. The relationship tests applied confirm a strong negative relationship between the two variables, thereby indicating a tendency to reject the null hypothesis. Only three people had an effective back channel of communication, and this is too small a sample size on which to draw conclusions, although it must be noted that all these people believed that the session was successful as a result of the presence of this back channel of communication. The measures of central location for the latter frequency indicate that most people who did not have an explicit back channel of communication also thought that the JAD session was unsuccessful as a result of the absence of this factor. *In light of these observations, the null hypothesis can be rejected.*

9.7.2 Hypothesis Set 11: Factors related to Success of GSS JAD

H_{86}: The absence of domination of the GSS/meeting system JAD session by participants with higher typing speeds does not contribute to the overall success of the JAD session. H_{87}: The absence of domination of the GSS/meeting system JAD session by participants with higher typing speeds contributes to the overall success of the JAD session.
H_{88}: The absence of reduced participation in the GSS/meeting system JAD session by participants with lower typing speeds does not contribute to the overall success of the JAD session. H_{89}: The absence of reduced participation in the GSS/meeting system JAD session by participants with lower typing speeds contributes to the overall success of the JAD session.
H_{90}: The absence of frustration arising from being unable to keep up with the typing speed at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session. H_{91}: The absence of frustration arising from being unable to keep up with the typing speed at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.
H_{92}: The absence of anxiety as a result of having to use technology at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session. H_{93}: The absence of anxiety as a result of having to use technology at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.
H_{94}: The maintenance of effective group dynamics at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session. H_{95}: The maintenance of effective group dynamics at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.
H_{96}: The presence of spontaneity of dialogue at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session. H_{97}: The presence of spontaneity of dialogue at the GSS/meeting system JAD session contributes to the overall success of the JAD session.
H_{98}: The presence of non-verbal cues at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session. H_{99}: The presence of non-verbal cues at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.
H_{100}: The presence of an explicit back channel of communication at the GSS/meeting systems JAD session does not contribute to the overall success of the JAD session. H_{101}: The presence of an explicit back channel of communication at the GSS/meeting systems JAD session contributes to the overall success of the JAD session.

No data was collected for this hypothesis set.

9.7.3 Hypothesis Set 12: Factors related to Success of DVC Interview

H_{102}: Sufficient lighting does not contribute to the overall success of the desktop videoconferencing interview.
H_{103}: Sufficient lighting contributes to the overall success of the desktop videoconferencing interview.

H_{104}: A high image resolution does not contribute to the overall success of the desktop videoconferencing interview.
H_{105}: A high image resolution contributes to the overall success of the desktop videoconferencing interview.

H_{106}: The absence of audio-video lag does not contribute to the overall success of the desktop videoconferencing interview.
H_{107}: The absence of audio-video lag contributes to the overall success of the desktop videoconferencing interview.

H_{108}: Simulated eye contact by looking at the camera rather than the monitor when speaking does not contribute to the overall success of the desktop videoconferencing interview.
H_{109}: Simulated eye contact by looking at camera rather than the monitor when speaking contributes to the overall success of the desktop videoconferencing interview.

H_{110}: Ability to read body language clearly does not contribute to the overall success of the desktop videoconferencing interview.
H_{111}: Ability to read body language clearly contributes to the overall success of the desktop videoconferencing interview.

H_{112}: Trusting the interviewer enough to disclose sensitive information does not contribute to the overall success of the desktop videoconferencing interview.
H_{113}: Trusting the interviewer enough to disclose sensitive information contributes to the overall success of the desktop videoconferencing interview.

H_{114}: The credibility of the interviewer does not contribute to the overall success of the desktop videoconferencing interview.
H_{115}: The credibility of the interviewer contributes to the overall success of the desktop videoconferencing interview.

No data was collected for this hypothesis set.

9.8 Other Results

This section presents the results of tests applied to data which do not relate directly to the hypotheses being tested, but which are of interest to the area of study.

9.8.1 Technology

9.8.1.1 Media for Virtual Communications

Question 10: Please indicate the extent of your use of the following media for communication with your fellow team members.

In order to determine the extent to which various technologies were used by the sample population for communication with their fellow team members, the measures of central location for each specified technology's frequency distribution was calculated. The frequency distributions are not reproduced here, but can be found in Appendix E. The calculation of the measures of central location allows for comparisons to be made between the levels of use of various technologies.

The calculated measures of central location for the level of use of each technology are presented in Table 9.82.

Technology	Mean Level of use	Mode
Electronic mail	3.500	4
Internet Chat Room	1.278	1
Meeting System/Group Support System	2.444	1
Telephone	3.222	5
Fax	1.444	1
Messaging Service	1.278	1
Room Videoconferencing	1.778	1
Desktop Videoconferencing	1.000	1
Teleconferencing	2.778	3
Face-to-Face	2.778	M_1=2 and M_2=4

Table 9.82: Mean Level of Use of Technology for Communication

9.8.1.2 Co-ordination and Integration Problems Identified in the Survey

Question 15: If you answered "Yes" to Questions 12 and/or 14, please provide a brief explanation of these problems.

Several problems were identified by various respondents. Table 9.83 shows the problems identified, categorised in terms of communication related and task performance related co-ordination and integration problems. The table also shows the number of respondents who identified each problem.

Problems	No. of Responses
Communication Related Co-ordination and Integration Problems	
1. Slow communication because of differing technology specifications and/or programs.	5
2. Scheduling problems as a result of difficulty in updating and checking each other's calendars when different calendaring systems were used.	1
3. Difficult to network different meeting systems.	2
Task Performance Related Co-ordination and Integration Problems	
1. Difficulty accessing work in different versions and/or programs.	7
2. Frustration and reduced productivity due to having to convert/redo work.	7

Table 9.83: Co-ordination and Integration Problems identified in the Survey

9.8.1.3 Comparison of Levels of Training for Communications and Task Performance Technology and Software

Question 16: Please indicate the extent of training provided regarding the use of task performance and communication software and technology.

The adequacy levels of training received in the use of communications and task performance technology and software were cross tabulated against each other in order to allow relationship tests to be performed on the cross tabulation. Table 9.84 shows the cross tabulation, while Table 9.85 shows the results of the relationship tests.

		Communications technology and software				
		No training	Completely inadequate training	Adequate training	Extremely adequate training	Totals
Task Performance technology and Software	No training	9	1	1	0	11
	Completely inadequate training	1	1	0	0	2
	Adequate training	1	0	3	0	4
	Extremely adequate training	0	0	0	1	1
	Totals	11	2	4	1	18

Table 9.84: Levels of Training for Task Performance Technology and Software Vs. Levels of Training for Communications Technology and Software

	Chi-square	df	p
Pearson Chi-square	29.129	df=9	p=.00062
Cramér's V	.734		
Spearman Rank R	.641	T=3.3398	p=.00416

Table 9,85: Results of Relationship Tests on Cross Tabulation in Table 9.84

The tests show that there is a relatively strong positive relationship between the levels of training received in the use of task performance and communications technology and software.

9.8.2 Informal Interaction

9.8.2.1 Media Used for Virtual Informal Interaction

Question 25: Please indicate the extent to which you used the following media to interact informally with your team mates.

In order to determine the extent to which various communication media were used by the sample population for informal interaction with their fellow team members, the measures of central location for each specified medium's frequency distribution were calculated. The frequency distributions are not reproduced here, but can be found in Appendix E. The calculation of the measures of central location allows for comparisons to be made between the frequency of use of various communication media.

The calculated measures of central location for the frequency of use of each communication medium is presented in Table 9.86

Communication Media	Mean Frequency of Use	Mode
Face-to-face	3.267	3
Electronic Mail	3.267	
Telephone	3.467	M_1=2 and M_2=4
Internet Chat Room	1.133	1
Meeting System/Group Support System	1.133	1
Room Videoconferencing	1.400	1
Desktop Videoconferencing	1.067	1

Table 9.86: Measures of Central Location for the Frequency of Use of Each Communication Medium

9.8.2.2 Entire Team engaging in Informal Interaction

Question 26: Did/do all the members of your team engage in informal interaction?

The measures of central location for the frequency distribution for the responses to the above question were calculated in order to determine whether or not it was common practice for all team members to engage in informal interaction. In calculating these values, the "N/A" responses were ignored, in order to ensure that the calculations would not provide data that is invalid as far as this study is concerned. The frequency distribution can be found in Appendix E. M=2 and x=1.67 for the frequency distribution.

9.8.2.3 Common Interests to Draw Team into Informal Discussion Forum

Question 29: Please provide a brief description of what kind of common interest could have drawn your team mates into an informal discussion forum.

The respondents identified several types of common interests. These are shown in Table 9.87 along with the number of respondents who identified each type of common interest.

Type of Common Interest	No. of Respondents
1. Discussion of personal interests	5
2. Informal learning experience through case studies where participation is more important than knowledge.	1
3. Discussion of technology (common interest for most computer people)	2
4. Online activities that promote a feeling of "togetherness"	2
5. Networked games and/or activities	1

Table 9.87: Common Interests Identified in the Survey

9.8.3 Requirements Elicitation Techniques

9.8.3.1 Use of Virtual Requirements Elicitation Techniques

Question 30: Please indicate the extent to which you engaged in the following requirements elicitation techniques.

The frequency distributions for each requirements elicitation technique can be found in Appendix E. Measures of central location for each frequency distribution were calculated in order to compare the extent to which various requirements elicitation techniques were used by the respondents. These measures of central location are shown in Table 9.88.

Virtual Requirements Elicitation Technique	Mean Values for Extent of use of each technique	Mode for Extent of use of each technique
Virtual JAD using videoconferencing	1.353	1
Virtual JAD using Group Support System	1.529	1
Virtual Interviews using Desktop videoconferencing	1.000	1
Virtual Interview using Chat System	1.294	1
Virtual Interview using the telephone	2.059	$M_1 = 1$, $M_2 = 2$
Electronic Questionnaire	1.706	1
Virtual Document Review	3.000	4
Virtual Observation	1.294	1

Table 9.88: Measures of Central Location for the Extent of use of Virtual Requirements Elicitation Techniques

9.8.4 Other Problems and Techniques

9.8.4.1 Other Virtual Requirements Elicitation Techniques

Question 40: Please describe any other virtual requirements elicitation techniques that you have implemented which have not been covered within this questionnaire.

There were no responses to this question.

9.8.4.2 Other Problems within Implementation of Virtual Requirements Elicitation Techniques

Question 41: Please state any other problems (not covered in this questionnaire) that you experienced with the implementation of virtual requirements elicitation techniques.

Several other problems were identified by the respondents. Several themes emerged from the answers of the respondents. These are presented in Table 9.89 along with the number of respondents who identified each problem. The shaded row(s) are problems that were identified within the questionnaire.

Problems Identified by Respondents	No. of Respondents
1. Stakeholders do not trust development side as much when they are remote.	2
2. Easier to ignore people when they are remote.	3
3. Different schedules makes setting up meetings difficult.	2
4. Technological problems lead to focus on technology rather than the content.	1
5. More difficult to get users to answer electronic questionnaires.	1
6. Cannot explain issues as easily over a non-visual medium.	1
7. Organisational politics are less easy to perceive and understand when remote.	1
8. People are distracted by things that are going on at their physical site.	2
9. Lack of adequate technological and environmental facilities at all sites.	1

Table 9.89: Other Problems within implementation of virtual requirements elicitation techniques

9.8.4.3 Solutions to the Problems

Question 42: For each problem, please state what steps (if any) were taken toward solving the problems. Please also state what you think could have been done to solve these problems.

Three solutions were identified by the respondents. These are presented in Table 9.90 along with the number of respondents who identified them.

Solutions Identified by Respondents	No. of Respondents
1. Focus on one on one meetings.	1
2. Send well prepared agendas well before hand.	1
3. Maintain developer presence at site.	

Table 9.90: Solutions Identified by Respondents

9.8.4.4 Other Problems encountered during experienced as a virtual team member

Question 43: Please state any other problems you may have encountered during your experience as a virtual team member, and any solutions that were put forward (both suggested and implemented).

Three themes emerged from the answers of the respondents. The problems that they experienced as virtual team members are shown in Table 9.91, along with the number of respondents who identified them.

Problems Identified by Respondents	No. of Respondents
1. User side is not as technologically competent	2
2. Time differences regarding synchronous communication	2

Table 9.90: Other Problems experienced as Virtual Team Members

9.9 Conclusion

This chapter presented the results of the statistical tests applied to the data. The test results were used to accept or reject the null hypotheses, thereby providing evidence for or against the support of the alternate hypotheses. The chapter also presented the results of tests applied to other variables of interest to the study, and categorized the free format answers of the respondents in terms of various themes. The next chapter is concerned with a discussion of these findings.

PART V

Discussion of Findings and Recommendations

This section aims to discuss the findings of the empirical study with specific reference to the CSFs.

The results of the hypothesis tests are analysed in terms of the CSFs. The analysis shows that most of the CSFs can be confirmed, although some have to be modified in order to conform to the findings of the empirical survey.

The implications of the confirmation and modification of the CSFs on the holistic model of RE are discussed with specific reference to the frameworks of which the model is composed. The frameworks are adapted to conform to the findings of the research.

The confirmation of the majority of the CSFs shows that the rationale behind the model is sound, although the validity of the model can only be tested through its implementation.

Chapter 10

Discussion of Findings and Recommendations

10.1 Introduction

This chapter interprets the results of the empirical study presented in Chapter 9 in terms of the theoretical model proposed in Chapter 7, and the research as a whole. The results and their implications are discussed in terms of the hypotheses presented in Chapter 8 and their corresponding critical success factors presented in Chapter 7. The discussion concludes with recommendations to adapt the critical success factors and the model based on the findings of the empirical study.

10.2 Confirmation of the Critical Success Factors.

This section discusses the results of the study in terms of the proposed critical success factors. Each critical success factor relates to one or more hypotheses, which were tested with the use of inferential statistical techniques in the previous chapter. Again, it must be noted that the limited sample size means that the rejection or acceptance of the hypotheses relating to the critical success factors should be treated with caution, as the results of tests performed on such a small population cannot be considered to be absolutes. Nevertheless, as mentioned in Chapter 9, the results do provide an indication regarding the tendency towards acceptance or rejection of the null hypotheses, and therefore it is possible to continue (albeit with prudence) by relating these tendencies to the validity of the critical success factors. Some of these tendencies point to an indication that certain critical success factors should be adapted based on the results of the empirical study, and the nature of these adaptations as well as the motivations for the adaptations are described in detail in this section.

10.2.1 CSF 1: Hold Frequent team building sessions in order to lay stronger foundations for trust and relationships within the team.

The null hypothesis related to this CSF was rejected. Furthermore, it was found that no matter how frequently or infrequently people engage in team building sessions, they all believed that even more frequent team building sessions would reinforce trust and relationships (even those who engaged in team building as often as once a week). It is also interesting to note that the only people who felt that more frequent team building sessions would not have reinforced trust and relationships within the team are people who engaged in team building less than once a month. This observation could indicate that team building sessions that are held too far apart do not reinforce trust and relationships at all.

Based on this, it is possible to conjecture that once trust and relationships are established, they require maintenance and reinforcement through frequent team building sessions, as these feelings are eroded to a certain degree in the space of time between the sessions. Certain authors reviewed in the literature survey (Carmel [1999:145] and Aristotelous [1999:66]) believe that trust falls away as soon as team members return to their physical locations.

This is supported by the evidence of the empirical study, which illustrates that there is a positive correlation between the frequency of team building sessions and the reinforcement of trust and relationships. Consequently, it is possible to speculate that an extended length of time between team building sessions makes such reinforcement problematic, as trust and relationships have been greatly deteriorated, resulting in the fact that they must be established from almost baseline levels at every team building session. This relationship between the frequency of team building sessions and the level of trust and relationships is portrayed in Figures 10.1 and 10.2.

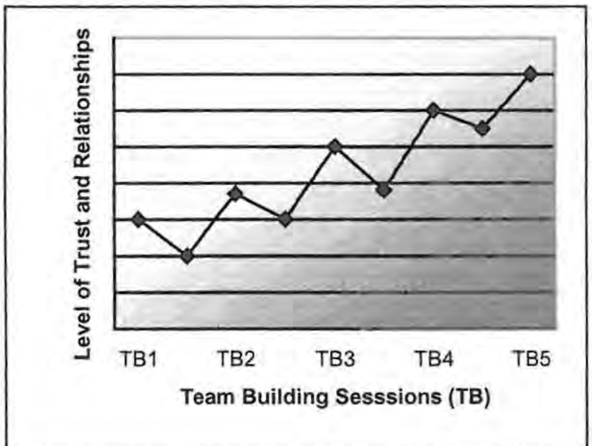

Figure 10.1: Level of trust and relationships when there are frequent team building sessions

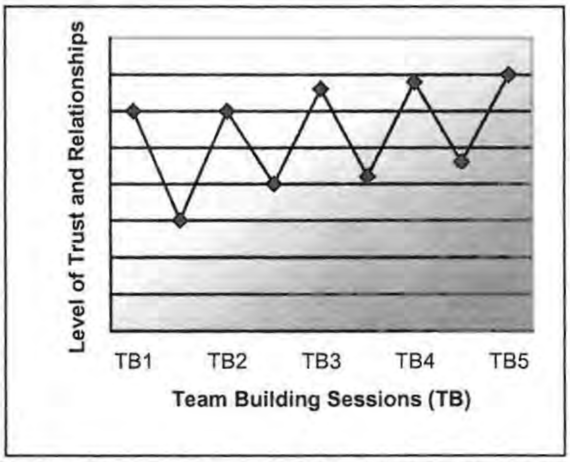

Figure 10.2: Level of trust and relationships when there are infrequent team building sessions

The figures underscore the author's contention regarding the level of trust and relationships and team building sessions. In Figure 10.1, there are frequent team building sessions, and although there is some erosion, overall the frequency of the team building sessions allows the level of trust and relationships to climb. In Figure 10.2, the team building sessions are held quite far apart, meaning that the erosion of trust and relationships between team building sessions is sharper, and the overall level of trust and relationships climbs slowly.

A situation such as the one depicted in Figure 10.2 could possibly have made team members feel (correctly) as if the team building sessions failed to accomplish anything, because the sessions are aimed at getting team members to the stages they reached at the end of the last team building session, rather that helping them to go beyond this position to a new level.

These results and the author's theories based on the results, indicate that there can therefore never be enough reinforcement of trust and relationships within the team. The literature review and the empirical study show that team building is one of the major techniques used to achieve such trust and relationships so holding frequent team building sessions is important to the success of a virtual team. Consequently, the validity of CSF 1 is confirmed.

10.2.2 CSF 2: Hold initial face-to-face team building meeting in order to lay stronger foundations for trust and bonding within the team.

The null hypothesis for this CSF was rejected. In addition, it was observed that most people who engaged in team building sessions did have an initial face-to-face meeting, and both groups of people who did engage in an initial face-to-face meeting and those who did not were of the opinion that such a meeting leads to greater trust and bonding than no face-to-face meeting.

It is interesting to note that the only person who did not believe that a face-to-face meeting would have led to greater trust and bonding was one of the two people who did not engage in such a face-to-face meeting. Furthermore, on examination of the response database, it was noted that this was also one of the respondents who engaged in team building sessions less than once a month, and who felt that more frequent team building sessions would not reinforce trust and bonding within the team.

This could indicate that team building for this respondent's virtual team was a low priority. A possible reason for this is that the respondent's virtual team may not have been fully aware of the benefits offered by team building, meaning that the team building sessions were conducted without a sharp focus on team building objectives that would have been beneficial to the team. This is, of course, speculation based on the meagre evidence provided by the respondent's answers to certain questions, however the relationship between the frequency of team building sessions and the respondent's beliefs regarding their role in reinforcing trust and relationships, as well as the belief that an initial face-to-face meeting would not have promoted trust and bonding is interesting, and bears some importance in terms of the interpretation of the results.

Regardless of the answers of this respondent, the rejection of the null hypothesis consequently supports confirmation of CSF 2.

10.2.3 CSF 3: Address the following issues in depth at the initial and ongoing team building sessions in order to ensure the success of the team: Clarity of participation, clarity of goals, social bonding and relationship building, clarity of processes for task performance and communication, definition of roles and responsibilities, trust, co-ordination of work logistics, leadership issues, management of conflict, reward and recognition structures.

The overall perspective showed that the issues did need to be addressed adequately at the team building sessions in order to ensure the overall success of the team. However, each issue was encapsulated within its own hypothesis, and therefore, the relationship between the adequacy with which the issue was addressed and the overall success of the team was tested separately for each issue. This allows for the observation and comparison of variations between the relationships for the same issues.

Positive relationships were perceived between the adequacy with which the issues were addressed at both the initial and ongoing team building sessions and the overall success of the team for clarity of participation, social bonding and relationship building, trust, co-ordination of work logistics, leadership issues and reward and recognition structures. This would indicate that these are issues that need to be clearly addressed at the initial teambuilding session and reinforced explicitly in the ongoing team building sessions so as to assure the overall success of the team.

Certain issues have much stronger relationships between the adequacy with which they are addressed at ongoing team building sessions and the overall success of the team than the relationship between the adequacy with which they are addressed at initial team building sessions and the overall success of the team. These are the issues of social bonding and relationship building, and reward and recognition structures. The nature of social bonding and relationship building supports this observation, as the building of social ties between people is an ongoing process rather than a once-off activity. As people understand each other better, so their relationships become stronger, constantly building upon previous interactions and experiences to arrive at a higher level. Therefore, it can be said that although it is important that the initial team building session lay the foundation for such social bonding and relationship building (through the implementation of team building activities at the initial face-to-face meeting) it is far more important that social ties are sustained and reinforced through ongoing team building sessions.

Reward and recognition structures probably become more important as the team progresses through the RE process, completing phases and meeting deadlines. It is possible that these issues are not as "real" at the initial team building session, but as the project progresses they become more important. This occurs as team members actually begin to receive rewards and recognition, or to decide that they should receive rewards and recognition for the work that is being performed. In light of this conjecture, it is necessary to make team members aware of the reward and recognition structures at the initial team building session, (by opening an ongoing discussion about these structures) but it is more important that they are reminded of these structures during the ongoing team building sessions. It is only as the project progresses that they will understand how the structures relate to their project, their team and themselves as individual entities.

The two issues of clarity of processes for task performance and communication and definition of roles and responsibilities showed a positive relationship between the adequacy with which they were addressed at the initial team building session and the overall success of the team. However, no relationship was observed between the adequacy with which they were addressed at the ongoing team building sessions and the overall success of the team. This would indicate that these are issues that must be addressed in detail at the initial team building session, but require little maintenance throughout the life of the team. The nature of the issues seems to support this, as once participants are clear on their roles and responsibilities regarding the team, and the processes for communication and task performance, they are able to perform their tasks with these issues in mind.

Presumably, the very acts of performing tasks for the team and communicating with team members in order to perform these tasks could reinforce the processes defined at the initial team building session. Similarly, task performance for the team could reinforce and remind them of their roles and responsibilities implicitly, so explicit reminders at ongoing team building sessions are unnecessary. In fact, such explicit reminders would only become necessary if the processes broke down for some reason, or if people did not act according to their roles and responsibilities. Such a breakdown is unlikely to happen if these issues are addressed clearly and adequately at the initial team building session.

Finally, the two issues of clarity of goals and management of conflict showed no relationship between the adequacy with which they were addressed and the overall success of the team indicating that these issues do not have to be addressed at the team building sessions in order to ensure the success of the team. In the case of clarity of goals, it is possible that all the respondents were completely clear on the goals of the team before the initial team building session, or that the goals became clear as the project progressed, and did not require reinforcement during the team building sessions. With regards to management of conflict, it is possible that if conflict did emerge within the team, team members handled such conflict in a way that each determined best. It is also possible that no major conflict emerged at all during the lifecycle of the team.

Subsequently, with the exception of the above issues, the critical success factor can be supported. It is acknowledged that the hypotheses were rejected for some of the other issues for which relationships were observed between the initial team building session and the overall success of the team, but not between the ongoing team building sessions and the success of the team. However, this would indicate only a modification in the critical success factor rather than its rejection altogether. The critical success factor should be modified to indicate which issues should be addressed adequately at the initial team building session, the ongoing team building sessions, or both, in order to promote the overall success of the team.

Modified CSF 3:

a. Address the following issues in detail only at the initial buildings session in order to ensure the success of the virtual team: definition of roles and responsibilities and clarity of processes for task performance and communication. Also lay foundations for social bonding and relationship building through the implementation of team building activities, and open an ongoing discussion regarding reward and recognition structures.

b. Address the following issues in more detail at the ongoing team building sessions than at the initial team building session in order to ensure the success of the virtual team: social bonding and relationship building and reward and recognition structures.

c. Address the following issues in detail at both the initial and ongoing team building sessions in order to ensure the success of the virtual team: clarity of participation, trust, co-ordination of work logistics and leadership issues.

10.2.4 CSF 4: Standardise communication and task performance software and technology in order to minimise co-ordination and integration problems.

The two null hypotheses for this CSF were rejected. It was found that respondents who had standardised communication and task performance technology and software did not experience any co-ordination and integration problems, while most of those who did not have such standardisation experienced these problems. More specifically, respondents identified the key problems as being:

- Slow communication because of differing technology specifications and/or programs.
- Scheduling Problems because of different calendaring tools used
- Difficult to network different meeting systems.
- Difficulty accessing work in different versions and/or programs.
- Frustration and reduced productivity due to having to convert/redo work.

In addition, every single respondent who stated that they experienced task related co-ordination and integration problems as a result of the non-standardisation of task performance technology and software listed the final two problems when asked to describe the nature of their problems.

In light of the findings of the empirical study, it is apparent that the standardisation of technology and software is important in preventing co-ordination and integration problems for a virtual team, thereby indicating support for the confirmation of CSF 4.

10.2.5 CSF 5: Ensure that adequate training is provided for communication and task performance software and technologies.

The hypothesis tests show that in general, no training or completely inadequate training is provided to team members in the use of communication and task performance software and technologies. In retrospect, the question should also have asked respondents to rate the contribution the level of training made to their task performance and communication activities. This would have allowed relationship tests to be performed to determine the relationship of the level of training to the level of contribution the training made to team members' task performance and communication activities, thus allowing for an explicit indication of whether or not more training meant more efficiency and effectiveness in task performance and communication. Unfortunately, although it can be determined that a very low level of training was provided for most team members, the importance of the critical success factor cannot be confirmed.

In addition, the levels of training for communications and task performance technology and software were compared as a matter of interest. A strong positive relationship was observed between the level of training received for communication technology and software and that received for task performance technology and software. This is an indication that in general, if team members are trained adequately in the use of one, they are also trained adequately in the use of the other. This evidence could be explained by the companies within which the team members work. Companies within the industry place different emphases on the value of training, meaning that those who view it as highly valuable to their success provide extremely adequate training, whereas those who see it as being less valuable only provide training when they deem it absolutely necessary, and when in can be justified quantifiably.

Despite the inability to confirm CSF 5, the author believes that training in the use of technology and software is extremely important to the efficiency of the virtual team. It is also believed that the company or companies within which the team members work should realise the long term benefits that such training will provide, not only to the transient virtual team, but to the company as a whole.

10.2.6 CSF 6: Implement a formal process for dealing with technological problems in order to minimise frustration, general misunderstandings, delays in task performance and delays in task co-ordination.

It was determined that the null hypotheses could be rejected for the problems of frustration and general message misunderstanding, but not for the problems of delays in task performance and delays in task co-ordination. This would indicate that CSF 6 can be confirmed, but should be modified as follows in order to be consistent with the research findings:

Modified CSF 6

Implement a formal process for dealing with technological problems in order to minimise the problems of frustration and general misunderstandings.

It is interesting to note that the two problems that the respondents felt would not be minimised through the implementation of a formal process for dealing with technological problems were the only two that were directly work related. This could mean that because such delays impact directly on the project, they are dealt with as quickly as possible, whether there is a process for dealing with them or not. It would have been interesting to supplement the information gathered by asking the respondents to detail reasons for their answers.

10.2.7 CSF 7: Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences, problems arising as a result of cultural differences and problems caused by general message misunderstandings.

The null hypotheses were rejected for frustration, delays in task performance and delays in task co-ordination, misunderstandings caused by language differences, and problems caused by general message misunderstandings, but not for problems arising as a results of cultural differences. This would indicate that CSF 7 is confirmed, but should be modified as follows in order to correlate to the research findings:

Modified CSF 7

Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings.

Problems arising as a result of cultural differences may not have been major issues for the virtual team, especially if the team were distributed nationally and not globally, as the author believes is the case with the majority of the respondents' teams. Based on this belief, it is possible to theorise that although the teams could have consisted of people from a variety of different ethnic and cultural backgrounds, they would most probably have consisted predominantly of those who work in South Africa. As a result, it is unlikely that major cultural adjustments would have had to be made by any member of the team. Most members of the professional workforce have worked with people of other South African cultures on a daily basis, and bringing the understanding gained from these experiences into the virtual team could allow them to overcome cultural differences, in many cases in an implicit manner. Therefore, if the respondents did not encounter the problems, this may be a possible explanation for their not stating that a communications strategy could reduce these problems.

10.2.8 CSF 8: Provide training in communications styles in a virtual environment in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences, problems arising as a result of cultural differences and problems caused by general message misunderstandings.

The hypotheses were rejected for frustration, delays in task performance, delays in task co-ordination, and problems caused by general message misunderstandings. The hypotheses could not be rejected for misunderstandings caused by language differences and problems arising as a result of cultural differences. This would indicate that CSF 8 is valid, but should be modified as follows in order to regulate it according to the research findings:

Modified CSF 8

Provide training in communications styles in a virtual environment in order to minimise frustration, delay in task performance, delays in task co-ordination and problems caused by general message misunderstandings.

Once again, it is possible to speculate that respondents did not believe that training in communications styles could have minimised problems arising as a result of language and cultural differences because they did not experience such problems as a result of being members of a nationally rather than globally distributed team. Members of the professional workforce in South Africa presumably possess a deeper understanding of professionals from different South African cultures as a result of having worked with people from these cultures.

In addition, as most tertiary education is conducted in English, it is unlikely that language differences would be a problem for members of a software development team.

10.2.9 CSF 9: Ensure informal interaction takes place between team members in order to promote trust, social bonding, a sense of "belonging" to the team, social satisfaction regarding relationships within the team, motivation and responsibility.

The individual null hypotheses for each factor were rejected, thereby supporting confirmation of the CSF. The results of the research also indicate that in general, not all members of a virtual team engage in informal interaction. This could be due to the difficulty in maintaining a "virtual" relationship with fellow team members. It was explained in the literature review that the maintenance of such relationships is of critical importance to the success of the team, and this hypothesis was supported by the confirmation of CSF 9. It is believed that if all members of the team do not engage in informal interaction, they are unable to experience the same levels of social bonding, satisfaction, motivation and responsibility of those who do engage in informal interaction. In addition, they are not able to contribute their own values, beliefs and experiences to the team, thus leading to less happy and more unproductive team members. This is detrimental not only to the individual team members, but also to the team as a whole, as informal interaction is a critical aspect of the social dimension of team communications, which in turn is an important input to the success of the team as a whole.

The research findings revealed several ways in which all virtual team members can be encouraged to participate in informal interaction. These include:

- a common area where the team members can meet to discuss personal interests;
- participation in informal learning experiences such as case studies, where contribution is more important than actual knowledge;
- various online activities such as network games and activities centered around getting to know other team members.

It is believed that if the team culture encourages participation in such informal interaction, the interactions help to build a more cohesive team culture, thus resulting in an upward spiral regarding the social dimension of team communications.

10.2.10 CSF 10: Ensure that the following are maintained in a videoconferencing JAD session in order to promote success: three or fewer individual sites, an explicit form of non-verbal

communication, different emphasis on facilitation skills, maintenance of effective group dynamics, explicit back channel of communication.

The individual null hypotheses for each factor were rejected, supporting the confirmation of CSF 10. Therefore, all the factors identified as being crucial to the success of a videoconferencing JAD session in the theoretical model must be maintained in order to ensure its overall success.

10.2.11 CSF 11: Ensure that the following are maintained in a GSS JAD session in order to promote success: similar typing speeds of all participants, no anxiety from less technical users, maintenance of effective group dynamics, spontaneity of dialogue, non-verbal cues, explicit back channel of communication.

No data was gathered on this technique of RE, and therefore the hypotheses could not be tested. This means that CSF 11 cannot be confirmed. Two participants indicated that they engaged in GSS JAD sessions, but neither of them completed the section on GSS JAD. It is surprising that none of the respondents engaged in such a JAD session, as it does impart a number of benefits. It also offers a number of disadvantages, and these are perhaps the reason that the sample population did not engage in such JAD sessions. In addition, respondents identified the problems of inadequate technological competence of the users and the difficulty of explaining issues over a non visual medium as two major problems. These are problems that could affect the GSS JAD in particular, although the author believes that with adequate training provided to the users and the implementation of a comprehensive GSS with visual aids such as electronic whiteboards, such problems can be overcome to allow for the execution of a successful JAD.

10.2.12 CSF 12: Ensure that the following are maintained in a DVC Interview in order to promote success: sufficient lighting, high resolution of image on screen, low audio-video lag, eye contact, ability to read body language, trust, credibility of interviewer.

No data was gathered on this technique of RE, and therefore, the hypotheses could not be tested. This means that CSF 12 cannot be confirmed. Despite the indications of the sample population that such interviews are not engaged in, the author believes that a careful choice of technology and software and attention to detail regarding the factors that the literature describes as being central to the success of the DVC interview, this method of RE can be effectively implemented.

10.3 Discussion of other results

10.3.1 Other Problems and Solutions

The study revealed several other problems not mentioned in the questionnaire that were experienced by the respondents:

- Stakeholders do not trust members of the development team as much when they are remote.
- It is easier to ignore people when they are remote.
- It is difficult to get people to answer an electronic questionnaire.
- It is difficult to explain things over a non-visual medium.
- Organisational politics are less easy to perceive and understand when remote.
- People are distracted by events at their physical sites.
- Technological problems lead to a focus on the technology rather than on the content.
- There is a lack of adequate technological and environmental facilities at all sites.

A large portion of these issues relate to the user/developer divide. This divide exists in most development projects, but is probably exaggerated when the project is virtual, as a result of the perceived distance imposed by the technology. This could explain why there is less trust of the developers and also why stakeholders find it easier to ignore electronic mail and telephone messages. When developers are present at the user site and are able to make face-to-face requests, it is far more difficult to ignore the request.

Respondents were also asked to provide details of solutions (both suggested and implemented) to any problems they encountered in their experiences as virtual team members. It was suggested that a developer presence should be maintained at the user site in order to overcome the problems of:

- low trust;
- ignored requests;
- the difficulty of explaining issues over a non-visual medium;
- the difficulty in perceiving and understanding organisational politics.

In this way the development team representative becomes the intermediary between the users and the developers, as he is part of the virtual development team, but is also physically a part of the user side. As such, the users' confidence that the project is being worked on is boosted, resulting in a corresponding increase in trust. In addition, the developer is able to follow up on requests face-to-face, thereby making it more difficult for users to ignore these requests. Furthermore, the developer is able to clarify and explain issues and ideas to the users face-to-face, allowing increased understanding and commitment from the users. Finally, the developer is in a better position to perceive and understand the underlying organisational politics of the user organisation, and will be able to pass this knowledge on to the development team. Such a development team presence consequently promotes trust, understanding and commitment from both the developer and the user side.

It was also proposed was that RE should focus on one-on-one meetings in order to avoid the difficulty of getting people to answer electronic questionnaires. Such meetings allow stakeholders to feel personally involved, and therefore more committed, however, the author believes they are not always viable in terms of time and the need to have a number of stakeholders in the room to discuss requirements and reach compromises.

Respondents further suggested that stakeholders should be sent well prepared agendas well in advance of RE meetings, as discussed in the model of RE proposed in Chapter 7. This would enable stakeholders to be aware of what was expected of them at RE meetings, and would give them a chance to think about issues to raise at the meetings, thus helping to ensure that more complete requirements are gathered.

A major problem of virtual teams that was identified in the study was the fact that technological problems lead to a focus on the technology rather than on the work content. In a team which relies principally on technology for communication and task performance, this is a very real problem. The author is of the opinion that this points to the need for a process for dealing with technological problems that will allow these problems to be solved quickly and easily. It also points to a need for standardisation of technology and software across the team, and the careful selection of the correct group support technology to meet the needs of the team. If the needs and requirements of the team are analysed carefully, and the correct support technology is selected and implemented, along with the employment of technical support staff who are experienced in the use of the technology, such problems should not be a major issue. The aim of any virtual team organiser should be to provide a seamless environment across which the team can work with minimal mishaps and problems.

The respondents also pointed out that there is a lack of adequate technological and environmental facilities at all sites. It is not clear from the response whether this was from the user side or whether it included the virtual team sites. Once again, the author believes that this points to the need for careful and adequate planning for the correct support technology for the virtual team. It is believed that a virtual team than has to focus on the technology and the facilities rather than the work to be performed will be less successful than traditional, face-to-face teams, thereby minimising the advantages of virtual work. Once again, it is imperative that a seamless, standardised virtual environment is generated across the team as described above.

Finally, it was revealed that people in a virtual team are distracted by what is going on at their physical sites. The distractions of the physical site are believed to come about as a result of team members' immersion within their physical context. Such immersion causes team members to give more import to matters at their physical site, resulting in only secondary attention being paid to their virtual activities. Such distractions could possibly cause low levels of trust, as team members feel that they are unable to rely on one another to prioritise their virtual work.

The author believes that equal immersion in the virtual context would allow team members to work more efficiently for their virtual team, ensuring that due attention is paid to the requests of team members regardless of events occurring at the physical site. As described in the literature review and the theoretical model, the maintenance of a strong team culture through frequent team building sessions and informal interactions should help to solve this problem, as team members will feel more responsible and accountable towards their virtual team, thus endeavouring to perform their tasks to the best of their ability.

10.3.2 Media for Communication

The results of the study also showed that electronic mail and the telephone were the most frequently used forms of communication between virtual team members, with face-to-face communication coming a close third. This indicates that most virtual teams in this study are not purely virtual – face-to-face interaction is quite common. In addition, it was expected that electronic mail and the telephone would be the most frequently used communication media, as these are easily accessible and inexpensive compared to other virtual communications media. These methods of communication are also traditional, and the author believes that South African culture in general is traditional and therefore more likely to hold on to "tried and tested" methods of communication, rather than experiment with new communication media.

10.3.3 Virtual Requirements Elicitation Techniques

Virtual document review was the most popular virtual RE technique, with telephonic interviews coming a close second, followed by electronic questionnaires. These are the three "easiest" techniques of virtual RE for the following reasons:

- Virtual document review is easily conducted by asking selected stakeholders to send relevant documentation to the development team via electronic mail or fax. It also does not involve extensive developer-user interaction.
- Electronic questionnaires are also easily implemented and do not require extensive developer-user interaction.
- Telephonic interviews are suitable for gathering non-sensitive data and are inexpensive to implement.

Thus, it can be seen that "true" virtual RE as described in the literature review of this questionnaire is not yet implemented in South Africa. The possible reasons for this are listed below:

- The technology required to implement the virtual RE techniques, the labour and the time required is not viable for most South African companies.
- South African companies are not yet aware of the benefits offered by virtual RE.
- Few South African software development companies are global, and therefore there is little need to employ virtual RE when users and team members are but two or three hours away by plane.
- The South African company culture is such that flying to various destinations to meet with users is considered to be a positive experience, and one that most people would rather not give up as they would have to do if they engaged in true virtual RE. In addition, it is traditional to fly across the country to meet clients rather than to ask the to engage in virtual meetings, and as mentioned before, it is believed that South African culture is firmly rooted in tradition.
- Few South African software companies are virtual; most have large corporate buildings situated in major South African cities where employees work for eight hours a day. Countries such as the United States are moving away from large corporate buildings, and encourage employees to work from home on flexi-time, thus promoting the idea of all things virtual. South Africa is only just awakening to the advantages offered to both the employee and the employer by such a method of virtual work.

The main idea underlying these reasons is the belief that corporate culture in the software industry is changing. Information Systems personnel are motivated in different ways to people in other professions, and many thrive on the idea of being able to keep their own hours and work from any location. The author believes that as South Africa becomes aware of the productivity to be gained from virtual work, all forms of virtual software development (including virtual RE) will become more popular.

10.4 Recommendations

This section summarises the recommendations in terms of the theoretical model. Therefore, the recommendations explain how and where the theoretical model should be adapted in order to bring it in line with the practical findings of the empirical study. As mentioned previously, the results of the empirical study are not wholly convincing as a result of the limited size of the sample population, however, they do indicate tendencies towards confirmation or rejection of the CSFs, thereby providing sufficient reasons for adapting the holistic model of RE based on the confirmation, rejection or modification of the CSFs. The holistic model of RE is reproduced in Figure 10.3.

The model of virtual RE was discussed in Chapter 7 in terms of its various components. It was noted that the major components are governed by frameworks, each of which prescribes activities to be performed in order to realise the success of that component. The frameworks together constitute the model, as by ensuring the success of each component, the success of the entire virtual RE process is assured.

This section discusses recommendations regarding the critical success factors and other information gathered in the empirical study in terms of the components of the model and their corresponding frameworks. The detailed frameworks are presented in Appendix C. It must be noted that the interdependence of the frameworks and components mean that each critical success factor may relate to more than one component or framework.

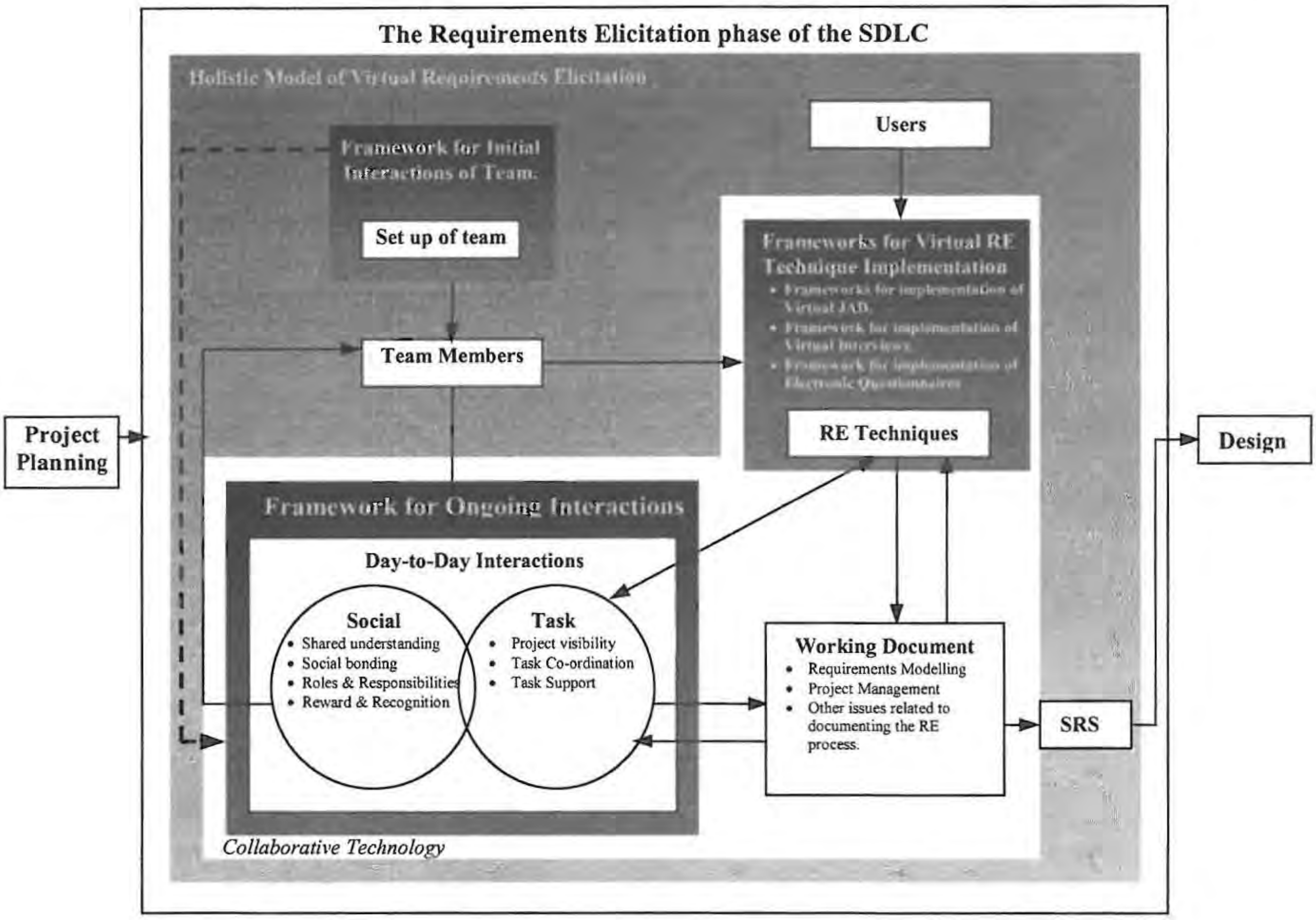

Figure 10.3: Holistic Model of Virtual Requirements Elicitation

10.4.1 Framework for Initial Virtual Team Interactions

Eight critical success factors relate to the initial set up phase of the team, and the corresponding framework. Three of these CSFs were confirmed with no need for modification. These are listed below:

- CSF 2: Hold an initial face-to-face team building session in order to lay stronger foundations for trust and bonding within the virtual team.
- CSF 4: Standardise communication and task performance technology in order to minimise co-ordination and integration problems.
- CSF 9: Ensure informal interaction takes place between team members in order to promote trust, social bonding, a sense of belonging to the team, social satisfaction regarding relationships within the team, motivation and responsibility.

Each of these issues must be considered during the set up phase of the team in order to assure the success of this initial phase of the RE process. The initial interactions framework in Appendix C describes these activities in Points 5 (CSF 2), 2.4 (CSF 4) and 6.6 and 7 (CSF 9).

CSF 9 is more an ongoing CSF, but informal interaction must be planned for during the set up of the team, and this is why it is included as a CSF for the initial interactions framework. Furthermore, it is believed that virtual team members should be made aware of the importance of informal interaction, and should be encouraged to think about and share ways in which they feel the virtual team can interact informally.

The research findings showed that not all virtual team members engage in informal interaction, and it was hypothesised that this is detrimental not only to the individual team members, but also to the team as a whole. Therefore, it is recommended that informal interaction by all team members should be encouraged, and a culture of sharing should be created in order to ensure that all team members share their values and beliefs with the rest of the team. The author believes that each team will have its own preferences regarding the nature of their informal interaction, and it is important to ensure that they are able to interact in the way that is most satisfying to them, as this will lead to the development of a cohesive team culture.

Various forums for encouraging informal interactions were identified in the findings, and it is recommended that these are implemented during the set up phase of the team as a starting point for team interactions on an informal basis. These forums include the following:

- A discussion forum where team members can meet to discuss personal interests.
- Informal learning experiences through online case studies (can be used for team building exercises as well) where participation is more important than actual knowledge.
- Online activities centered around getting to know each other.
- Network games to promote a sense of team spirit.

The design and implementation of these forums should be incorporated into the initial interactions framework in Points 6.6 and 7, which describe the activities to be performed to set the basis for informal interactions.

Several critical success factors relating to this framework were confirmed with modifications. The modified CSFs are stated below:

- CSF 3a: Address the following issues in detail at the initial team building sessions in order to ensure the success of the virtual team: definition of roles and responsibilities and clarity of processes for task performance and communication. Also lay the foundations for social bonding and relationship building and open an ongoing discussion of reward and recognition structures.

- CSF 3c: Address the following issues in detail at both the initial and ongoing team building sessions in order to ensure the success of the virtual team: clarity of participation, trust, co-ordination of work logistics and leadership issues.
- CSF 6: Implement a formal process for dealing with technological problems in order to minimise the problems of frustrations and general misunderstandings.
- CSF 7: Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings.
- CSF 8: Provide training in communications styles in a virtual environment in order to minimise frustration, delays in task co-ordination, delays in task performance and problems caused by general message misunderstandings.

CSF 3a recommends several issues to be addressed in detail only at the initial team building sessions. It is recommended that these are not addressed at ongoing team building sessions, although it is acknowledged that reminders may be necessary if people do not adhere to their roles, or if various processes break down. CSF 3c suggests several issues to be addressed at both the initial and the ongoing team building sessions at an equal level of adequacy. The initial interactions framework prescribes several other issues to be addressed at the initial team building sessions (Points 5.4 and 5.5), so these sections must be adapted in order to conform to the CSFs 3a and 3c.

It was confirmed that a process for dealing with technological problems would allow for the minimisation of frustration and general misunderstandings. It was also theorised that such a process would help to reduce the focus on the technology rather than the content of virtual communications when technological problems arose. As such, although the validity of this reason has not been confirmed empirically, it is recommended that the process for dealing with technological problems should be designed and implemented in such a way as to provide virtual teams with as seamless a working environment as possible, as this will allow them to concentrate on the work rather than the enabling technology. The initial interactions framework prescribes that the process should be designed and implemented in the first weekly virtual team meeting (Point 6.4).

CSFs 7 and 8 should also be designed and implemented in the set-up phase of the team, and their importance should be communicated to all virtual team members. The framework prescribes the steps to be taken regarding communications styles training and the development of a communications strategy in Points 6.2 and 6.3.

CSF 5 relates to the initial virtual team interactions framework, but it could not be confirmed as a result of the fact that not enough information was gathered regarding the contribution of training levels to the overall success of the team. It is believed that training is an important constituent of overall success, but as this CSF was not confirmed, no recommendations can be made regarding it. Because the CSF was not rejected, it is believed that it should remain within the initial virtual team interactions framework.

Separate from the confirmation or adaptation of the CSFs, the empirical study also revealed other information according to which the model should be adapted. It was revealed in Section 10.3 that the maintenance of a development team presence at the user's site solves a number of problems and helps to boost user confidence, trust and commitment. Therefore, it is recommended that a development team member should be placed at the user's site at the start of the project. The development team representative thereby becomes a part of two teams, and acts as the intermediary between the development team and the users. The representative should remain at the user's site throughout the duration of the RE phase of development.

The recommendations detailed in this section require that the initial interactions framework be adapted in order to coordinate it with the findings of the research. The principal aspects of the initial interactions framework were shown in Chapter 7. Table 10.1 shows the principal aspects of the adapted framework, and the detailed modified framework is available in Appendix D. The holistic model of virtual RE has also been modified in order to include the team representative at the user site, and the adapted model is also available in Appendix D.

The following section discusses recommendations that are pertinent to the ongoing interactions framework.

1. Select Team

The team is selected on the basis of the skills and experience required for the project. A development team representative should be posted at the user site to promote clarity, trust and commitment from the user and developer sides.

2. Select collaborative technology and software for the team

It is recommended that a comprehensive group support system such as TeamRoom is used as the foundational technology for team communications. In addition various support technologies and software for task performance must be selected. Technology and software must be standardised across the team in order to ensure that co-ordination and integration problems do not surface, thus providing a seamless environment over which team members are able to interact transparently.

3. Install software and hardware

The chosen technology and software must be implemented at each team member's physical site.

4. Provide training

All team members should be trained in the use of the technologies and software, thus ensuring that they are used with maximum efficiency and effectiveness.

5. Implement initial face-to-face team building session

An initial team building session helps to lay stronger foundations for trust and bonding within the team. In addition, the objectives of the team building session should be determined in conjunction with a careful analysis of the needs of the team. It is believed that the following objectives should be addressed in detail only at the initial team building session in order to assure team success: the definition of roles and responsibilities, and clarity of processes for task performance and communication. In addition, the initial team building session should aim to lay the foundation for social bonding and relationship building, and open an ongoing discussion regarding reward and recognition structures. Other issues to be addressed in detail at both the initial and ongoing team building sessions include trust, clarity of participation, leadership issues, and the coordination of work logistics.

6. Implement initial virtual meeting

The initial virtual meeting allows team members to become familiar with the use of the collaborative technology. During the virtual meeting, communications styles training and a process for dealing with technological problems and a communications strategy should be detailed.

- The first virtual meeting should provide team members with training in communications styles in a virtual environment as virtual interactions are different to face-to-face interactions as a result of the technology barrier. Such training ensures that the team will be able to communicate with minimal frustration, delays in task co-ordination, delays in task performance and problems caused by general message misunderstandings.
- Implementation of a process for dealing with technological problems
  A process for dealing with technological problems must be detailed in order to ensure that team members are able to perform their tasks with minimal frustrations and general misunderstandings and to ensure a seamless environment for virtual communications and task performance over which team members are able to work transparently with a focus on the content of their work rather than the technology used to perform their work.
- Implementation of a communications strategy:
  The communications strategy describes the frequency with which various meetings will take place, which media will be used for each type of meeting, when and how documentation will be updated, how team members will communicate regarding task performance. In this way team members are able to perform their tasks with minimal frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings. It is recommended that team members engage in a weekly update meeting where they are able to educate others as to the status of their work.

7. Set up informal chat room for team members

Informal interaction is considered to be important in the development of a cohesive team culture, as this is the principal way in which team members share their values and beliefs with the team. A strongly bonded team is likely to be more effective than teams with few social ties, as bonded team members are more aware of their responsibilities towards their fellow team mates, and are able to work together towards a common purpose. Therefore, it is extremely important that a channel for informal interaction be set up.

Forums such as network games, activities, online case studies where the focus is on participation rather than knowledge are important channels for informal interaction, and should be set up as example forums. In addition, team members should be made aware that it is their responsibility to suggest ways in which they feel they can encourage all team members to interact informally on a regular basis. They should be given every assurance that their suggestions will be implemented if feasible.

8. Implement first weekly meeting

This is the first meeting where directly work related activities will be performed in the virtual environment. Team members will define the type of SRS structure and models to be used, and will also determine task performance norms for the team.

9. Development of milestones

Deadlines should be developed by the project leader and the project schedule should be made available to all team members.

Table 10.1: Principal Aspects of Adapted Initial Interactions Framework

10.4.2 Ongoing Interactions Framework

In the description of the model of virtual RE, it was noted that the ongoing interactions framework is highly dependent on the initial interactions framework, as the initial framework lays the foundation on which the ongoing framework is based. As a result, the two frameworks share several critical success factors.

CSF 1 and CSF 9 were confirmed without the need for modifications by the results of the empirical study. They are listed below:

- CSF 1: Hold frequent team building sessions in order to lay stronger foundations for trust and relationships within the team.
- CSF 9: Ensure that informal interaction takes place between team members in order to promote trust, social bonding, a sense of "belonging" to the team, social satisfaction regarding relationships within the team, motivation and responsibility.

Point 1 in the ongoing interactions framework describes how to conduct the team building exercises, and states that they should be conducted at least bi-weekly. The results of the study indicate that no matter how often team building sessions were conducted, they increased trust and relationships, so it is recommended that the framework be adapted to say that team building should be conducted as frequently as possible, at a minimum level of twice a week.

Point 3 in the framework describes how to maintain informal interaction. Such maintenance requires monitoring of the interactions, and attention to the frequency with which each team member interacts with his/her team mates informally. In addition, as mentioned in Section 10.4.1, several types of forums were identified for encouraging virtual team members to engage in informal interaction, so these should be included in the informal interaction section of the framework. Finally, it was also mentioned that each team will have different preferences regarding the type of informal discussion forum that is the centrepiece for their group informal interactions. Therefore, this section of the framework should also incorporate a process for identifying and implementing team members' ideas for discussion forums.

Several critical success factors relating to the ongoing framework were confirmed subject to certain modifications. These are mentioned below:

- CSF 3b: Address the following issues in more detail at the ongoing team building sessions than at the initial team building session in order to ensure the success of the virtual team: social bonding and relationship building and reward and recognition structures.

- CSF 3c: Address the following issues in detail at the initial and ongoing team building sessions in order to ensure the success of the virtual team: clarity of participation, trust, co-ordination of work logistics and leadership issues.
- CSF 6: Implement a formal process for dealing with technological problems in order to minimise the problems of frustration and general misunderstandings.
- CSF 7: Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings.
- CSF 8: Provide training in communications styles in a virtual environment in order to minimise frustration, delays in task performance, delays in task co-ordination and problems caused by general message misunderstandings.

CSFs 3b and 3c relate to the ongoing issues to be addressed at team building sessions. Sections 1.3 and 1.4 of the framework include certain other issues to be addressed at the ongoing team building sessions, so it is recommended that these sections be modified to include only those issues mentioned in CSFs 3b and 3c.

As mentioned before, much of the ongoing interactions framework is highly dependent on the foundation laid by the initial interactions framework. Therefore, CSFs 6, 7, 8 and 9 are concerned mainly with the maintenance of issues that were implemented in the initial set up phase of the team.

In this light, it is recommended that the team is carefully monitored in order to ensure that:

- the technological problems process is being adhered to, and allows team members to focus on the content of their work rather than the technological problems;
- the communications strategy is being adhered to;
- team members are using the communications styles training that they received during the initial set-up phase;
- all team members are engaging in informal interaction via the forums that were set up in the initial phase;
- team members are suggesting and implementing new channels of informal interaction that are more suited to their team culture.

Point 4 in the ongoing interactions framework addresses the monitoring of the technological problems process, and needs to be adapted to ensure that the technological problems process allows team members to focus on the content of their work rather than technological problems. Point 5 targets the monitoring of communications styles training and the communications strategy, and does not require modification. Point 3 directs the monitoring of informal interaction and must be adapted to include the suggestions of the team members regarding informal interaction channels, as well as the implementation of these channels

The principal aspects of the ongoing interactions framework were shown in Chapter 7. The recommendations detailed above require that the framework should be adapted to conform to the research findings. Table 10.2 shows the principal aspects of the adapted framework, and the detailed modified framework is available in Appendix D.

1. Implement ongoing team building meetings
Frequent team building meetings are important in reinforcing trust and relationships within the team. The needs of the team should be analysed and objectives for each team building meeting should be detailed based on these needs. Social bonding and relationship building, and reward and recognition structures should be addressed in detail at the ongoing team building sessions, and clarity of participation, trust, coordination of work logistics and leadership issues should be addressed in detail at both the initial and the ongoing team building sessions.
2. Implement weekly status meetings
Weekly status meetings provide team members with the chance to update the team regarding the status of their work. Such meetings ensure that project visibility is maintained by all team members, by ensuring that they are aware of the current state of the project, and allows people to give advice and support regarding the work of their colleagues.
3. Encourage informal interaction
Informal interactions should be encouraged as far as possible, as they help the team to develop a team culture. In addition, celebrations at the end of milestones should be encouraged, as this allows bonding and a sense of achievement. It is important to determine whether the initial forums for informal interaction are being used, and whether or not team members are suggesting and implementing forums for informal interaction which encourage all team members to interact with each other.
4. Monitor adherence to Technological Problems Strategy
Team leaders should ensure that technological problem norms are being adhered to, and that technological problems are reported immediately and alleviated as soon as possible. Adherence to a technological strategy ensures that team members are able to perform their tasks with minimal frustration and misunderstandings, and with a focus on the content of their work rather than on the technology.
5. Monitor adherence to Communications Strategy
By monitoring the pattern of communications, it is possible to discern the level of adherence to the communications strategy. Adherence to the communications strategy allows team members to communicate with minimal frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings. The use of communications styles training should also be monitored, as the use of such training minimises frustration, delays in task co-ordination, delays in task performance and problems caused by general message misunderstandings.
7. Implement virtual RE techniques
The RE techniques should be implemented according to their respective frameworks.

Table 10.2: Principal Aspects of Adapted Ongoing Interactions Frameworks

10.4.3 Requirements Elicitation Frameworks

10.4.3.1 Videoconferencing JAD Framework

One critical success factor related to the videoconferencing JAD session, and it was confirmed without modifications based on the findings of the empirical study. The critical success factor is stated here:

- CSF 10: Ensure that the following are maintained in a videoconferencing JAD session in order to assure the success of the JAD sessions: three or fewer individual sites, an explicit form of non-verbal communication, a different emphasis on facilitation skills, maintenance of effective group dynamics and an explicit back channel of communication.

This CSF is encapsulated in Points 9, 10, 11 and 5.5 of the videoconferencing JAD framework. Because the CSF was accepted without condition, the videoconferencing JAD framework requires no adaptation.

10.4.3.2 GSS JAD Framework

The CSF related to this framework could not be verified as there were no responses to this section of the questionnaire. It is recommended that the CSF should not be rejected, as the lack of responses only indicates that none of the sample population engaged in GSS JAD. In addition, the CSF is derived from the model of RE which is firmly rooted in an extensive literature review that points to the importance of the CSF. Therefore, it is recommended that further research should be conducted regarding the importance of the CSF before it is accepted or rejected.

Such research should test the validity of the CSF in global virtual teams, as it is clear that South Africans do not engage in such JAD sessions. The CSF is stated as follows:

- CSF 11: Ensure that the following are maintained in a GSS JAD session in order to promote success: similar typing speeds of all participants, no anxiety from less technical users, maintenance of effective group dynamics, spontaneity of dialogue, non verbal cues, an explicit form of non-verbal communication, and an explicit back channel of communication.

This CSF is encapsulated in Points 3, 10, 13.6, and 15.2

10.4.3.3 DVC Interview Framework

Similarly, the CSF relating to the DVC interview framework could not be confirmed as a result of null responses to the corresponding questions, and therefore it is recommended that further research is conducted in this area using global virtual teams. The CSF is stated as follows:

- CSF 12: Ensure that the following are maintained in a DVC Interview in order to promote success: sufficient lighting, high resolution of image on screen, low audio-video lag, eye contact, ability to read body language, trust, credibility of interviewer.

This CSF is encapsulated in Points 12, 15.4 and 16.3

10.4.3.4 Electronic Questionnaire Framework

There were no critical success factors for the implementation of an electronic questionnaire, as it was determined that the design and implementation of the electronic questionnaire follows a very similar procedure to the design and implementation of a traditional questionnaire. As both techniques require very little user-developer interaction, there were few factors that were thought to be critical to the success of the electronic questionnaire. There is very little that is "new" within this framework, and it was included mainly to ensure that the holistic model was comprehensive.

10.5 Summary of Recommendations

It was recommended that the frameworks for each component of RE be adapted in order to conform to the findings of the empirical study. This section summarises the recommendations presented in the previous section.

1. Place a development team representative at the user site to promote trust, clarity and commitment from user and development sides.
2. Hold an initial face-to-face team building session in order to lay strong foundations for trust and bonding within the virtual team.
3. Hold frequent team building sessions in order to reinforce trust and relationships within the team.
4. Standardise communication and task performance technology in order to minimise co-ordination and integration problems.
5. Ensure informal interaction takes place between team members in order to promote trust, social bonding, a sense of belonging to the team, social satisfaction regarding relationships within the team, motivation and responsibility.
6. Ensure that team members suggest and implement team forums for informal interaction that will encourage all team members to participate in such informal interactions.

7. Address the following issues in detail only at the initial team building session in order to ensure the success of the virtual team: definition of roles and responsibilities and clarity of processes for task performance and communication. Also lay the foundation for social bonding and relationship building and open an ongoing discussion of reward and recognition structures in order to ensure the success of the team.
8. Address the following issues in more detail at the ongoing team building sessions than the initial team building session in order to ensure the success of the virtual team: social bonding and relationship building and reward and recognition structures.
9. Address the following issues in detail at both the initial and ongoing team building sessions in order to ensure the success of the virtual team: clarity of participation, trust, co-ordination of work logistics and leadership issues.
10. Implement a formal process for dealing with technological problems in order to minimise the problems of frustration and general misunderstandings and to ensure a seamless environment for virtual communications and task performance over which team members are able to work transparently, and with a focus on the content of their work and communications rather than the technology.
11. Implement a communications strategy in order to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings.
12. Provide training in communications styles in a virtual environment in order to minimise frustration, delays in task co-ordination, delays in task performance and problems caused by general message misunderstandings.
13. Ensure that the following are maintained in a videoconferencing JAD session in order to assure the success of the JAD sessions: three or fewer individual sites, an explicit form of non verbal communication, a different emphasis on facilitation skills, maintenance of effective group dynamics and an explicit back channel of communications

The above recommendations relate directly to the frameworks which comprise the holistic model of RE. Additional recommendations include the conducting of further research regarding the validity of the frameworks for GSS JAD and DVC interviews using global virtual teams.

10.6 Conclusion

This chapter explained how the results of the research detailed in Chapter 9 related to the confirmation of validity of the critical success factors. It was noted that the results of the hypothesis tests only indicate a tendency towards confirmation or rejection of the critical success factors as a result of the small size of the overall sample population. Based on the results of these tests, it was found that all but two of the critical success factors possessed such a tendency towards confirmation, with or without modification. The critical success factors relating to GSS JAD sessions and DVC interviews could not be confirmed as no data regarding these issues was gathered in the empirical study. This meant that the hypotheses relating to these critical success factors could not be tested, resulting in the inability to validate the critical success factors.

The remainder of the critical success factors were found to be valid and important, although some had to be modified to a certain extent based on the findings of the empirical study. The modifications and the reasons for the modifications were detailed in this chapter, and it was noted in the recommendations section that the holistic model of RE should also be modified to bring it in line with the adapted critical success factors. In addition, several other important issues regarding other problems experienced by the respondents in their virtual teams and the corresponding solutions came to light. It was recommended that these should also be incorporated into the virtual RE model in Chapter 7.

The following chapter concludes the research by summarising the major aspects of the study, and describes the principal contributions of the research in terms of the literature, the holistic model of virtual RE and the empirical study used to validate the critical success factors for virtual RE.

PART VI
Conclusion

This section concludes the research by discussing the contributions of this research and detailing areas for future research.

Chapter 11

Conclusion

11.1 Introduction

The research detailed in this dissertation focuses on overcoming the problems experienced by virtual team members engaged in distributed RE. This objective was accomplished via the conception of a holistic model of RE, consisting of several frameworks, which prescribe the activities to be performed to ensure the success of the virtual RE team. This chapter concludes the research by detailing its contributions and discussing areas of future research within the subject area.

11.2 Contributions of the Research

Virtual teams are a rapidly expanding aspect of today's business society. Constant innovations in collaborative technology, and the increasing trend towards globalisation has seen an explosive growth in distributed work in organisations across the world. The advantages of using virtual teams are tremendous in terms of the cost savings, time savings and global customer reach that they can offer to an organisation. In addition, the emphasis on knowledge management, and the importance of information as a competitive advantage, has caused many organisations to seize the concept of virtual teams in a bid to gain and maintain a competitive footing.

The software industry is well positioned to take advantage of the benefits offered by virtual teams, as the ability to build an expert team from disparate locations offers many benefits. Despite these returns however, virtual teams often fail for a number of reasons, many of which arise from a lack of consideration that the virtual nature of the team requires a completely new paradigm for communication and task performance.

In light of this, it is first necessary to overcome the problems of virtual teams before they can be used with maximum efficiency and effectiveness. This research contributes to the conquering of such problems, but is scoped by considering only a small sub-section of virtual teams, namely, South African virtual teams engaged in distributed RE. Despite the need to scope the research however, it is important to note that several contributions of this research apply to more general virtual teams.

RE is an initial phase of software development, which aims to identify the characteristics of the system to be developed through extensive developer-user interaction. In addition, RE team members also interact within the team on a day-to-day basis, as they use the requirements collected from the users to develop a SRS.

Developer-user interactions take place mainly through the implementation of RE techniques, such as JAD, interviews and questionnaires. Several of these techniques can be adapted for use within the virtual environment, but this research focuses on the three principal techniques mentioned above. The adaptation of these techniques into the virtual environment brings about many problems, most of which relate to the need to use technology for all interactions. The various collaborative technologies available were analysed, and the characteristics of the technology were matched to the characteristics of the RE techniques in order to determine the most suitable technology for the implementation of each technique.

The research identified a comprehensive list of problems experienced by virtual team members and users within the implementation of these techniques.

Virtual teams also interact within their teams outside of the RE technique implementations. Such interactions take place via collaborative technologies, and they bring with them their own set of problems. These problems occur within both the social and task dimensions of communications. The two dimensions of communications were discussed in the research, and a comprehensive set of problems relating to the two dimensions were identified.

Solutions to the problems within the implementation of the techniques, and those within the day to day interactions of the team were identified through an extensive literature survey and the author's own hypotheses and beliefs.

The main contribution of this research is the development of a holistic model of RE based on these solutions. The model consists of various frameworks, each of which prescribes the activities to be performed to ensure the success of a component of the RE process. By assuring the success of each individual component, it is possible to assure the success of the entire process. The holistic nature of the model means that it applies to the entire RE process – all the activities required to be performed to ensure the success of the virtual RE team are detailed from the conception of the team to the production of the SRS.

The model consists of three major frameworks: the framework for initial interactions, the framework for ongoing interactions and a set of frameworks for the implementation of the RE techniques. The frameworks are dependent on each other to a large extent, as the success of one component of the process is often dependent on the success of another. Thus, the initial interactions framework lays the foundation for team interactions, communications and task performance, whilst the ongoing interaction frameworks maintains the team's interactions, communications and task performance. The implementation of the RE techniques is closely linked to the ongoing interactions framework, as the use of such techniques is a major part of the team's work. Each major technique possesses its own framework, thus allowing for the easy insertion of new frameworks for other techniques of RE.

An examination of the principal aspects of each framework revealed several critical success factors for the virtual team. These critical success factors are the most important to the success of the virtual team. In order to verify the rationale behind the model, the critical success factors were verified through the use of an empirical study. Most of the critical success factors were confirmed, some with adaptations. It was noted in the research that the empirical study used to confirm, reject or adapt the CSFs was limited in the sample population to which the study was administered. As a result, it was further mentioned that the results of the study cannot be considered to conclusively validate the CSFs, although the same results do provide sufficient indication of a tendency towards such validation/confirmation.

The confirmation of these CSFs shows that the reasoning behind the model is sound and valid, although the model itself has not as yet been tested empirically. The contributions of this research lie in the identification of these critical success factors for virtual teams engaged in RE. The adherence to these factors ensures that virtual team members engaged in RE will avoid many of the problems that such teams are prone to. The confirmed CSFs, and their contributions to this research are described below:

1. A development representative should be placed at the user site in order to ensure trust, commitment and understanding from the users and the developers throughout the development project.
2. Teams should engage in an initial face-to-face team building session in order to lay the foundation for trust and bonding within the team. At this team building session, roles should be defined and the processes for task performance and communication should be clarified. The addressing of these two issues takes place mainly at the initial team building meeting, although there are several other issues that should be addressed throughout the lifecycle of the team.
3. Teams should engage in frequent team building sessions throughout the lifecycle of the team, as more frequent team building sessions increase trust and bonding within the team. Such trust and bonding is important, as it increases motivation and social satisfaction of team members, ultimately resulting in effective team work. Social bonding and relationship building should therefore be the focus of such team building sessions, and team members should also be encouraged to discuss their reward and recognition structures. Other issues to be addressed at both the initial and the ongoing team building sessions include clarity of participation, trust building, the coordination of work logistics and leadership issues.
4. Because of the technology-based focus of the virtual team, the planning for and selection of appropriate technology for the virtual team is important. The technology should be selected on the basis of best "fit" between the technology and the tasks to be performed, and the preferences of the team. Despite the need to select and plan for technology carefully, technology should not be the main preoccupation of the virtual team. It is a common problem that there is often a focus on the technology rather than the content of the work, and this should be avoided at all costs, as it undermines the value of the virtual team. To achieve this objective, it is necessary firstly to standardise the technology and software across the team, and to develop a process for dealing with technological problems.
5. It is extremely important that the technology and software for virtual team communications and task performance are standardised across the team in order to ensure that they do not encounter coordination and integration problems. Such standardisation therefore enables a seamless environment across which communication and task performance can take place transparently.

6. Reaching towards the goal of a seamless environment is also aided by the identification of a strategy for dealing with technological problems. Such a strategy enables misunderstandings and frustrations to be reduced, thereby enabling more efficient and effective work performance.
7. Furthermore, communication in a virtual environment is very different to face-to-face communication, because of the dependence on technology to communicate. Such a dependence brings about a host of problems, as team members who are used to communicating face-to-face have to move into communicating in a virtual environment, where many of the cues and implicit signals are lost. Therefore, it is important to provide them with training in communication styles in a virtual environment, in order to minimise frustration, delays in task co-ordination, delays in task performance and problems caused by general message misunderstandings.
8. Closely linked to the reasons behind providing communications styles in a virtual environment is the need to develop a communications strategy for team interactions. Because different technologies are suited to different types of interactions, team members must define the types of technology to be used for various types of meetings and interactions. Issues of time zone differences (not applicable to South African virtual teams) and differing schedules also make the need for an explicit communications strategy apparent. By implementing and adhering to such a strategy, team member are able to minimise frustration, delays in task performance, delays in task co-ordination, misunderstandings caused by language differences and problems caused by general message misunderstandings.
9. An important aspect of the general interactions of virtual teams is informal interaction. It was found that informal interaction is the basis of a cohesive team culture. A strong team culture is extremely important to a virtual team, as such teams often have problems maintaining a sense of group identity and shared purpose. Informal interaction allows for trust, social bonding, a sense of belonging to the team, social satisfaction regarding relationships within the team, motivation and responsibility. Such informal interaction should therefore be promoted through the implementation of interaction forums where team members can meet to discuss issues that are not work-related. Examples of such forums include chat rooms, online informal learning experiences and other online activities such as network games. As each team differs in the norms, values and beliefs it upholds, the responsibility of defining forums which encourage all team members to participate in informal interaction rests on the shoulders of the team members.

Team members engage in RE techniques with system users in order to discover requirements about the system to be built. Although three major techniques of RE were examined in this study, each using various types of technology, only the critical success factor for videoconferencing JAD was confirmed. Confirmation of critical success factors for the other techniques remains an important aspect of future research. In addition, frameworks for the implementation of other RE techniques can be added easily to the model.

10. With regards to videoconferencing JAD, it was found that such a JAD session is only successful if there are three or fewer individual sites. Where there are more sites, the session becomes difficult to control and coordinate, and may lose some of its advantages.
11. In addition, it is important to maintain an effective form of non-verbal communication in the JAD session, as, even though such a session is "almost" face-to-face, many of the non-verbal cues of participants and facilitators are lost.
12. Furthermore, facilitators in a videoconferencing JAD session require a different, or more enhanced set of skills to facilitators in a traditional environment, and therefore, the facilitator of such a JAD session should be well trained in the skills required for the successful execution of a videoconferencing JAD session.
13. Videoconferencing JAD sessions are also prone to the same group related disadvantages of traditional groups, and the additional, virtual nature of the session makes the maintenance of group dynamics difficult. Group dynamics is one of the most important advantages of JAD sessions, and therefore it is important that facilitators recognise this difficulty, and make the additional effort to maintain these dynamics.
14. Finally, back channels of communication do not evolve naturally in a virtual environment, especially between individual sites. Such back channels are important in generating feedback regarding the success of the JAD session. It is the responsibility of the JAD facilitator to set up an explicit back channel of communication, and to encourage participants to use it to discuss the JAD session.

11.3 Future Research

The rationale behind the holistic model of RE was tested by probing the opinions of various South African IS professionals with practical experience in virtual teams as to the importance of the critical success factors. The confirmation of these CSFs implied confirmation of the reasoning behind the model. Areas for future research based on the subject area studied in this dissertation are listed below:

1. Proposed Model

- A major area of future research should be conducted in the use of the full model or a subset of its frameworks, in virtual RE, in order to validate the model as a whole, or one or more of its sub-frameworks.

2. Initial Interactions Framework

Research should be conducted in the following areas:

- Determination of the best technologies to be used for the general interactions of a virtual team engaged in virtual RE. The use of the technology depends to a great extent on the culture of the team, the tasks to be performed and the outcome required. It is important to develop a framework that will assist the team in choosing the technology that will enable them to perform their tasks with maximum effectiveness and efficiency.
- Types of team building activities to be performed at the initial face-to-face meeting in order to address the issues that are pertinent to the success of the team.
- Type, content and methods of communications styles training in a virtual environment.
- The content and rationale for the content of the process for dealing with technological problems.
- The content and rationale for the content of the communications strategy.

3. Ongoing Interactions Frameworks

Research should be conducted in the following areas:

- Types, nature and content of informal discussion forums which will engage all team members in informal interaction.
- Types of virtual team building activities to be performed at the ongoing team building sessions in order to ensure the success of the team.
- Methods and techniques of monitoring and encouraging informal interaction.

4. RE Frameworks

Research should be conducted within the following areas:

4.1 JAD Frameworks

- Methods and techniques of non-verbal communication in the videoconferencing JAD and the GSS JAD environment.
- Types of facilitation skills required in the virtual JAD environment
- Methods and techniques of maintaining effective group dynamics in the virtual JAD environment.

4.2 Desktop Videoconferencing Interviews

- The effect of using desktop videoconferencing interviews on the trust and credibility of the interviewer.

4.3 Other* RE *Techniques

- The adaptation of other traditional RE techniques into the virtual environment.

11.4 In Closing

This research developed a holistic model of virtual RE to overcome the problems experienced by virtual teams engaged in distributed RE. Although the evidence shows that South Africa has not yet embraced the concept of virtual teams in software development to any great degree, it is believed that the use of such teams is going to become far more prevalent in the country, as companies strive harder for global reach. The advantages of using such teams far outweigh the costs, and by preventing the problems to which such teams are prone through a sound understanding of the nature of the teams, it is believed that the largely untapped (in South Africa) potential of virtual teams can be reached.

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Appendix B

Questionnaire

Virtual Team Questionnaire

Thank you for accessing this questionnaire. The questionnaire is part of a research project aimed at identifying the problems experienced by virtual team members engaged in requirements elicitation, in order to develop a model of virtual requirements elicitation which overcomes or avoids these problems. You have been selected to participate in this study as a result of your experiences as a virtual team member.

Instructions for Answering the Questionnaire

1. Please answer the questionnaire with your last or current virtual requirements elicitation team experience in mind. If you have participated in more that one virtual requirements elicitation team, and wish to answer the questionnaire based on your experiences in more than one virtual team, please email udeabrew@ru.ac.za in order to be assigned more questionnaire sessions.

2. Please note that you are permitted only one questionnaire session at a time - i.e. you may not log out of the questionnaire and return to it. If for any reason you are unable to complete the questionnaire and wish to return to it later, please email u.deabrew@ru.ac.za to be assigned another questionnaire session.

3. The questions are divided into several blocks in order to divide the questionnaire itself into sub-topics. Each block is presented in one window. At the end of each block is a "Continue" button which you must click to move on to the next block of questions.

4. Should you encounter any problems with the questionnaire, please do not hesitate to contact me.

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Continue

Virtual Team Questionnaire

Section 1: Team Building

This section of the questionnaire concerns team building with your virtual team on both an initial and ongoing basis.

1. Was or is your project team engaged in team building sessions?
   - Yes
   - No
2. At what stage of the project did you have team building sessions?
   - Planning
   - Analysis
   - Design
   - Implementation
   - Maintenance
3. How often did you have team building sessions?
   - Once a week
   - Once every fortnight
   - Once a month
   - Less than once a month
   - Not at all
4. Do you feel that more frequent team building sessions would have reinforced trust and relationships within your team?
   - Yes
   - No
   - N/A
5. Was your first team building session face-to-face?
   - Yes
   - No
   - N/A
6. Do you feel that having an initial face-to-face team buildings session allowed/ would have allowed for greater trust and bonding compared to no face-to-face meeting?
   - Yes
   - No
   - N/A

7. Please rate the extent to which the following issues were addressed at the initial team building session.

- Clarity of Participation
- Clarity of Goals
- Social Bonding and relationship building
- Clarity of processes for task performance and communication
- Defining roles and responsibilities
- Trust
- Co-ordination of work logistics
- Leadership issues
- Management of conflict
- Reward and recognition structures

8. Please rate the extent to which the following issues were addressed at the ongoing team building sessions.

- Clarity of Participation
- Clarity of Goals
- Social Bonding and relationship building
- Clarity of processes for task performance and communication
- Defining roles and responsibilities
- Trust
- Co-ordination of work logistics
- Leadership issues
- Management of conflict
- Reward and recognition structures

9. Please rate the overall success of the team as a result of each issue mentioned below.

- Clarity of Participation
- Clarity of Goals
- Social Bonding and relationship building
- Clarity of processes for task performance and communication
- Defining roles and responsibilities
- Trust
- Co-ordination of work logistics
- Leadership issues
- Management of conflict
- Reward and recognition structures

Continue

Virtual Team Questionnaire
Section 2: Technology

This section of the questionnaire concerns the use of communications and task performance technology within your virtual team.

10. Please indicate your use of the following media for communication with your fellow team members.

Electronic Mail
Internet Chat Room
Meeting System
Telephone
Fax
Messaging Service
Room Videoconferencing
Desktop Videoconferencing
Teleconferencing
Face-to-Face

11. Was/is the communication technology and software standardised across the team?

- Yes
- No

12. Please state whether you experienced communication related co-ordination and integration problems.

- Yes
- No

13. Was/is the task performance technology and software standardised across the team?

- Yes
- No

14. Please state whether you experience task related co-ordination and integration problems.

- Yes
- No

15. If you answered "Yes" to questions 12 and/or 14, please provide a brief explanation of these problems.

16. Please indicate the extent of training provided regarding the use of task performance and communication software and technology.

Task Performance	[▾]
Communication	[▾]

17. Was/is there a formal process for dealing with technological problems?

- ( ) Yes
- ( ) No

18. Did/do all team members adhere to this process?

- ( ) Yes
- ( ) No

19. Did the process/could the process have minimised any of the following?

Frustration	( ) Yes	( ) No	( ) Not Sure
Misunderstandings	( ) Yes	( ) No	( ) Not Sure
Delays in task performance	( ) Yes	( ) No	( ) Not Sure
Delays in task co-ordination	( ) Yes	( ) No	( ) Not Sure

Continue

Virtual Team Questionnaire
Section 3: Communication

This section of the questionnaire concerns communication between the team members of your virtual team.

20. Was/is there a communications strategy to which team members adhered/adhere?

- Yes
- No

21. Did the strategy/could the strategy have minimised any of the following?

Frustration	Yes	No	Not Sure
Delays in task performance	Yes	No	Not Sure
Delays in task co-ordination	Yes	No	Not Sure
Misunderstandings arising as a result of language differences	Yes	No	Not Sure
Problems arising as a result of cultural differences	Yes	No	Not Sure
General Message Misunderstanding	Yes	No	Not Sure

22. Was training in communications styles in a virtual environment provided?

- Yes
- No

23. Did this training/could this training have minimised any of the following?

Frustration	Yes	No	Not Sure
Delays in task performance	Yes	No	Not Sure
Delays in task co-ordination	Yes	No	Not Sure
Misunderstandings arising as a result of language differences	Yes	No	Not Sure
Problems arising as a result of cultural differences	Yes	No	Not Sure
General Message Misunderstanding	Yes	No	Not Sure

Continue

Virtual Team Questionnaire
Section 4: Informal Interaction

This section of the questionnaire concerns any informal interaction (i.e. interactions outside of work related issues), which occurred within your virtual team.

24. How often does your team engage in informal interaction?
    - Between twice and five times a week
    - Once every fortnight
    - Once a month
    - Less than once a month
    - Not at all

25. Please indicate the extent to which you used the following media to interact informally with your team mates.

Face-to-Face	
Electronic Mail	
Telephone	
Internet Chat Room	
Meeting Systems (e.g. Netmeeting)	
Room Videoconferencing	
Desktop Videoconferencing	

26. Did/do all the members of your team engage in informal interaction?
    - Yes
    - No
    - N/A

27. Do you fell that engaging in informal interaction more frequently allowed/could have allowed increased levels of any of the following?

Trust between team members	Yes	No	Not Sure
Social bonding between team members	Yes	No	Not Sure
A sense of "belonging" to the team	Yes	No	Not Sure
Social satisfaction regarding relationships within the team	Yes	No	Not Sure
Motivation to perform tasks more efficiently for the team	Yes	No	Not Sure
Responsibility to not let your team mates down	Yes	No	Not Sure

28. Do you feel that you would have engaged in informal interaction more often if there had been something of common interest that would have drawn your team mates into some type of dicussion forum?

- Yes
- No

29. Please provide a brief description of what kind of common interest could have drawn your team mates into an informal discussion forum.

Continue

Virtual Team Questionnaire
Section 5: Requirements Elicitation Techniques

This section of the questionnaire concerns the actual requirements elicitation techniques which you may have used within your virtual environment

30. Please indicate the extent to which you engaged in the following requirements elicitation techniques.

Virtual JAD using videoconferencing	
Virtual JAD using a Group Support System	
Virtual interviews using Desktop Videoconferencing	
Virtual Interviews using a chat system	
Virtual Interviews using the Telephone	
Electronic Questionnaire	
Virtual Document Review	
Virtual Observation	

Continue

Virtual Team Questionnaire
Section 5.1: Videoconferencing JAD

This section of the questionnaire applies to those people who have engaged in a videoconferencing JAD session or a videoconferencing structured workshop. If you do not fall into the above category, please click the Continue button at the bottom of the screen.

31. Please indicate your role in the videoconferencing JAD session.

- Facilitator
- Developer
- User
- Other

32. Please indicate whether the following factors were present or absent from the videoconferencing JAD session.

Three or fewer individual sites	Present	Absent
Explicit form of non-verbal communication	Present	Absent
Different emphasis on facilitation skills	Present	Absent
Maintenance of effective group dynamics	Present	Absent
Explicit back channel of communication	Present	Absent

33. Please indicate the level of success of the videoconferencing JAD session as a direct result of the absence/presence of the following factors as noted by you in the previous question.

Three or fewer individual sites	
Explicit form of non-verbal communication	
Different emphasis on facilitation skills	
Maintenance of effective group dynamics	
Explicit back channel of communication	

Continue

Virtual Team Questionnaire
Section 5.2: Group Support Systems/Meeting System JAD

This section of the questionnaire applies to those people who have engaged in a Group Support Systems or Meeting System JAD session or a Group Support System or Meeting System structured workshop. If you do not fall into the above category, please click the Continue button at the bottom of the screen.

34. Please indicate your role in the GSS JAD session.

- Facilitator
- Developer
- User
- Other

35. Please indicate whether the following factors were present or absent from the GSS JAD session.

Domination of session by participant(s) with higher typing speeds	Present	Absent
Reduced participation by participant(s) with lower typing speeds	Present	Absent
Frustration arising from being unable to keep up with typing speed	Present	Absent
Increased anxiety as a result of having to use the technology	Present	Absent
Maintenance of effective group dynamics	Present	Absent
Spontaneity of dialogue	Present	Absent
Non-verbal cues	Present	Absent
Explicit back channel of communication	Present	Absent

36. Please indicate the level of success of the GSS JAD session as a direct result of the absence/presence of the following factors as noted by you in the previous question.

Domination of session by participant(s) with higher typing speeds

Reduced participation by participant(s) with lower typing speeds

Frustration arising from being unable to keep up with typing speed

Increased anxiety as a result of having to use the technology

Maintenance of effective group dynamics

Spontaneity of dialogue

Non-verbal cues

Explicit back channel of communication

Continue

Virtual Team Questionnaire

Section 5.3: Desktop Videoconferencing Interview

This section of the questionnaire applies to those people who have engaged in a Desktop Videoconferencing Interview. If you do not fall into the above category, please click the Continue button at the bottom of the screen.

37. Please indicate your role in the interview.
- Interview er
- Interview ee
- Other

38. Please indicate whether the following factors were present or absent from the desktop videoconferencing interview.

Insufficient lighting	Present	Absent
Low resolution of image on screen	Present	Absent
Audio-video lag	Present	Absent
Lack of eye contact due to looking at monitor when speaking	Present	Absent
Inability to read body language because of camera zoom	Present	Absent
Trusting interviewer enough to disclose sensitive information	Present	Absent
Credibility of interviewer	Present	Absent

39. Please indicate the level of success of the GSS JAD session as a direct result of the absence/presence of the following factors as noted by you in the previous question.

Insufficient lighting	
Low resolution of image on screen	
Audio-video lag	
Lack of eye contact due to looking at monitor when speaking	
Inability to read body language because of camera zoom	
Trusting interviewer enough to disclose sensitive information	
Credibility of interviewer	

Continue

Virtual Team Questionnaire
Section 6: Other Techniques and Problems

This section of the questionnaire asks you to state any other issues pertaining to your work in a virtual environment, which you feel have not been covered in this questionnaire.

40. Please describe other virtual requirements elicitation techniques that you have implemented which have not been covered in this questionnaire.

41. For each RE technique mentioned above, please state any problems you experienced with the implementation of the RE technique.

42. For each problem, please state what steps (if any) were taken toward the solving of the problems. Please also state what you think could have been done to solve these problems.

43. Please state any other problems you may have encountered during your experience as a virtual team member, and any solutions that were put forward (both suggested and implemented).

Continue

Thank you for completing this questionnaire. If you would like a copy of the results and findings of this survey, or if you have any queries, please do not hesitate to contact me.

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Continue

Appendix C: Detailed Frameworks for Holistic Model of RE

C.1 Framework for Initial Virtual Team Interactions

1. **Select Team**
   1.1. Skills and expertise
   1.2. Previous experience in the virtual environment is beneficial

2. **Select Collaborative Technology and Software**
   2.1. A comprehensive GSS such as TeamRoom is recommended as the foundational communication tool.
      2.1.1. Modularity
      2.1.2. Interface choices
      2.1.3. Data portability
      2.1.4. Provides structure and flexibility
      2.1.5. High user learning curve
   2.2. Choose support software to be implemented
      2.2.1. Word Processor
      2.2.2. Data modeling tool
      2.2.3. Project management tool
      2.2.4. Calendaring tool
   2.3. Determine technology infrastructure and hardware required
   2.4. Ensure that all technology and software is standardized to ensure that co-ordination and integration problems do not occur.

3. **Install software and hardware.**
   3.1. Distribute all software to virtual team members
   3.2. Interact with team members and systems administrators to ensure that the specified hardware is available at all sites.
   3.3. Set up central GSS server
   3.4. Install all hardware and software in conjunction with systems administrators and virtual team members.
   3.5. Ensure that all hardware and software is running.

4. **Provide Training**
   4.1. Determine team members' levels of competence with regards to software and technology in conjunction with team members.
   4.2. Set up training documentation.
   4.3. Distribute training documentation to team members.
   4.4. Follow up by ensuring that all team members are following the training program.
      4.4.1. Ensure that team members understand that comprehensive training assures the use of the technology with maximum effectiveness and efficiency.

5. **Implement Initial Face to Face Meeting**
   5.1. Decide on venue that is neutral and away from all members' worksites.
   5.2. Inform team members of time and date of initial meeting
   5.3. Ensure that team members understand that an initial face to face meeting is necessary to lay the foundations for trust and bonding.
   5.4. Analyse needs of the team
      5.4.1. Clarity concerning participation
      5.4.2. Clarity of purpose
      5.4.3. Social bonding and relationship building
      5.4.4. Clarity of processes for task performance and communication
      5.4.5. Roles and Responsibilities
      5.4.6. Trust
      5.4.7. Co-ordination of work logistics
      5.4.8. Leadership issues
      5.4.9. Management of conflict
      5.4.10. Reward and Recognition

   5.5. Determine objectives for team building
      5.5.1. Define a common purpose
      5.5.2. Build a satisfying and rewarding team culture based on social bonding and relationship building.

5.5.3. Build Trust
5.5.4. Clarify expectations by defining roles and responsibilities and participation arenas
5.5.5. Define reward and recognition structures
5.5.6. Determine work co-ordination
5.5.7. Determine conflict management procedures
5.6. Plan team building exercises
5.6.1. Select a neutral venue
5.6.2. Set the correct atmosphere
5.7. Conduct team building exercises
5.7.1. Create identity for the team
5.7.2. Write a Statement of Purpose for the team
5.7.3. Use contracting, leadership questionnaires, value discussions, intimacy exercises to allow team members to explore team culture issues, trust and expectations.
5.7.4. Decide on general team norms
5.7.5. Decide how conflict will be managed – define process of negotiation and problem resolution.
5.7.6. Reach agreement on reward and recognition structures
5.7.6.1. Team rewards rather than individual rewards
5.7.6.2. Praise at weekly update meeting
5.7.6.3. Celebration at the end of a milestone
5.7.6.3.1. Something different that the team can do together, which they will look forward to, and which signals celebration
5.7.6.3.2. E.g. newest network game
5.7.7. Discuss, in general, the implications of using communication technology rather than face-to-face communication (input to communications styles training).
5.7.8. Define roles and responsibilities
5.7.8.4. What roles does our team need?
5.7.8.5. How will we define those roles?
5.7.8.6. How will we share the roles
5.7.8.7. What is our strategy for re-evaluating roles and players as we go along?
5.8. Take a photograph of the team to put onto mousepads for each team member (this will serve as a consistent reminder of the team).
5.9. Review team building
5.9.1. Ask for feedback from team after each team building exercise
5.9.2. Ask for feedback from team on the overall team building effort once the meeting is over
5.9.3. Use feedback when designing team building exercises for the virtual team.

6. **Implement initial virtual meeting**
6.1. Ensure that all team members are able to use the software and technology.
6.2. Ensure that team members understand how to communicate in a virtual environment by providing communications style training.
6.2.1. Describe the importance of communications styles training in minimising frustration, delays in task performance and task co-ordination, misunderstandings arising as a result of language differences, problems arising as a result of cultural differences and general message misunderstandings.
6.2.1.8. Describe the need to provide contextual information
6.2.1.9. Use emoticons or capital letters to communicate the tone of message.
6.2.1.10. Remember it is the quality of the ideas that is of importance, not the quality of the language communicating the ideas.
6.2.1.11. Restate your team-mates' ideas to make sure that you interpreted their communications correctly.
6.2.1.12. Use humorous expressions that everyone can understand.
6.2.1.13. Use simple words and words representing real-life objects and events so that you are easier to understand.
6.2.1.14. Ask for team members' feedback.
6.2.1.15. Describe technical context so that team members will understand constraints.
6.2.1.16. Describe individual schedules so that team mates can understand each others' unavailability.
6.3. Develop the essentials of the team's communication strategy (communication norms)
6.3.1. Ensure that all team members understand the importance of such a strategy in minimising frustration, delays in task performance and task co-ordination, misunderstandings arising as a result of language differences, problems arising as a result of cultural differences and general message misunderstandings.
6.3.1.17. When will meetings take place?
6.3.1.17.1. Weekly update meetings MUST take place, as virtual teams require more frequent and explicit check-ins.
6.3.1.18. How will the meeting take place (i.e. which media will be used for which type of meetings?)
6.3.1.19. How often will team members provide status updates?
6.3.1.20. When and how will shared documentation in the central repository be updated?
6.3.1.21. Establish a code of conduct to avoid delays.
6.3.1.22. What other software and technology is needed (e.g. project calendaring tool, team calendar, etc.)
6.3.1.22.1. How will this support software be used?
6.3.1.23. How will tasks be co-ordinated in the face of time, space and cultural differences?
6.3.1.23.1. Draw up schedule of time zone differences of team members
6.3.1.23.2. Commit to updating team calendar with personal leave days and public holidays
6.3.1.23.3. Commit to leaving comprehensive contact details when going on leave or taking a holiday
6.3.1.23.4. Commit to writing a short exposition on personal values, beliefs and culture to place in an electronic yearbook
6.3.1.23.5. Commit to considering all of the above when contacting and working with colleagues on the team

6.4. Decide on process for dealing with technological problems
6.4.1. Describe the importance of a process for dealing with technological problems in terms of the minimisation of frustration, delays in task performance and task co-ordination and general misunderstandings.
6.4.1.24. Contact system administrator as soon as possible when there are technical difficulties.
6.4.1.25. Send log of messages received to date when there are questions about system reliability
6.4.1.26. When there are technical problems with messages sent to team mates, explain technical details in follow up message.
6.4.1.27. Send decoding instructions with coded documents.
6.5. Define social norms

6.6. Informal interaction on a regular basis
6.6.1. Describe the importance of informal interaction in terms of promoting trust, social bonding, a feeling of belonging to the team, social satisfaction regarding relationships within the team, and motivation to perform tasks more efficiently for the team, thereby building a cohesive team culture.
6.6.1.28. Commit to setting up a team room that allows photographs to be posted for informal chats
6.6.1.29. Place responsibility for creating at least one non-routine topic of conversation on one team member per week.
6.6.1.30. Commit to developing an electronic yearbook, which can be stored in one of the team rooms for perusal by all team members.
6.6.1.31. Encourage team members to post personal happenings onto team calendar
6.6.1.32. Commit to providing as much contextual information as possible in all communication
6.6.1.33. Commit to updating team calendar with personal information
6.7. Close first virtual meeting
6.7.1. Remind all team members of their duties before the next weekly meeting
6.7.1.34. Articles for the electronic yearbook
6.7.1.35. Updating team calendar with a comprehensive schedule of personal leave days and public holidays

7. **Set up informal chat room for team members**
7.1. Ask for photographs to be posted onto the site, so that team members have an idea of what the person they are talking to looks like.

8. **Implement first weekly meeting**
8.1. Define type of SRS structure to be used
8.2. Define types of models to be used to represent requirements
8.3. Decide on responsibilities for various sections of the SRS.
8.4. Set up a template for the SRS and place it in the central document repository.
8.5. Decide on task norms
8.5.1. Stick to the structure of the SRS
8.5.2. Commit to performing tasks as quickly, efficiently as possible
8.5.3. Send updates to all team members as soon as task is finished so that project schedule can be updated and dependent tasks can begin.
9. **Develop milestones and place project schedule in a Team Room**

C.2 Framework for Ongoing Interactions of Virtual Team

1. **Implement ongoing team building sessions**
1.1. Ensure frequent team building sessions in order to reinforce trust and relationships within the team.
1.2. Review feedback from past team building sessions
1.3. Analyse needs of the team on an ongoing basis using feedback from previous team building sessions
1.3.1. Clarity concerning participation
1.3.2. Clarity of purpose
1.3.3. Social bonding and relationship building
1.3.4. Clarity of processes for task performance and communication
1.3.5. Roles and Responsibilities
1.3.6. Trust
1.3.7. Co-ordination of work logistics
1.3.8. Leadership issues
1.3.9. Management of conflict
1.3.10. Reward and Recognition
1.4. Determine objectives for team building based on needs
1.4.1. Define a common purpose
1.4.2. Build a satisfying and rewarding team culture based on social bonding and relationship building.
1.4.3. Build Trust
1.4.4. Clarify expectations by defining roles and responsibilities and participation arenas
1.4.5. Define reward and recognition structures
1.4.6. Determine work co-ordination
1.4.7. Determine conflict management procedures
1.5. Plan team building exercises to achieve the objectives
1.5.1. Aim to come up with new and interesting exercises
1.6. Run team building exercises
1.7. Review
1.7.1. At the end of each exercise
1.7.2. At the end of the session
1.7.2.1. How valuable was the session?
1.7.2.2. How well did it work?

2. **Implement Weekly Status Meetings**
2.1. Each team member must state what they are doing with regards to the project
2.1.1. Reduces slacking as team members have to answer to their team mates.
2.1.2. Gives the whole team an idea of what team members are doing, and how it contributes to the overall purpose.
2.2. Each team member must state what tasks they have recently completed
2.3. Each team member must state what they are going to do next
2.3.1. Identify dependencies
2.4. Praise team members who have completed their tasks on time or ahead of schedule

- 2.5. Ask for input on task related issues from other team members
- 2.6. Discuss general issues
  - 2.6.1. Update on how the project is progressing as a whole
  - 2.6.2. Update on the project schedule
    - 2.6.2.3. When is the next milestone?
    - 2.6.2.4. Will it be reached on time?

3. **Encourage informal interaction**
   - 3.1. Monitor pattern of interactions regularly to ascertain whether or not:
     - 3.1.1. Team members interact regularly on an informal basis?
     - 3.1.2. Social relationships are being built up?
     - 3.1.3. Team members have a sense of "belonging" to the team
     - 3.1.4. All team members engage in informal interaction.
     - 3.1.5. Team members are socially satisfied within the team.
     - 3.1.6. Team members have a sense of responsibility towards the team.
     - 3.1.7. Team members have a more intense feeling of motivation as a result of informal interactions.
     - 3.1.8. The calendar is updated with personal happenings frequently?
     - 3.1.9. The electronic yearbook is being accessed, updated and read regularly?
     - 3.1.10. Team members are aware of social and physical contexts of their colleagues?
   - 3.2. Use feedback to determine issues to be addressed (needs) in next team building session
   - 3.3. Congratulate or sympathise with team members with regards to personal happenings on the team calendar
   - 3.4. Celebrations
     - 3.4.1. Newest network game
     - 3.4.2. Do people enjoy the celebration at the end of the milestone?
     - 3.4.3. If feedback is negative, a new form of celebration must be devised.

4. **Monitor adherence to Technological Problems Strategy**
   - 4.1. Are norms for dealing with technological problems being adhered to?
   - 4.2. Ask systems administrator to provide log of all reported technological problems on a weekly basis
   - 4.3. Check with team members whether the technological problems strategy allows them to perform their tasks with minimal frustration, delays and misunderstandings.
     - 4.3.1. If not, the strategy may have to be adapted.
   - 4.4. Use above feedback to determine issues to be addressed (needs) in next team building session.

5. **Monitor adherence to Communications Strategy**
   - 5.1. Are team members sensitive to time and space differences?
   - 5.2. Do people update the team calendar with personal leave days and public holidays?
   - 5.3. Are tasks completed or well on track before people take leave or public holidays?
   - 5.4. Are people working well together in the virtual environment?
   - 5.5. Is communications styles training being used by all team members?
     - 5.5.1. Are team members using their communications styles training to communicate with minimal frustrations, delays, general message misunderstandings, misunderstandings arising as a result of cultural differences and misunderstandings arising as a result of language differences?
   - 5.6. Use above feedback to determine issues to be addressed (needs) in next team building session.

6. **Implement Requirements Elicitation Techniques**

C.3 Framework for Design and Implementation of Videoconferencing JAD

Phase 1: Preparation

1. **Select participants**
   - 1.1. Use organisational charts and interviews to determine suitable participants.

2. **Develop web page for the project**
   - 2.1. Set up help centre
   - 2.2. Set up library for draft documents
   - 2.3. Set up back channel for feedback for personnel.

3. **Select all personnel**
   - 3.1. Remote support managers, technical manager, communication flow manager and scribe

4. **Select collaborative technology**
   - 4.1. Consultation with technical manager, remote support managers and communication flow manager. Also select technology needed for team building exercises.
     - 4.1.1. Minimum hardware requirements are cameras, projectors, projector screens, microphones and speakers.
     - 4.1.2. Use full duplex audio to ensure fluid conversation.
     - 4.1.3. Use separate dedicated phone links.
     - 4.1.4. Choose high bandwidth network type
     - 4.1.5. Choose suitable support technologies – CASE tools, electronic whiteboards, etc.
     - 4.1.6. Set up Control Room at facilitator's site, from which all technical equipment will be operated
     - 4.1.7. Train scribe in documentation technology.

5. **Develop template for working document**

6. **Determine analysis technique to be used.**

7. **Determine meeting locations in consultation with remote location managers.**

8. **Develop and distribute meeting agenda**

9. **Prepare environment**
    9.1. Ensure effective group and technology configuration
    9.2. Arrange all equipment in each venue in close consultation with remote managers, to ensure that all venues are set up in a similar fashion.
        9.2.1. Minimise ambient noise effects
        9.2.2. Lighting should be sufficient for written work, lighting should not wash out image projection, participants should be clearly lit.
        9.2.3. Layout each site as shown in Chapter 5 (Figures 5.1 and 5.2)
        9.2.4. Set up PCs or laptops necessary for team building exercises.
        9.2.5. Ensure effective group configuration and virtual social distance by:
            9.2.5.1. Positioning projector screens so that all participants can see each other
            9.2.5.2. Positioning loudspeakers as shown in conference layout for maximum clarity of sound.
            9.2.5.3. Ensuring adequate display size on the projector screens (as close to life size as possible without losing image clarity).
            9.2.5.4. Positioning workspaces as shown in conference layout so as to achieve maximum illusion of co-location.

10. **Determine non-verbal cues to be used**
    10.1. Coloured cards

11. **Setup back channel for participants on web page**

12. **Determine team-building exercises to use**
    12.1. Set up PCs or laptops accordingly with the help of remote managers and technical personnel.

13. **Implement initial meeting with all personnel**
    13.1. Hold a test run to ensure that technologies are functional, and lighting and sound are correct.
    13.2. Ensure that personnel are aware of the back channel of communication, and encourage them to use it.

14. **Implement pre-meeting with participants**
    14.1. Familiarise participants with the technology to be used (including technology for team building exercises).
    14.2. Establish management commitment
    14.3. Summarise the JAD process
    14.4. Distribute and discuss the working document

15. **Prepare back-up plan – e.g. audio conference**

16. **Last minute check**
    16.1. Each remote manager and the facilitator must check to see that the equipment is functioning as required.

17. **Establish contact**
    17.1. Establish contact with other venues at least 45 minutes before the JAD session begins.

Phase 2: Implementation

18. **Open the session**
    18.1. Brief welcome
    18.2. Run-down of agenda for the session

19. **Business Overview/Update**
    19.1. If this is the first session, a business overview is needed
        19.1.1. Presented by project sponsor
        19.1.2. Explanation of the importance of upgrading to or building a new system
        19.1.3. Encouraging the participants to discuss their needs and requirements carefully and completely
    19.2. If this is not the first session, the slot should be occupied by a project update.
        19.2.1. Presented by the facilitator
        19.2.2. Give participants feedback on what they did in the last session, and how they are going to build on it in this session.

20. **Familiarisation (for first session)**
    20.1. Ascertain that all participants are familiar with the technology to be used – Recap
    20.2. Introduce location managers and all other personnel and explain what their functions are.
    20.3. Familiarise participants with the web-page for the sessions, and encourage them to use the informal virtual café as a back channel for feedback and communication outside of the JAD sessions.

21. **Run team building exercise**
    21.1. If this is the first session, the participants should begin by introducing themselves, and using an intimacy exercise to get to know each other better, followed by the creation of an identity for the group and the creation of a statement of purpose.
    21.2. If this is not the first session, facilitators should use a shorter exercise
    21.3. Receive and discuss feedback on the exercise
    21.4. Develop group norms (first session only)
        21.4.1. Distribute coloured cards
        21.4.2. Familiarise participants with the use of coloured cards and emblems for non-verbal communication
        21.4.3. Allow participants to develop their own norms
        21.4.4. Display the norms on a whiteboard that will be visible at every meeting.

22. **Open discussion**
    22.1. Ask users about their requirements
    22.2. Participants negotiate requirements
    22.3. Keep track of open issues
    22.4. Do not digress from agenda
    22.5. Use observational, instructional, self and other awareness and evaluation skills to:
        22.5.1. Resolve conflicts
        22.5.2. Encourage participation
        22.5.3. Help group to understand technical terms and jargon and analysis techniques.
        22.5.4. Encourage clear communication
        22.5.5. Structure and record group's input in the shared workspace
        22.5.6. Help group recognise key issues and important solutions
        22.5.7. Guide the group while remaining neutral
        22.5.8. Encourage the use of non verbal communication
    22.6. Build data model

23. **Close the session**
    23.1. Re-cap the most important points
    23.2. Remind participants about the time and date for the next JAD session
    23.3. Remind participants about the back-channel that is available for communication with the facilitator and/or other participants, and encourage participants to use it to provide feedback.

Phase 3: Follow up

24. **Review working document and place updated copy on JAD session web page**

25. **Place minutes of JAD session on the web page.**

26. **Consult with remote managers, technical manager, and communications flow manager for feedback regarding the technical implementation of the JADA session.**

27. **Check chat café regularly until next session to receive feedback for self and JAD session evaluation.**

C.4 Framework for Design and Implementation of GSS JAD

Phase 1: Preparation

1. **Select technology.**
    1.1. TeamRoom is recommended, as it was designed specifically for requirements elicitation over the electronic workspace. Consider:
        1.1.1. Modularity
        1.1.2. Interface choices
        1.1.3. Data Portability
        1.1.4. Ability to provide both structure and flexibility
        1.1.5. User learning curve
        1.1.6. Multimedia network is required

2. **Select participants**

3. **Distribute typing tutor packages to participants**
    3.1. Send guidelines of what the minimum typing speed should be.

4. **Distribute copies of GSS application**
    4.1. Send clear installation instructions to participants.

5. **Install central server**

6. **Select and implement additional software for team building exercises.**

7. **Select and train scribe.**

8. **Develop a template for the working document.**
    8.1. Place template in the documentation room of the GSS application.

9. **Determine analysis technique to be used.**

10. **Determine non-verbal cues to be used**
    10.1. Ensure that GSS application is able to handle non-verbal cues

11. **Set up training program**
    11.1. Determine scenario
    11.2. Assign roles
    11.3. Determine requirements for each role.

12. **Contact all JAD participants about initial test meeting**

13. **Implement initial test meeting**
    13.1. Ensure that all participants are connected to the server
    13.2. Introduce all team members
    13.3. Explain how the GSS application works
    13.4. Allow participants to set up their personal rooms during the meeting.
    13.5. Inform participants of the presence of the Informal Chat Room, and encourage them to use it.
    13.6. Ascertain that typing speeds of participants are adequate
    13.7. Describe how the training exercise will proceed in the next meeting.

14. **Contact participants about training session.**

15. **Implement initial training session**
    15.1. Distribute scenarios and roles
    15.2. Facilitate negotiation of requirements observing group dynamics and method of interaction.
        15.2.1. Monitor interactions
        15.2.2. Encourage spontaneous dialogue
        15.2.3. Monitor participant contributions
        15.2.4. Determine problems to be addressed
    15.3. Develop simulated requirements specification
    15.4. Ask for feedback
    15.5. Close training session

16. **Develop a guideline document for participants**
    16.1. Use feedback and observation to develop the guideline document

17. **Distribute guideline documents**

18. **Develop JAD Agenda**
    18.1. Place JAD Agenda in Work Agenda sector of GSS application.
    18.2. Request all participants to read it.

19. **Implement a pre-meeting**
    19.1. Discuss guideline document
    19.2. Establish management commitment
    19.3. Summarise the JAD Process.
    19.4. Discuss JAD Agenda, and ask if there are any modifications that should be made to it.

20. **Prepare a backup plan**

21. **Last minute check just before the meeting**
    21.1. Ensure all participants are online and ready for the session

Phase 2: Implementation

22. **Open the session**
    22.1. Brief welcome
    22.2. Rundown of JAD agenda

23. **Business Overview/Update**
    23.1. If this is the first session, a business overview is needed
        23.1.1. Presented by project sponsor
        23.1.2. Explanation of the importance of upgrading to or building a new system
        23.1.3. Encouraging the participants to discuss their needs and requirements carefully and completely
    23.2. If this is not the first session, the slot should be occupied by a project update.
        23.2.1. Presented by the facilitator
        23.2.2. Give participants feedback on what they did in the last session, and how they are going to build on it in this session

24. **Familiarisation (for first session)**
    24.1. Ascertain that all participants are familiar with the technology to be used – Recap

25. **Implement team building exercise**
    25.1. If this is the first session, the participants should begin by introducing themselves, and using an intimacy exercise to get to know each other better, followed by the creation of an identity for the group and the creation of a statement of purpose.
    25.2. If this is not the first session, facilitators should use a shorter exercise
    25.3. Receive and discuss feedback on the exercise
    25.4. Develop group norms (first session only)
        25.4.1. Show how the different coloured icons on the screen can be used for communicating feelings about how the JAD session is progressing.
        25.4.2. Allow participants to develop their own norms
        25.4.3. Place a list of norms in the Meeting Room of the GSS application

26. **Open discussion**
    26.1. Ask users about their requirements
    26.2. Participants negotiate requirements
    26.3. Keep track of open issues
    26.4. Do not digress from agenda
    26.5. Use explicit and implicit feedback gained from previous meetings and training session to:
        26.5.1. Resolve conflicts
        26.5.2. Encourage participation
        26.5.3. Help group to understand technical terms and jargon and analysis techniques

26.5.4. Structure and record group's input in the Documentation Room.
26.5.5. Encourage clear communication
26.5.6. Help group recognise key issues and important solutions
26.5.7. Guide the group while remaining neutral
26.6. Build data model

27. **Close the session**
27.1. Re-cap most important points
27.2. Remind participants about time and date for next JAD session
27.3. Remind participants about the back channel that is available for communication with the facilitator and/or other participants, and encourage participants to use it to provide feedback.

Phase 3: Follow up

28. **Review working document and place updated copy in the Working Document Room.**
29. **Place minutes of JAD session in Reports Room**
30. **Check informal Chat Room regularly until next JAD session to receive feedback for self and JAD session evaluation.**

C.5 Framework for Design and Implementation of DVC Interview

Phase 1: Preparation

1. **Select participants**
1.1. Key people at all levels in organization
1.2. People within formal and informal organizational structures
1.3. Draw up schedule of interviewees
1.3.1. Who they are
1.3.2. Where they are
1.3.3. When they will be interviewed

2. **Determine number of different interview locations**
2.1. Use interview schedule to determine number of different locations.

3. **Contact department heads at all locations to organize interviewee locations.**
3.1. Choose quiet room where there will be minimal intrusion

4. **Select conferencing technology**
4.1. Basic computer requirements:
4.1.1. 486 DX processor
4.1.2. Windows 3.1 or higher running in enhanced mode
4.1.3. Windows Sockets compliant TCP/IP stack (Winsock).
4.1.4. 256 colour (8 bit) video driver at any resolution.
4.1.5. CODEC circuitry
4.2. Audio functionality
4.2.1. Windows Soundboard conforming to Windows Multimedia Specification.
4.2.2. Full Duplex Audio
4.2.3. Headphones instead of speakers too reduce echo and feedback
4.2.4. Hands free, sensitive microphone.
4.3. Visual functionality
4.3.1. Video capture board that supports Microsoft Video for Windows.
4.3.2. Video camera to plug into the video capture board or Connectix Quickcam camera (no video capture board required).
4.4. Network type
4.4.1. Typical corporate network is adequate.

5. **Select DVC Software**
5.1. Over 70 different options
5.2. Choose a user friendly, easy too install option.

6. **Distribute DVC software and hardware (if necessary) to all interviewee locations.**
6.1. Send instructions on how to install it on the computers.
6.2. It may be necessary to liaise with technical personnel at each location to set up the software and hardware.

7. **Read background material**

8. **Establish interview objectives**

9. **Set time and location for interviews**

10. **Decide on question types and structure**

11. **Prepare the interviewee**
11.1. Send interviewee guideline communication document
11.2. Send interviewee objectives of interview
11.3. Request interviewee to wear solid, dark colours to the DVC interview
11.4. Send interviewee a list of questions, if possible
11.5. If this is the first interviewee at a given location, advise him/her of the date of the test run.

12. **Test Run**

12.1. Ensure participants are well lit with light source placed behind camera.
12.2. Hang pastel sheet in background if background is not a plain wall.
12.3. Adjust camera options
12.3.1. Type of light
12.3.2. Size of image
12.3.3. Optimal Resolution
12.4. Place camera on top of monitor.

13. **Prepare a back-up plan – e.g. audio interview.**

14. **Ensure technology is functioning correctly on the day of the interview.**

Phase 2: Conducting the Interview

15. **Introduce the interview**
15.1. Dress appropriately too project competence and professionalism without intimidating the user.
15.2. Arrive early so that the interviewee can connect as soon as he/she arrives.
15.3. Ensure that all technology is functioning correctly at both ends.
15.4. Establish and maintain eye contact with the interviewee by always looking at the camera when speaking.
15.5. Build rapaport with the interviewee by explaining the foals of the interview and the reasons for choosing him/her as an interviewee.
15.6. Record interview.
15.6.1. Most DVC software allows automatic recording
15.6.2. Ask the interviewee if he or she minds having the interview recorded.

16. **Conduct body of Interview**
16.1. Open with easy, non-threatening questions to set the interviewee at ease.
16.2. Make a concerted effort to pick up and note jargon used by the interviewee when he/she is describing organizational, business and application domains.
16.3. Concentrate on verbal cues and facial expressions.
16.4. Ask probing and clarifying questions to ensure understanding.
16.5. Periodically summarise key points that interviewee is communicating.
16.6. Limit time of interview too allocated period to ensure that interviewee is not being kept from other duties and to ensure optimal absorption of information.
16.7. Look for exception and error conditions and probe for details.

17. **Close the Interview**
17.1. Ask interviewee if there is anything that has not been touched on during the interview that he/she feels is important.
17.2. Summarise and provide feedback on overall impression.
17.3. Inform interviewee of subsequent steps to take and what will be done next.
17.4. Set up future appointment times for follow up interviews.
17.5. Thank interviewee
17.6. Guide interviewee in disconnecting if necessary.

Phase 3: Following Up Interview

18. **Write up interview report as soon as interview is over**
18.1. Assures quality of interview data

19. **Write up report on use of DVC for interview**
19.1. Subjective report on how successful the interview was

20. **Send interview report to interviewee with request to read it and inform analyst of clarifications or updates that may be needed.**

21. **Ask interviewee too provide feedback on the use of DVC for the interview.**

22. **Use interview information to construct models of business processes discussed in interview.**

23. **Combine interviewee and interviewer reports on use of DVC for interview to draw up list of recommendations to make DVC interviews more successful in the future if necessary.**

C.6 Framework for Design and Implementation of Electronic Questionnaire

Phase 1: Preparation

1. **Select respondents**
1.1. Sample of people who are representative of entire group
2. **Check that all respondents are computer literate and have internet and electronic mail access.**
2.1. Contact department heads to find out this information
2.2. Basic computer requirements: any computer capable of running Netscape Navigator or Internet Explorer.
3. **Determine questions to be asked**
3.1. Questionnaire type: free format or fixed format
3.2. Exact questions

4. **Choose software for questionnaire design and implementation**
4.1. Research software packages
4.2. Evaluate alternatives based on the questions to be asked and the specific requirements (e.g. analysis of data).

- 4.3. Choose suitable software package
  - 4.3.1. Easy to learn and use
  - 4.3.2. All required capabilities
  - 4.3.3. Level of support provided by supplier
- 5. **Implement software package**
  - 5.1. Set up database for questionnaire responses
- 6. **Choose and implement technology for the software package**
  - 6.1. Server
    - 6.1.1. Software company's server
    - 6.1.2. External server
    - 6.1.3. Internal company server
    - 6.1.4. Personal computer
  - 6.2. Network
    - 6.2.1. Any network can be used
- 7. **Hire outside expertise if necessary**
- 8. **Design Questionnaire**
  - 8.1. Provide complete instructions for answering the questionnaire that will answer any anticipated questions.
  - 8.2. Provide full details of how responses will be kept confidential and/or anonymous.
  - 8.3. Keep questionnaire simple and easy to navigate
  - 8.4. Not too many pages – keep the questionnaire brief.
  - 8.5. Clear buttons and icons that allow users to move between sections.
    - 8.5.1. Routing options can take respondents to next question based on responses (i.e. branching of questions is not a problem as it is not transparent to the respondent).
  - 8.6. No clutter
  - 8.7. Be consistent
  - 8.8. Order questions in logical sequence
    - 8.8.1. Questions of importance to respondents go first
    - 8.8.2. Cluster items of similar content together
  - 8.9. Questions must be unambiguous, simple and unbiased
  - 8.10. Do not use questions that give clues to the expected answers – do not lead the response
  - 8.11. Limit use of open ended questions that will be difficult to tabulate
  - 8.12. Limit use of questions that can raise concern about job security or other negative issues.
  - 8.13. Make sure questions are aimed at level of intellect and particular interests of the respondents
  - 8.14. Build in automatic data checking and valid range verification
  - 8.15. Design questionnaire according to HCI principles.
- 9. **Test questionnaire**
  - 9.1. Post questionnaire on web page/Email questionnaire too respondents
  - 9.2. Select sample of respondents
  - 9.3. Send them passwords and instructions on how to access the web page containing the questionnaire via electronic mail.
  - 9.4. Provide a section where respondents can provide feedback as to problems they may have experienced with the questionnaire.
  - 9.5. Receive and check responses and feedback
  - 9.6. Modify questionnaire according to responses and feedback if necessary
  - 9.7. Retest the questionnaire if necessary
  - 9.8. Repeat process until there are no problems

Phase 2: Implementing the Questionnaire

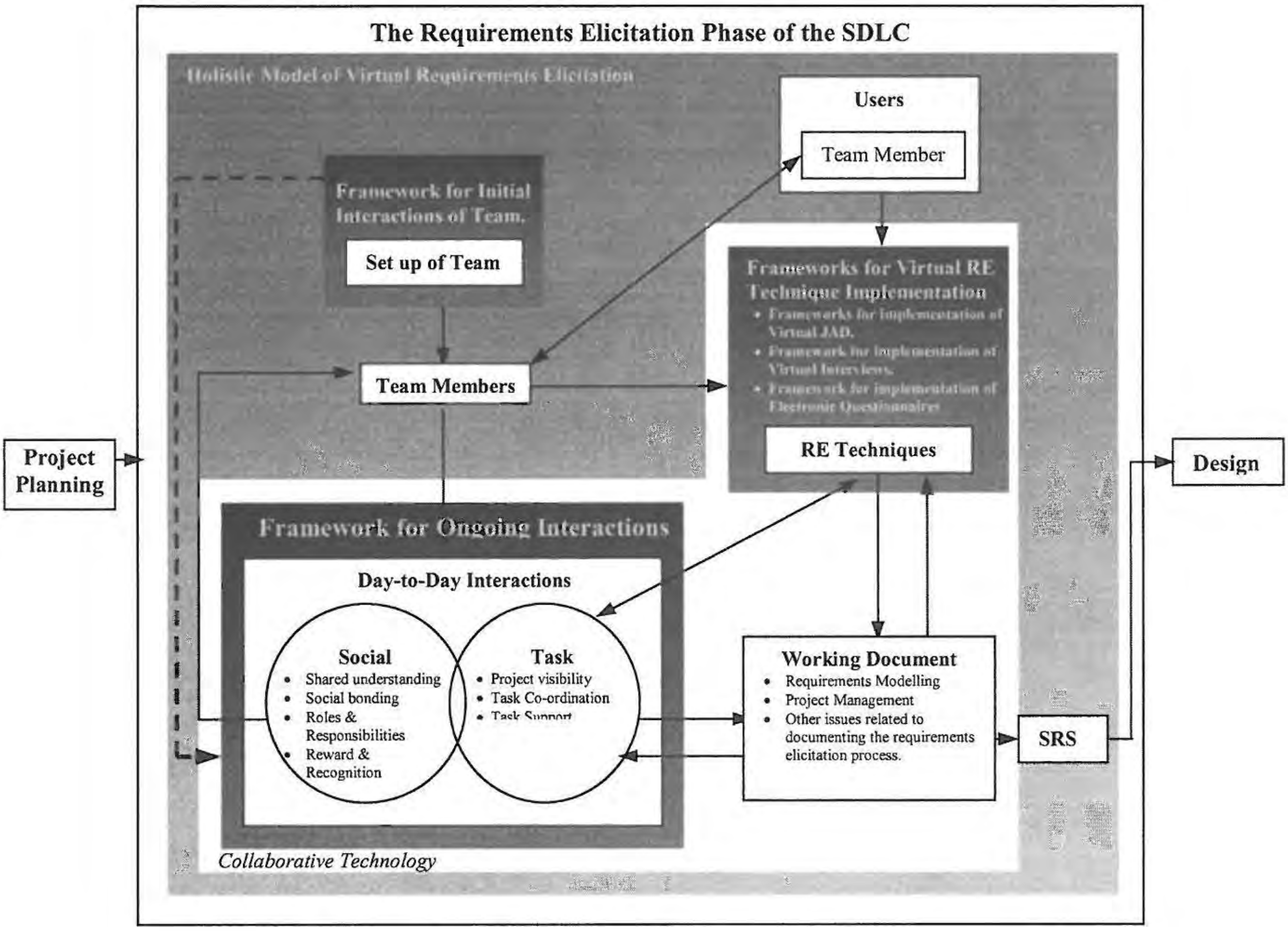
- 10. **Post final questionnaire on the web-page/email final questionnaire to respondents**
- 11. **Send respondents password and instructions on how to access the web page containing the questionnaire via electronic mail.**
  - 11.1. In the electronic mail, clearly state:
    - 11.1.1. Why questionnaire is being conducted
    - 11.1.2. Why the respondents were selected
    - 11.1.3. An offer to supply a summary of the questionnaire responses
- 12. **Receive responses**
  - 12.1. Responses can be sent straight to the database on the server
- 13. **Check responses for invalid data, unusable responses**
- 14. **Analyse data with the help of the software package**

Phase 3: Following up the questionnaire

- 15. **Send all respondents an email thanking them for their time**
- 16. **Send respondents a summary of responses if necessary**
- 17. **Use responses to:**
  - 17.1. 17.1 Add to data model
  - 17.2. 17.2 Determine which areas need further clarification

Appendix D: Adapted Holistic Model of RE and Detailed Frameworks

D.0 Adapted Holistic Model of Requirements Elicitation



D.1 Framework for Initial Virtual Team Interactions

1. **Select Team**
    1.1. Skills and expertise
    1.2. Previous experience in the virtual environment is beneficial
    1.3. Determine team members to be situate at user site in consultation with all team members
    1.4. Post team representative at user site

2. **Select Collaborative Technology and Software**
    2.1. A comprehensive GSS such as TeamRoom is recommended as the foundational communication tool.
        2.1.1. Modularity
        2.1.2. Interface choices
        2.1.3. Data portability
        2.1.4. Provides structure and flexibility
        2.1.5. High user learning curve
    2.2. Choose support software to be implemented
        2.2.1. Word Processor
        2.2.2. Data modeling tool
        2.2.3. Project management tool
        2.2.4. Calendaring tool
    2.3. Determine technology infrastructure and hardware required
    2.4. Ensure that all technology and software is standardized to ensure that co-ordination and integration problems do not occur.

3. **Install software and hardware.**
    3.1. Distribute all software to virtual team members
    3.2. Interact with team members and systems administrators to ensure that the specified hardware is available at all sites.
    3.3. Set up central GSS server
    3.4. Install all hardware and software in conjunction with systems administrators and virtual team members.
    3.5. Ensure that all hardware and software is running.

4. **Provide Training**
    4.1. Determine team members' levels of competence with regards to software and technology in conjunction with team members.
    4.2. Set up training documentation.
    4.3. Distribute training documentation to team members.
    4.4. Follow up by ensuring that all team members are following the training program.
        4.4.1. Ensure that team members understand that comprehensive training assures the use of the technology with maximum effectiveness and efficiency.

5. **Implement Initial Face to Face Meeting**
    5.1. Decide on venue that is neutral and away from all members' worksites.
    5.2. Inform team members of time and date of initial meeting
    5.3. Ensure that team members understand that an initial face to face meeting is necessary to lay the foundations for trust and bonding.
    5.4. Analyse needs of the team
        5.4.1. Clarity concerning participation
        5.4.2. Social bonding and relationship building
        5.4.3. Clarity of processes for task performance and communication
        5.4.4. Roles and Responsibilities
        5.4.5. Trust
        5.4.6. Co-ordination of work logistics
        5.4.7. Leadership issues
    5.5. Determine objectives for team building
        5.5.1. Define a common purpose
        5.5.2. Lay a foundation for a satisfying and rewarding team culture based on social bonding and relationship building.
        5.5.3. Lay a foundation for building trust
        5.5.4. Clarify expectations by defining roles and responsibilities and participation arenas
        5.5.5. Clarify processes for task performance and communication
        5.5.6. Define reward and recognition structures
        5.5.7. Determine work co-ordination
    5.6. Plan team building exercises
        5.6.1. Select a neutral venue
        5.6.2. Set the correct atmosphere
    5.7. Conduct team building exercises
        5.7.1. Create identity for the team
        5.7.2. Write a Statement of Purpose for the team
        5.7.3. Use contracting, leadership questionnaires, value discussions, intimacy exercises to allow team members to explore team culture issues, trust and expectations.
        5.7.4. Decide on general team norms
        5.7.5. Decide how conflict will be managed – define process of negotiation and problem resolution.
        5.7.6. Reach agreement on reward and recognition structures
            5.7.6.1. Team rewards rather than individual rewards
            5.7.6.2. Praise at weekly update meeting
            5.7.6.3. Celebration at the end of a milestone
                5.7.6.3.1. Something different that the team can do together, which they will look forward to, and which signals celebration
                5.7.6.3.2. E.g. newest network game

5.7.7. Discuss, in general, the implications of using communication technology rather than face-to-face communication (input to communications styles training).
5.7.8. Define roles and responsibilities
5.7.8.4. What roles does our team need?
5.7.8.5. How will we define those roles?
5.7.8.6. How will we share the roles
5.7.8.7. What is our strategy for re-evaluating roles and players as we go along?
5.8. Take a photograph of the team to put onto mousepads for each team member (this will serve as a consistent reminder of the team).
5.9. Review team building
5.9.1. Ask for feedback from team after each team building exercise
5.9.2. Ask for feedback from team on the overall team building effort once the meeting is over
5.9.3. Use feedback when designing team building exercises for the virtual team.

6. Implement initial virtual meeting
6.1. Ensure that all team members are able to use the software and technology.
6.2. Ensure that team members understand how to communicate in a virtual environment by providing communications style training.
6.2.1. Describe the importance of communications styles training in minimising frustration, delays in task performance and task co-ordination, and general message misunderstandings.
6.2.1.8. Describe the need to provide contextual information
6.2.1.9. Use emoticons or capital letters to communicate the tone of message.
6.2.1.10. Remember it is the quality of the ideas that is of importance, not the quality of the language communicating the ideas.
6.2.1.11. Restate your team-mates' ideas to make sure that you interpreted their communications correctly.
6.2.1.12. Use humorous expressions that everyone can understand.
6.2.1.13. Use simple words and words representing real-life objects and events so that you are easier to understand.
6.2.1.14. Ask for team members' feedback.
6.2.1.15. Describe technical context so that team members will understand constraints.
6.2.1.16. Describe individual schedules so that team mates can understand each others' unavailability.
6.3. Develop the essentials of the team's communication strategy (communication norms)
6.3.1. Ensure that all team members understand the importance of such a strategy in minimising frustration, delays in task performance and task co-ordination, misunderstandings arising as a result of language differences, and general message misunderstandings.
6.3.1.17. When will meetings take place?
6.3.1.17.1. Weekly update meetings MUST take place, as virtual teams require more frequent and explicit check-ins.
6.3.1.18. How will the meeting take place (i.e. which media will be used for which type of meetings?)
6.3.1.19. How often will team members provide status updates?
6.3.1.20. When and how will shared documentation in the central repository be updated?
6.3.1.21. Establish a code of conduct to avoid delays.
6.3.1.22. What other software and technology is needed (e.g. project calendaring tool, team calendar, etc.)
6.3.1.22.1. How will this support software be used?
6.3.1.23. How will tasks be co-ordinated in the face of time, space and cultural differences?
6.3.1.23.1. Draw up schedule of time zone differences of team members
6.3.1.23.2. Commit to updating team calendar with personal leave days and public holidays
6.3.1.23.3. Commit to leaving comprehensive contact details when going on leave or taking a holiday
6.3.1.23.4. Commit to writing a short exposition on personal values, beliefs and culture to place in an electronic yearbook
6.3.1.23.5. Commit to considering all of the above when contacting and working with colleagues on the team

6.4. Decide on process for dealing with technological problems
6.4.1. Describe the importance of a process for dealing with technological problems in terms of the minimisation of frustration, and general misunderstandings and the assurance of a seamless environment over which team members are able to work with a focus on the content of their work rather than the technology.
6.4.1.24. Contact system administrator as soon as possible when there are technical difficulties.
6.4.1.25. Send log of messages received to date when there are questions about system reliability
6.4.1.26. When there are technical problems with messages sent to team mates, explain technical details in follow up message.
6.4.1.27. Send decoding instructions with coded documents.
6.5. Define social norms
6.6. Informal interaction on a regular basis
6.6.1. Describe the importance of informal interaction in terms of promoting trust, social bonding, a feeling of belonging to the team, social satisfaction regarding relationships within the team, and motivation to perform tasks more efficiently for the team, thereby building a cohesive team culture.
6.6.1.28. Make team members aware of the informal discussion forums available.
6.6.1.29. Encourage team members to suggest informal discussion forums which they think will be most enjoyed by all the members of their team.
6.6.1.30. Commit to implementing the suggested informal discussion forums as far as possible.
6.6.1.31. Commit to setting up a team room that allows photographs to be posted for informal chats
6.6.1.32. Place responsibility for creating at least one non-routine topic of conversation on one team member per week.
6.6.1.33. Commit to developing an electronic yearbook, which can be stored in one of the team rooms for perusal by all team members.
6.6.1.34. Encourage team members to post personal happenings onto team calendar
6.6.1.35. Commit to providing as much contextual information as possible in all communication
6.6.1.36. Commit to updating team calendar with personal information
6.7. Close first virtual meeting
6.7.1. Remind all team members of their duties before the next weekly meeting
6.7.1.37. Articles for the electronic yearbook
6.7.1.38. Updating team calendar with a comprehensive schedule of personal leave days and public holidays

7. **Set up informal interaction forums for team members**
    7.1. Chat site where team members can discuss issues of personal relevance
    7.2. Network game and online activities sites
    7.3. Informal case study sites where team members can work together to develop solutions to case study problems.
    7.4. Ask for photographs to be posted onto sites, so that team members have an idea of what the person they are talking to looks like.

8. **Implement first weekly meeting**
    8.1. Define type of SRS structure to be used
    8.2. Define types of models to be used to represent requirements
    8.3. Decide on responsibilities for various sections of the SRS.
    8.4. Set up a template for the SRS and place it in the central document repository.
    8.5. Decide on task norms
        8.5.1. Stick to the structure of the SRS
        8.5.2. Commit to performing tasks as quickly, efficiently as possible
        8.5.3. Send updates to all team members as soon as task is finished so that project schedule can be updated and dependent tasks can begin.
9. **Develop milestones and place project schedule in a Team Room**

D.2 Framework for Ongoing Interactions of Virtual Team

1. **Implement ongoing team building sessions**
    1.1. Ensure frequent team building sessions in order to reinforce trust and relationships within the team.
    1.2. Review feedback from past team building sessions
    1.3. Analyse needs of the team on an ongoing basis using feedback from previous team building sessions
        1.3.1. Clarity concerning participation
        1.3.2. Building social bonding and relationship building
        1.3.3. Building trust
        1.3.4. Co-ordination of work logistics
        1.3.5. Leadership issues
        1.3.6. Reward and Recognition
    1.4. Determine objectives for team building based on needs
        1.4.1. Build a satisfying and rewarding team culture based on social bonding and relationship building.
        1.4.2. Clarify participation
        1.4.3. Build Trust
        1.4.4. Discuss and modify reward and recognition structures on an ongoing basis
        1.4.5. Determine work co-ordination
        1.4.6. Ensure that leadership issues are open and maintained
    1.5. Plan team building exercises to achieve the objectives
        1.5.1. Aim to come up with new and interesting exercises
    1.6. Run team building exercises
    1.7. Review
        1.7.1. At the end of each exercise
        1.7.2. At the end of the session
            1.7.2.1. How valuable was the session?
            1.7.2.2. How well did it work?
2. **Implement Weekly Status Meetings**
    2.1. Each team member must state what they are doing with regards to the project
        2.1.1. Reduces slacking as team members have to answer to their team mates.
        2.1.2. Gives the whole team an idea of what team members are doing, and how it contributes to the overall purpose.
    2.2. Each team member must state what tasks they have recently completed
    2.3. Each team member must state what they are going to do next
        2.3.1. Identify dependencies
    2.4. Praise team members who have completed their tasks on time or ahead of schedule
    2.5. Ask for input on task related issues from other team members
    2.6. Discuss general issues
        2.6.1. Update on how the project is progressing as a whole
        2.6.2. Update on the project schedule
            2.6.2.3. When is the next milestone?
            2.6.2.4. Will it be reached on time?
3. **Encourage informal interaction**
    3.1. Monitor pattern of interactions regularly to ascertain whether or not:
        3.1.1. Team members interact regularly on an informal basis?
        3.1.2. Social relationships are being built up?
        3.1.3. Team members have a sense of "belonging" to the team
        3.1.4. All team members engage in informal interaction.
        3.1.5. Team members are socially satisfied within the team.
        3.1.6. Team members have a sense of responsibility towards the team.
        3.1.7. Team members have a more intense feeling of motivation as a result of informal interactions.
        3.1.8. Team members are interacting via the initial forums
        3.1.9. Team members are suggesting and implementing new forums
        3.1.10. The calendar is updated with personal happenings frequently?

3.1.11. The electronic yearbook is being accessed, updated and read regularly?
3.1.12. Team members are aware of social and physical contexts of their colleagues?
3.2. Use feedback to determine issues to be addressed (needs) in next team building session
3.3. Congratulate or sympathise with team members with regards to personal happenings on the team calendar
3.4. Celebrations
3.4.1. Newest network game
3.4.2. Do people enjoy the celebration at the end of the milestone?
3.4.3. If feedback is negative, a new form of celebration must be devised.

4. **Monitor adherence to Technological Problems Strategy**
4.1. Are norms for dealing with technological problems being adhered to?
4.2. Ask systems administrator to provide log of all reported technological problems on a weekly basis
4.3. Check with team members whether the technological problems strategy allows them to perform their tasks with minimal frustration, and misunderstandings, and whether they are able to focus on their work content rather than the technology.
4.3.1. If not, the strategy may have to be adapted.
4.4. Use above feedback to determine issues to be addressed (needs) in next team building session.

5. **Monitor adherence to Communications Strategy**
5.1. Are team members sensitive to time and space differences?
5.2. Do people update the team calendar with personal leave days and public holidays?
5.3. Are tasks completed or well on track before people take leave or public holidays?
5.4. Are people working well together in the virtual environment?
5.5. Is communications styles training being used by all team members?
5.5.1. Are team members using their communications styles training to communicate with minimal frustrations, delays, general and message misunderstandings
5.6. Use above feedback to determine issues to be addressed (needs) in next team building session.

6. **Implement Requirements Elicitation Techniques**

D.3 Framework for Design and Implementation of Videoconferencing JAD

Phase 1: Preparation

1. **Select participants**
1.1. Use organisational charts and interviews to determine suitable participants.
2. **Develop web page for the project**
2.1. Set up help centre
2.2. Set up library for draft documents
2.3. Set up back channel for feedback for personnel.
3. **Select all personnel**
3.1. Remote support managers, technical manager, communication flow manager and scribe
4. **Select collaborative technology**
4.1. Consultation with technical manager, remote support managers and communication flow manager. Also select technology needed for team building exercises.
4.1.1. Minimum hardware requirements are cameras, projectors, projector screens, microphones and speakers.
4.1.2. Use full duplex audio to ensure fluid conversation.
4.1.3. Use separate dedicated phone links.
4.1.4. Choose high bandwidth network type
4.1.5. Choose suitable support technologies – CASE tools, electronic whiteboards, etc.
4.1.6. Set up Control Room at facilitator's site, from which all technical equipment will be operated
4.1.7. Train scribe in documentation technology.
5. **Develop template for working document**
6. **Determine analysis technique to be used.**
7. **Determine meeting locations in consultation with remote location managers.**
8. **Develop and distribute meeting agenda**
9. **Prepare environment**
9.1. Ensure effective group and technology configuration
9.2. Arrange all equipment in each venue in close consultation with remote managers, to ensure that all venues are set up in a similar fashion.
9.2.1. Minimise ambient noise effects
9.2.2. Lighting should be sufficient for written work, lighting should not wash out image projection, participants should be clearly lit.
9.2.3. Layout each site as shown in Chapter 5 (Figures 5.1 and 5.2)
9.2.4. Set up PCs or laptops necessary for team building exercises.
9.2.5. Ensure effective group configuration and virtual social distance by:
9.2.5.1. Positioning projector screens so that all participants can see each other
9.2.5.2. Positioning loudspeakers as shown in conference layout for maximum clarity of sound.
9.2.5.3. Ensuring adequate display size on the projector screens (as close to life size as possible without losing image clarity).
9.2.5.4. Positioning workspaces as shown in conference layout so as to achieve maximum illusion of co-location.
10. **Determine non-verbal cues to be used**
10.1. Coloured cards
11. **Setup back channel for participants on web page**
12. **Determine team-building exercises to use**
12.1. Set up PCs or laptops accordingly with the help of remote managers and technical personnel.
13. **Implement initial meeting with all personnel**
13.1. Hold a test run to ensure that technologies are functional, and lighting and sound are correct.
13.2. Ensure that personnel are aware of the back channel of communication, and encourage them to use it.
14. **Implement pre-meeting with participants**

- 14.1. Familiarise participants with the technology to be used (including technology for team building exercises).
- 14.2. Establish management commitment
- 14.3. Summarise the JAD process
- 14.4. Distribute and discuss the working document

15. **Prepare back-up plan – e.g. audio conference**
16. **Last minute check**
    - 16.1. Each remote manager and the facilitator must check to see that the equipment is functioning as required.
17. **Establish contact**
    - 17.1. Establish contact with other venues at least 45 minutes before the JAD session begins.

Phase 2: Implementation

18. **Open the session**
    - 18.1. Brief welcome
    - 18.2. Run-down of agenda for the session
19. **Business Overview/Update**
    - 19.1. If this is the first session, a business overview is needed
        - 19.1.1. Presented by project sponsor
        - 19.1.2. Explanation of the importance of upgrading to or building a new system
        - 19.1.3. Encouraging the participants to discuss their needs and requirements carefully and completely
    - 19.2. If this is not the first session, the slot should be occupied by a project update.
        - 19.2.1. Presented by the facilitator
        - 19.2.2. Give participants feedback on what they did in the last session, and how they are going to build on it in this session.
20. **Familiarisation (for first session)**
    - 20.1. Ascertain that all participants are familiar with the technology to be used – Recap
    - 20.2. Introduce location managers and all other personnel and explain what their functions are.
    - 20.3. Familiarise participants with the web-page for the sessions, and encourage them to use the informal virtual café as a back channel for feedback and communication outside of the JAD sessions.
21. **Run team building exercise**
    - 21.1. If this is the first session, the participants should begin by introducing themselves, and using an intimacy exercise to get to know each other better, followed by the creation of an identity for the group and the creation of a statement of purpose.
    - 21.2. If this is not the first session, facilitators should use a shorter exercise
    - 21.3. Receive and discuss feedback on the exercise
    - 21.4. Develop group norms (first session only)
        - 21.4.1. Distribute coloured cards
        - 21.4.2. Familiarise participants with the use of coloured cards and emblems for non-verbal communication
        - 21.4.3. Allow participants to develop their own norms
        - 21.4.4. Display the norms on a whiteboard that will be visible at every meeting.
22. **Open discussion**
    - 22.1. Ask users about their requirements
    - 22.2. Participants negotiate requirements
    - 22.3. Keep track of open issues
    - 22.4. Do not digress from agenda
    - 22.5. Use observational, instructional, self and other awareness and evaluation skills to:
        - 22.5.1. Resolve conflicts
        - 22.5.2. Encourage participation
        - 22.5.3. Help group to understand technical terms and jargon and analysis techniques.
        - 22.5.4. Encourage clear communication
        - 22.5.5. Structure and record group's input in the shared workspace
        - 22.5.6. Help group recognise key issues and important solutions
        - 22.5.7. Guide the group while remaining neutral
        - 22.5.8. Encourage the use of non verbal communication
    - 22.6. Build data model
23. **Close the session**
    - 23.1. Re-cap the most important points
    - 23.2. Remind participants about the time and date for the next JAD session
    - 23.3. Remind participants about the back-channel that is available for communication with the facilitator and/or other participants, and encourage participants to use it to provide feedback.

Phase 3: Follow up

24. **Review working document and place updated copy on JAD session web page**
25. **Place minutes of JAD session on the web page.**
26. **Consult with remote managers, technical manager, and communications flow manager for feedback regarding the technical implementation of the JADA session.**
27. **Check chat café regularly until next session to receive feedback for self and JAD session evaluation.**

D.4 Framework for Design and Implementation of GSS JAD

Phase 1: Preparation

1. **Select technology.**
    - 1.1. TeamRoom is recommended, as it was designed specifically for requirements elicitation over the electronic workspace. Consider:
        - 1.1.1. Modularity
        - 1.1.2. Interface choices
        - 1.1.3. Data Portability

1.1.4. Ability to provide both structure and flexibility
1.1.5. User learning curve
1.1.6. Multimedia network is required

2. **Select participants**
3. **Distribute typing tutor packages to participants**
    3.1. Send guidelines of what the minimum typing speed should be.
4. **Distribute copies of GSS application**
    4.1. Send clear installation instructions to participants.
5. **Install central server**
6. **Select and implement additional software for team building exercises.**
7. **Select and train scribe.**
8. **Develop a template for the working document.**
    8.1. Place template in the documentation room of the GSS application.
9. **Determine analysis technique to be used.**
10. **Determine non-verbal cues to be used**
    10.1. Ensure that GSS application is able to handle non-verbal cues
11. **Set up training program**
    11.1. Determine scenario
    11.2. Assign roles
    11.3. Determine requirements for each role.
12. **Contact all JAD participants about initial test meeting**
13. **Implement initial test meeting**
    13.1. Ensure that all participants are connected to the server
    13.2. Introduce all team members
    13.3. Explain how the GSS application works
    13.4. Allow participants to set up their personal rooms during the meeting.
    13.5. Inform participants of the presence of the Informal Chat Room, and encourage them to use it.
    13.6. Ascertain that typing speeds of participants are adequate
    13.7. Describe how the training exercise will proceed in the next meeting.
14. **Contact participants about training session.**
15. **Implement initial training session**
    15.1. Distribute scenarios and roles
    15.2. Facilitate negotiation of requirements observing group dynamics and method of interaction.
        15.2.1. Monitor interactions
        15.2.2. Encourage spontaneous dialogue
        15.2.3. Monitor participant contributions
        15.2.4. Determine problems to be addressed
    15.3. Develop simulated requirements specification
    15.4. Ask for feedback
    15.5. Close training session
16. **Develop a guideline document for participants**
    16.1. Use feedback and observation to develop the guideline document
17. **Distribute guideline documents**
18. **Develop JAD Agenda**
    18.1. Place JAD Agenda in Work Agenda sector of GSS application.
    18.2. Request all participants to read it.
19. **Implement a pre-meeting**
    19.1. Discuss guideline document
    19.2. Establish management commitment
    19.3. Summarise the JAD Process.
    19.4. Discuss JAD Agenda, and ask if there are any modifications that should be made to it.
20. **Prepare a backup plan**
21. **Last minute check just before the meeting**
    21.1. Ensure all participants are online and ready for the session

Phase 2: Implementation

22. **Open the session**
    22.1. Brief welcome
    22.2. Rundown of JAD agenda
23. **Business Overview/Update**
    23.1. If this is the first session, a business overview is needed
        23.1.1. Presented by project sponsor
        23.1.2. Explanation of the importance of upgrading to or building a new system
        23.1.3. Encouraging the participants to discuss their needs and requirements carefully and completely
    23.2. If this is not the first session, the slot should be occupied by a project update.
        23.2.1. Presented by the facilitator
        23.2.2. Give participants feedback on what they did in the last session, and how they are going to build on it in this session
24. **Familiarisation (for first session)**
    24.1. Ascertain that all participants are familiar with the technology to be used – Recap
25. **Implement team building exercise**
    25.1. If this is the first session, the participants should begin by introducing themselves, and using an intimacy exercise to get to know each other better, followed by the creation of an identity for the group and the creation of a statement of purpose.
    25.2. If this is not the first session, facilitators should use a shorter exercise
    25.3. Receive and discuss feedback on the exercise
    25.4. Develop group norms (first session only)

25.4.1. Show how the different coloured icons on the screen can be used for communicating feelings about how the JAD session is progressing.
25.4.2. Allow participants to develop their own norms
25.4.3. Place a list of norms in the Meeting Room of the GSS application

26. **Open discussion**
26.1. Ask users about their requirements
26.2. Participants negotiate requirements
26.3. Keep track of open issues
26.4. Do not digress from agenda
26.5. Use explicit and implicit feedback gained from previous meetings and training session to:
26.5.1. Resolve conflicts
26.5.2. Encourage participation
26.5.3. Help group to understand technical terms and jargon and analysis techniques
26.5.4. Structure and record group's input in the Documentation Room.
26.5.5. Encourage clear communication
26.5.6. Help group recognise key issues and important solutions
26.5.7. Guide the group while remaining neutral
26.6. Build data model

27. **Close the session**
27.1. Re-cap most important points
27.2. Remind participants about time and date for next JAD session
27.3. Remind participants about the back channel that is available for communication with the facilitator and/or other participants, and encourage participants to use it to provide feedback.

Phase 3: Follow up

28. **Review working document and place updated copy in the Working Document Room.**
29. **Place minutes of JAD session in Reports Room**
30. **Check informal Chat Room regularly until next JAD session to receive feedback for self and JAD session evaluation.**

D.5 Framework for Design and Implementation of DVC Interview

Phase 1: Preparation

1. **Select participants**
1.1. Key people at all levels in organization
1.2. People within formal and informal organizational structures
1.3. Draw up schedule of interviewees
1.3.1. Who they are
1.3.2. Where they are
1.3.3. When they will be interviewed

2. **Determine number of different interview locations**
2.1. Use interview schedule to determine number of different locations.

3. **Contact department heads at all locations to organize interviewee locations.**
3.1. Choose quiet room where there will be minimal intrusion

4. **Select conferencing technology**
4.1. Basic computer requirements:
4.1.1. 486 DX processor
4.1.2. Windows 3.1 or higher running in enhanced mode
4.1.3. Windows Sockets compliant TCP/IP stack (Winsock).
4.1.4. 256 colour (8 bit) video driver at any resolution.
4.1.5. CODEC circuitry
4.2. Audio functionality
4.2.1. Windows Soundboard conforming to Windows Multimedia Specification.
4.2.2. Full Duplex Audio
4.2.3. Headphones instead of speakers too reduce echo and feedback
4.2.4. Hands free, sensitive microphone.
4.3. Visual functionality
4.3.1. Video capture board that supports Microsoft Video for Windows.
4.3.2. Video camera to plug into the video capture board or Connectix Quickcam camera (no video capture board required).
4.4. Network type
4.4.1. Typical corporate network is adequate.

5. **Select DVC Software**
5.1. Over 70 different options
5.2. Choose a user friendly, easy too install option.

6. **Distribute DVC software and hardware (if necessary) to all interviewee locations.**
6.1. Send instructions on how to install it on the computers.
6.2. It may be necessary to liaise with technical personnel at each location to set up the software and hardware.

7. **Read background material**
8. **Establish interview objectives**
9. **Set time and location for interviews**
10. **Decide on question types and structure**
11. **Prepare the interviewee**
11.1. Send interviewee guideline communication document
11.2. Send interviewee objectives of interview
11.3. Request interviewee to wear solid, dark colours to the DVC interview
11.4. Send interviewee a list of questions, if possible
11.5. If this is the first interviewee at a given location, advise him/her of the date of the test run.

12. **Test Run**

- 12.1. Ensure participants are well lit with light source placed behind camera.
- 12.2. Hang pastel sheet in background if background is not a plain wall.
- 12.3. Adjust camera options
  - 12.3.1. Type of light
  - 12.3.2. Size of image
  - 12.3.3. Optimal Resolution
- 12.4. Place camera on top of monitor.

13. **Prepare a back-up plan – e.g. audio interview.**
14. **Ensure technology is functioning correctly on the day of the interview.**

Phase 2: Conducting the Interview

15. **Introduce the interview**
    - 15.1. Dress appropriately too project competence and professionalism without intimidating the user.
    - 15.2. Arrive early so that the interviewee can connect as soon as he/she arrives.
    - 15.3. Ensure that all technology is functioning correctly at both ends.
    - 15.4. Establish and maintain eye contact with the interviewee by always looking at the camera when speaking.
    - 15.5. Build rapaport with the interviewee by explaining the foals of the interview and the reasons for choosing him/her as an interviewee.
    - 15.6. Record interview.
      - 15.6.1. Most DVC software allows automatic recording
      - 15.6.2. Ask the interviewee if he or she minds having the interview recorded.
16. **Conduct body of Interview**
    - 16.1. Open with easy, non-threatening questions to set the interviewee at ease.
    - 16.2. Make a concerted effort to pick up and note jargon used by the interviewee when he/she is describing organizational, business and application domains.
    - 16.3. Concentrate on verbal cues and facial expressions.
    - 16.4. Ask probing and clarifying questions to ensure understanding.
    - 16.5. Periodically summarise key points that interviewee is communicating.
    - 16.6. Limit time of interview too allocated period to ensure that interviewee is not being kept from other duties and to ensure optimal absorption of information.
    - 16.7. Look for exception and error conditions and probe for details.
17. **Close the Interview**
    - 17.1. Ask interviewee if there is anything that has not been touched on during the interview that he/she feels is important.
    - 17.2. Summarise and provide feedback on overall impression.
    - 17.3. Inform interviewee of subsequent steps to take and what will be done next.
    - 17.4. Set up future appointment times for follow up interviews.
    - 17.5. Thank interviewee
    - 17.6. Guide interviewee in disconnecting if necessary.

Phase 3: Following Up Interview

18. **Write up interview report as soon as interview is over**
    - 18.1. Assures quality of interview data
19. **Write up report on use of DVC for interview**
    - 19.1. Subjective report on how successful the interview was
20. **Send interview report to interviewee with request to read it and inform analyst of clarifications or updates that may be needed.**
21. **Ask interviewee too provide feedback on the use of DVC for the interview.**
22. **Use interview information to construct models of business processes discussed in interview.**
23. **Combine interviewee and interviewer reports on use of DVC for interview to draw up list of recommendations to make DVC interviews more successful in the future if necessary.**

D.6 Framework for Design and Implementation of Electronic Questionnaire

Phase 1: Preparation

1. **Select respondents**
   - 1.1. Sample of people who are representative of entire group
2. **Check that all respondents are computer literate and have internet and electronic mail access.**
   - 2.1. Contact department heads to find out this information
   - 2.2. Basic computer requirements: any computer capable of running Netscape Navigator or Internet Explorer.
3. **Determine questions to be asked**
   - 3.1. Questionnaire type: free format or fixed format
   - 3.2. Exact questions
4. **Choose software for questionnaire design and implementation**
   - 4.1. Research software packages
   - 4.2. Evaluate alternatives based on the questions to be asked and the specific requirements (e.g. analysis of data).
   - 4.3. Choose suitable software package
     - 4.3.1. Easy to learn and use
     - 4.3.2. All required capabilities
     - 4.3.3. Level of support provided by supplier
5. **Implement software package**
   - 5.1. Set up database for questionnaire responses

6. **Choose and implement technology for the software package**
   - 6.1. Server
     - 6.1.1. Software company's server
     - 6.1.2. External server
     - 6.1.3. Internal company server
     - 6.1.4. Personal computer
   - 6.2. Network
     - 6.2.1. Any network can be used

7. **Hire outside expertise if necessary**
8. **Design Questionnaire**
   - 8.1. Provide complete instructions for answering the questionnaire that will answer any anticipated questions.
   - 8.2. Provide full details of how responses will be kept confidential and/or anonymous.
   - 8.3. Keep questionnaire simple and easy to navigate
   - 8.4. Not too many pages – keep the questionnaire brief.
   - 8.5. Clear buttons and icons that allow users to move between sections.
     - 8.5.1. Routing options can take respondents to next question based on responses (i.e. branching of questions is not a problem as it is not transparent to the respondent).
   - 8.6. No clutter
   - 8.7. Be consistent
   - 8.8. Order questions in logical sequence
     - 8.8.1. Questions of importance to respondents go first
     - 8.8.2. Cluster items of similar content together
   - 8.9. Questions must be unambiguous, simple and unbiased
   - 8.10. Do not use questions that give clues to the expected answers – do not lead the response
   - 8.11. Limit use of open ended questions that will be difficult to tabulate
   - 8.12. Limit use of questions that can raise concern about job security or other negative issues.
   - 8.13. Make sure questions are aimed at level of intellect and particular interests of the respondents
   - 8.14. Build in automatic data checking and valid range verification
   - 8.15. Design questionnaire according to HCI principles.
9. **Test questionnaire**
   - 9.1. Post questionnaire on web page/Email questionnaire too respondents
   - 9.2. Select sample of respondents
   - 9.3. Send them passwords and instructions on how to access the web page containing the questionnaire via electronic mail.
   - 9.4. Provide a section where respondents can provide feedback as to problems they may have experienced with the questionnaire.
   - 9.5. Receive and check responses and feedback
   - 9.6. Modify questionnaire according to responses and feedback if necessary
   - 9.7. Retest the questionnaire if necessary
   - 9.8. Repeat process until there are no problems

Phase 2: Implementing the Questionnaire

10. **Post final questionnaire on the web-page/email final questionnaire to respondents**
11. **Send respondents password and instructions on how to access the web page containing the questionnaire via electronic mail.**
    - 11.1. In the electronic mail, clearly state:
      - 11.1.1. Why questionnaire is being conducted
      - 11.1.2. Why the respondents were selected
      - 11.1.3. An offer to supply a summary of the questionnaire responses
12. **Receive responses**
    - 12.1. Responses can be sent straight to the database on the server
13. **Check responses for invalid data, unusable responses**
14. **Analyse data with the help of the software package**

Phase 3: Following up the questionnaire

15. **Send all respondents an email thanking them for their time**
16. **Send respondents a summary of responses if necessary**
17. **Use responses to:**
    - 17.1. 17.1 Add to data model
    - 17.2. 17.2 Determine which areas need further clarification

Appendix E: Frequency Distributions

Section 1

Question 1

	Count	Cumulative Count	Percent of answered	Cumulative Percent of answered
Yes	12	12	70.59	70.59
No	5	17	29.41	100.00
Totals	17	17	100.00	100.00

Question 2

Phase	Count
Planning	9
Analysis	5
Design	2
Implementation	3
Maintenance	0
Missing	6

Question 3

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Once a week	3	3	21.43	21.43
Once every fortnight	2	5	14.29	35.71
Once a month	2	7	14.29	50.00
Less than once a month	5	12	35.71	85.71
Not at all	2	14	14.29	100.00
Totals	14	14	100.00	100.00

Question 4

	Count	Cumulative Count	Percent of answered	Cumulative percent of answered
Yes	10	10	71.42	71.42
No	2	12	14.29	85.71
N/A	2	14	14.29	100.00
Totals	14	14	100.00	100.00

Question 5

	Count	Cumulative Count	Percent of answered	Cumulative percent of answered
Yes	9	9	64.29	64.29
No	3	12	21.42	85.71
N/A	2	14	14.29	100.00
Totals	14	14	100.00	100.00

Question 6

	Count	Cumulative Count	Percent of answered	Cumulative percent of answered
Yes	11	11	78.57	78.57
No	1	12	7.14	85.71
N/A	2	14	14.29	100.00
Totals	14	14	100.00	100.00

Question 7

(i) Clarity of participation

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	2	2	16.67	16.67
Not addressed adequately	3	5	25.00	41.67
Addressed quite adequately	4	9	33.33	75.00
Addressed adequately	2	11	16.67	91.67
Addressed more than adequately	1	12	8.83	100.00
Totals	12	12	100.00	100.00

(ii) Clarity of goals

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	1	1	8.32	8.32
Not addressed adequately	2	3	16.67	24.99
Addressed quite adequately	5	8	41.67	66.66
Addressed adequately	2	10	16.67	83.33
Addressed more than adequately	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(iii) Social bonding and relationship building

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	1	1	8.33	8.33
Not addressed adequately	4	4	33.33	41.66
Addressed quite adequately	4	9	33.33	74.99
Addressed adequately	2	11	16.68	91.67
Addressed more than adequately	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(iv) Clarity of processes for task performance and communication

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	1	1	8.33	8.33
Not addressed adequately	3	4	25.00	33.33
Addressed quite adequately	4	8	33.33	66.67
Addressed adequately	3	11	25.00	91.67
Addressed more than adequately	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(v) Defining roles and responsibilities

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	0	0	0	0
Not addressed adequately	3	3	25.00	25.00
Addressed quite adequately	4	7	33.33	58.33
Addressed adequately	2	9	16.67	75.00
Addressed more than adequately	3	12	25.00	100.00
Totals	12	12	100.00	100.00

(vi) Trust

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	4	4	33.33	33.33
Not addressed adequately	2	6	16.67	50.00
Addressed quite adequately	2	8	16.67	66.67
Addressed adequately	1	9	8.33	75.00
Addressed more than adequately	3	12	25.00	100.00
Totals	12	12	100.00	100.00

(vii) Co-ordination of work logistics

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	4	4	33.33	33.33
Not addressed adequately	2	6	16.67	50.00
Addressed quite adequately	3	9	25.00	75.00
Addressed adequately	3	12	25.00	100.00
Addressed more than adequately	0	12	0.00	100.00
Totals	12	12	100.00	100.00

(viii) Leadership issues

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	3	3	25.00	25.00
Not addressed adequately	3	6	25.00	50.00
Addressed quite adequately	0	6	0	50.00
Addressed adequately	4	10	33.33	83.33
Addressed more than adequately	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(ix) Management of Conflict

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	3	3	25.00	25.00
Not addressed adequately	4	7	33.33	58.33
Addressed quite adequately	0	7	0.00	58.33
Addressed adequately	5	12	41.67	100.00
Addressed more than adequately	0	12	0.00	100.00
Totals	12	12	100.00	100.00

(x) Reward and Recognition structures

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	8	8	66.67	66.67
Not addressed adequately	1	9	8.33	75.00
Addressed quite adequately	1	10	8.33	83.33
Addressed adequately	1	11	8.33	91.67
Addressed more than adequately	1	12	8.33	100.00
Totals	12	12	100.00	100.00

Question 8

(i) Clarity of participation

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	2	2	16.67	16.67
Not addressed adequately	3	5	25.00	41.67
Addressed quite adequately	4	9	33.33	75.00
Addressed adequately	1	10	8.33	83.33
Addressed more than adequately	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(ii) Clarity of goals

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	2	2	16.67	16.67
Not addressed adequately	0	2	0.00	16.67
Addressed quite adequately	5	7	41.67	58.33
Addressed adequately	4	11	33.33	91.67
Addressed more than adequately	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(iii) Social bonding and relationship building

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	1	1	8.33	8.33
Not addressed adequately	2	3	16.67	25.00
Addressed quite adequately	2	5	16.67	41.67
Addressed adequately	3	8	25.00	66.67
Addressed more than adequately	4	12	33.00	100.00
Totals	12	12	100.00	100.00

(iv) Clarity of processes for task performance and communication

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	3	3	25.00	25.00
Not addressed adequately	1	4	8.33	33.33
Addressed quite adequately	2	6	16.67	50.00
Addressed adequately	3	9	25.00	75.00
Addressed more than adequately	3	12	25.00	100.00
Totals	12	12	100.00	100.00

(v) Defining roles and responsibilities

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	2	2	16.67	16.67
Not addressed adequately	2	4	16.67	33.33
Addressed quite adequately	3	7	25.00	58.33
Addressed adequately	3	10	25.00	83.33
Addressed more than adequately	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(vi) Trust

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	2	2	16.67	16.67
Not addressed adequately	4	6	33.33	50.00
Addressed quite adequately	1	7	8.33	58.33
Addressed adequately	2	9	16.67	75.00
Addressed more than adequately	3	12	25.00	100.00
Totals	12	12	100.00	100.00

(vii) Co-ordination of work logistics

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	2	2	16.67	16.67
Not addressed adequately	3	5	25.00	41.67
Addressed quite adequately	3	8	25.00	66.67
Addressed adequately	2	10	16.67	83.33
Addressed more than adequately	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(viii) Leadership issues

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	3	3	25.00	25.00
Not addressed adequately	3	6	25.00	50.00
Addressed quite adequately	0	6	0.00	50.00
Addressed adequately	4	10	33.33	83.33
Addressed more than adequately	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(ix) Management of conflict

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	3	3	25.00	25.00
Not addressed adequately	4	7	33.33	58.33
Addressed quite adequately	0	7	0.00	58.33
Addressed adequately	4	11	33.33	91.67
Addressed more than adequately	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(x) Reward and recognition structures

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not addressed	7	7	58.33	58.33
Not addressed adequately	0	7	0.00	58.33
Addressed quite adequately	2	9	16.67	75.00
Addressed adequately	2	11	16.67	91.67
Addressed more than adequately	1	12	8.33	100.00
Totals	12	12	100.00	100.00

Question 9

(i) Clarity of participation

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	3	3	25.00	25.00
Quite successful	7	10	58.33	83.33
Successful	1	11	8.33	91.67
Extremely Successful	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(ii) Clarity of goals

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	2	2	16.67	16.67
Quite successful	4	6	33.33	50.00
Successful	4	10	33.33	83.33
Extremely Successful	2	12	16.67	100.00
Totals	12	12	100.00	100.00

(iii) **Social bonding and relationship building**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	0	0	0.00	0.00
Quite successful	4	4	33.33	33.33
Successful	3	7	25.00	58.33
Extremely Successful	5	12	41.67	100.00
Totals	12	12	100.00	100.00

(iv) **Clarity of processes for task performance and communication**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	3	3	25.00	25.33
Quite successful	4	7	33.33	58.33
Successful	4	11	33.33	91.67
Extremely Successful	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(v) **Defining roles and responsibilities**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	3	3	25.00	25.00
Quite successful	5	8	41.67	66.67
Successful	3	11	25.00	91.67
Extremely Successful	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(vi) **Trust**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	1	1	8.33	8.33
Quite successful	4	5	33.33	41.67
Successful	4	9	33.33	75.00
Extremely Successful	3	12	25.00	100.00
Totals	12	12	100.00	100.00

(vii) **Co-ordination of work logistics**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	3	3	25.00	25.00
Quite successful	6	9	50.00	75.00
Successful	2	11	16.67	91.67
Extremely Successful	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(viii) **Leadership issues**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	2	2	16.67	16.67
Quite successful	5	7	41.67	58.33
Successful	4	11	33.33	91.67
Extremely Successful	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(ix) **Management of conflict**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	4	4	33.33	33.33
Quite successful	4	8	33.33	66.67
Successful	4	12	33.33	100.00
Extremely Successful	0	12	0.00	100.00
Totals	12	12	100.00	100.00

(x) **Reward and recognition structures**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not successful	5	5	41.67	41.67
Quite successful	4	9	33.33	75.00
Successful	1	10	8.33	83.33
Extremely Successful	2	12	16.67	100.00
Totals	12	12	100.00	100.00

Section 2: Technology

Question 10

(i) **Electronic Mail**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered

None	0	0	0.00	0.00
Low	2	2	11.11	11.11
Medium	5	7	27.78	38.89
High	11	18	61.11	100.00
Totals	18	18	100.00	100.00

(ii) **Internet Chat Room**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	15	15	83.33	83.33
Low	2	17	11.11	94.44
Medium	0	17	0.00	94.44
High	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(iii) **Meeting System**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	7	7	38.89	38.89
Low	1	8	5.56	44.44
Medium	5	13	27.78	72.22
High	5	18	27.78	100.00
Totals	18	18	100.00	100.00

(iv) **Telephone**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	1	1	5.56	5.56
Low	3	4	16.67	22.22
Medium	5	9	27.78	50.00
High	9	18	50.00	100.00
Totals	18	18	100.00	100.00

(v) **Fax**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	12	12	66.67	66.67
Low	4	16	22.22	88,89
Medium	2	18	11.11	100.00
High	0	18	0.00	100.00
Totals	18	18	100.00	100.00

(vi) **Messaging Service**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	15	15	83.33	83.33
Low	2	17	11.11	94.44
Medium	0	17	0.00	94.44
High	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(vii) **Room Videoconferencing**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	9	9	50.00	50.00
Low	4	13	22.22	72.22
Medium	5	18	27.78	100.00
High	0	18	0.00	100.00
Totals	18	18	100.00	100.00

(viii) **Desktop Videoconferencing**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	18	18	100.00	100.00
Low	0	18	0.00	100.00
Medium	0	18	0.00	100.00
High	0	18	0.00	100.00
Totals	18	18	100.00	100.00

(ix) **Teleconferencing**

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	4	4	22.22	22.22
Low	6	10	33.33	55.55
Medium	7	17	38.89	94.44
High	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(x) Face-to-face

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	2	2	11.11	11.11
Low	7	9	38.89	50.00
Medium	2	11	11.11	61.11
High	7	18	38.89	100.00
Totals	18	18	100.00	100.00

Question 11

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	10	10	55.56	55.56
No	8	18	44.44	100.00
Totals	18	18	100.00	100.00

Question 12

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	6	6	33.33	33.33
No	12	18	66.67	100.00
Totals	18	18	100.00	100.00

Question 13

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	10	10	55.56	55.56
No	8	18	44.44	100.00
Totals	18	18	100.00	100.00

Question 14

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	7	7	38.89	38.89
No	11	18	61.11	100.00
Totals	18	18	100.00	100.00

Question 15

Problem	Count
Slow communication because of differing technology specifications and/or programs.	5
Scheduling Problems because of different calendaring tools used	1
Difficult to network different meeting systems.	2
Difficulty accessing work in different versions and/or programs.	7
Frustration and reduced productivity due to having to convert/redo work.	7

Question 16

(i) Task performance software and technology

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
No training	11	11	61.11	61.11
Completely inadequate training	2	13	11.11	72.22
Adequate training	4	17	22.22	94.44
Extremely adequate training	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(ii) Communication software and technology

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
No training	11	11	61.11	61.11
Completely inadequate training	2	13	11.11	72.22
Adequate training	4	17	22.22	94.44
Extremely adequate training	1	18	5.56	100.00
Totals	18	18	100.00	100.00

Question 17

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	6	6	33.33	33.33
No	12	12	66.67	100.00
Totals	18	18	100.00	100.00

Question 18

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	5	5	83.33	83.33
No	1	6	16.67	100.00
N/A	12	18		
Totals	18	18	100.00	100.00

Question 19

(i) Frustration

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	13	13	72.22	72.22
No	2	15	11.11	83.33
Not Sure	3	18	16.67	100.00
Totals	18	18	100.00	100.00

(ii) Misunderstandings

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	10	10	55.56	55.56
No	3	13	16.67	72.22
Not Sure	5	18	27.78	100.00
Totals	18	18	100.00	100.00

(iii) Delays in task performance

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	9	9	50.00	50.00
No	3	12	16.67	66.67
Not Sure	6	18	33.33	100.00
Totals	18	1	100.00	100.00

(iv) Delays in task co-ordination

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	8	8	44.44	44.44
No	3	11	16.67	61.11
Not Sure	7	18	38.89	100.00
Totals	18	18	100.00	100.00

Section 3: Communication

Question 20

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	10	10	55.56	55.56
No	8	18	44.44	100.00
Totals	18	18	100.00	100.00

Question 21

(i) Frustration

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	14	14	77.78	77.78
No	3	17	16.67	94.44
Not Sure	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(ii) Delays in task performance

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	12	12	66.67	66.67
No	3	15	16.67	83.33
Not Sure	3	18	16.67	100.00
Totals	18	18	100.00	100.00

(iii) Delays in task co-ordination

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	11	11	61.11	61.11
No	4	15	22.22	83.33
Not Sure	3	18	16.67	100.00
Totals	18	18	100.00	100.00

(iv) Misunderstandings caused by language differences

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	6	6	33.33	33.33
No	6	12	33.33	66.67
Not Sure	6	18	33.33	100.00
Totals	18	18	100.00	100.00

(v) Cultural differences

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	5	5	27.78	27.78
No	8	13	44.44	72.22
Not Sure	5	18	27.78	100.00
Totals	18	18	100.00	100.00

(vi) Message misunderstanding

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	9	9	50.00	50.00
No	6	15	33.33	83.33
Not Sure	3	18	16.67	100.00
Totals	18	18	100.00	100.00

Question 22

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	3	3	16.67	16.67
No	15	18	83.33	100.00
Totals	18	18	100.00	100.00

Question 23

(i) Frustration

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	12	12	66.67	66.67
No	2	14	11.11	77.78
Not Sure	4	18	22.22	100.00
Totals	18	18	100.00	100.00

(ii) Delays in task performance

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	11	11	61.11	61.11
No	2	13	11.11	72.22
Not Sure	5	18	27.78	100.00
Totals	18	18	100.00	100.00

(iii) Delays in task co-ordination

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	9	9	50.00	50.00
No	3	12	16.67	66.67
Not Sure	6	18	33.33	100.00
Totals	18	18	100.00	100.00

(iv) Misunderstandings caused by language differences

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	6	6	33.33	33.33
No	4	10	22.22	55.55
Not Sure	8	18	44.44	100.00
Totals	18	18	100.00	100.00

(v) Cultural differences

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	5	5	27.78	27.78
No	5	10	27.78	55.56
Not Sure	8	18	44.44	100.00
Totals	18	18	100.00	100.00

(vi) Message misunderstanding

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	9	9	50.00	50.00
No	2	11	11.11	61.11
Not Sure	7	18	38.89	100.00
Totals	18	18	100.00	100.00

Section 4: Informal Interaction

Question 24

	Count	Cumulative Count	Percent of answered	Cumulative percent answered

Between twice and five times a week	5	5	27.78	27,78
Once a week	2	7	11.11	38.89
Once every fortnight	0	7	0.00	38.89
Less than once every fortnight	8	15	44.44	83.33
Not at all	3	18	16.67	100.00
Totals	18	18	100.00	100.00

Question 25

(i) Face-to-face

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	3	3	20.00	20.00
Used infrequently	2	5	13.33	33.33
Used quite frequently	4	9	26.67	60.00
Used frequently	3	12	20.00	80.00
Used very frequently	0	12	0.00	80.00
Used all the time	3	15	20.00	100.00
Totals	15	15	100.00	100.00

(ii) Electronic Mail

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	3	3	20.00	20.00
Used infrequently	3	6	20.00	40.00
Used quite frequently	2	8	13.33	53.33
Used frequently	3	11	20.00	73.33
Used very frequently	2	13	13.33	86.67
Used all the time	2	15	13.33	100.00
Totals	15	15	100.00	100.00

(iii) Telephone

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	1	1	6.67	6.67
Used infrequently	4	5	26.67	33.33
Used quite frequently	2	7	13.33	46.67
Used frequently	4	11	26.67	73.33
Used very frequently	3	14	20.00	93.33
Used all the time	1	15	6.67	100.00
Totals	15	15	100.00	100.00

(iv) Internet Chat Room

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	13	13	86.67	86.67
Used infrequently	2	15	13.33	100.00
Used quite frequently	0	15	0.00	100.00
Used frequently	0	15	0.00	100.00
Used very frequently	0	15	0.00	100.00
Used all the time	0	15	0.00	100.00
Totals	15	15	100.00	100.00

(v) Meeting Systems

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	14	14	93.33	93.33
Used infrequently	0	14	0.00	93.33
Used quite frequently	1	15	6.67	100.00
Used frequently	0	15	0.00	100.00
Used very frequently	0	15	0.00	100.00
Used all the time	0	15	0.00	100.00
Totals	15	15	100.00	100.00

(vi) Room Videoconferencing

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	13	13	86.67	86.67
Used infrequently	1	14	6.67	93.33
Used quite frequently	0	14	0.00	93.33
Used frequently	0	14	0.00	93.33
Used very frequently	0	14	0.00	93.33
Used all the time	1	15	6.67	100.00
Totals	15	15	100.00	100.00

(vii) Desktop Videoconferencing

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not used at all	14	14	93.33	93.33
Used infrequently	1	15	6.67	100.00
Used quite frequently	0	15	0.00	100.00
Used frequently	0	15	0.00	100.00
Used very frequently	0	15	0.00	100.00
Used all the time	0	15	0.00	100.00
Totals	15	15	100.00	100.00

Question 26

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	5	5	27.78	27.78
No	10	15	55.56	83.33
N/A	3	18	16.67	100.00
Totals	18	18	100.00	100.00

Question 27

(i) Trust between team members

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	17	17	94.44	94.44
No	1	18	5.56	100.00
Not Sure	0	18	0.00	100.00
Totals	18	18	100.00	100.00

(ii) Social bonding between team members

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	17	17	94.44	94.44
No	1	18	5.56	100.00
Not Sure	0	18	0.00	100.00
Totals	18	18	100.00	100.00

(iii) A feeling of belonging to the team

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	17	17	94.44	94.44
No	1	18	5.56	100.00
Not Sure	0	18	0.00	100.00
Totals	18	18	100.00	100.00

(iv) Satisfaction with regards to the social relationships within the team

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	16	16	88.89	88.89
No	1	17	5.56	94.44
Not Sure	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(v) Motivation to perform tasks more efficiently for the team

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	15	15	83.33	83.33
No	2	17	11.11	94.44
Not Sure	1	18	5.56	100.00
Totals	18	18	100.00	100.00

(vi) Responsibility to not let your team mates down.

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	15	15	83.33	83.33
No	1	16	5.56	88.89
Not Sure	2	18	11.11	100.00
Totals	18	18	100.00	100.00

Question 28

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Yes	13	13	72.22	72.22
No	5	18	27.78	100.00
Totals	18	18	100.00	100.00

Question 29

Problem	Count
Discussion of personal interests (e.g. religion, sport, family stories, etc.)	5
Informal learning experience through case studies – participation more NB than applicable knowledge.	1
Common interest in technology.	2
Online activities – share same pizza even though in different places – togetherness.	2
Networked games and/or activities.	1

Section 5: Virtual Requirements Elicitation Techniques

Question 30

(i) Virtual JAD using videoconferencing

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	13	13	76.47	76.47
Low	3	16	17.65	94.12
Medium	0	16	0.00	94.12
High	1	17	5.88	100.00
Totals	17	17	100.00	100.00

(ii) Virtual JAD using a meeting system

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	12	12	70.58	70.58
Low	2	14	11.76	82.35
Medium	2	16	11.76	94.12
High	1	17	5.88	100.00
Totals	17	17	100.00	100.00

(iii) Virtual interviews using desktop videoconferencing

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	17	17	100.00	100.00
Low	0	17	0.00	100.00
Medium	0	17	0.00	100.00
High	0	17	0.00	100.00
Totals	17	17	100.00	100.00

(iv) Virtual interviews using a chat system

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	14	14	82.35	82.35
Low	2	16	11.76	94.12
Medium	0	16	0.00	94.12
High	1	17	5.88	100.00
Totals	17	17	100.00	100.00

(v) Virtual interviews using the telephone

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	6	6	35.29	35.29
Low	6	12	35.29	70.59
Medium	3	15	17.65	88.23
High	2	17	11.76	100.00
Totals	17	17	100.00	100.00

(vi) Electronic questionnaires

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	8	8	47.06	47.06
Low	6	14	35.29	82.35
Medium	3	17	17.65	82.35
High	0	17	0.00	100.00
Totals	17	17	100.00	100.00

(vii) Virtual document review

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	3	3	17.65	17.65
Low	2	5	11.76	29.41
Medium	4	9	23.53	52.94
High	8	17	47.06	100.00
Totals	17	17	100.00	100.00

(viii) Virtual observation

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
None	14	14	82.35	82.35
Low	1	15	5.88	88.24
Medium	2	17	11.76	100.00
High	0	17	0.00	100.00
Totals	17	17	100.00	100.00

Section 6: Videoconferencing JAD

Question 31

Role in JAD session	Count
Facilitator	1
User/stakeholder	10
Developer	1
Observer	2

Question 32

(i) Three or fewer individual sites

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Present	11	11	91.67	91.67
Absent	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(ii) Explicit form of non verbal communication

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Present	3	3	25.00	25.00
Absent	9	12	75.00	100.00
Totals	12	12	100.00	100.00

(iii) Different emphasis on facilitation skills

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Present	6	6	50.00	50.00
Absent	6	12	50.00	100.00
Totals	12	12	100.00	100.00

(iv) Maintenance of effective group dynamics

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Present	1	1	8.33	8.33
Absent	11	12	91.67	100.00
Totals	12	12	100.00	100.00

(v) Explicit back channel of communication

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Present	3	3	25.00	25.00
Absent	9	12	75.00	100.00
Totals	12	12	100.00	100.00

Question 33

(i) Three or Fewer Individual Sites

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not at all Successful	0	0	0.00	0.00
Quite Successful	2	2	16.67	16.67
Successful	10	12	83.33	100.00
Extremely Successful	0	12	0.00	100.00
Totals	12	12	100.00	100.00

(ii) Explicit form of non verbal communication

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not at all Successful	6	6	50.00	50.00
Quite Successful	4	10	33.33	73.33
Successful	2	12	16.67	100.00
Extremely Successful	0	12	0.00	100.00
Totals	12	12	100.00	100.00

(iii) Different Emphasis on Facilitation Skills

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not at all Successful	4	4	33.33	33.33
Quite Successful	7	11	58.33	91.67
Successful	1	12	8.33	100.00
Extremely Successful	0	12	0.00	100.00
Totals	12	12	100.00	100.00

(iv) Maintenance of Effective Group Dynamics

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not at all Successful	10	10	73.33	73.33
Quite Successful	1	11	8.33	91.67
Successful	0	11	0.00	91.67
Extremely Successful	1	12	8.33	100.00
Totals	12	12	100.00	100.00

(v) Explicit Back Channel of Communication

	Count	Cumulative Count	Percent of answered	Cumulative percent answered
Not at all Successful	6	6	50.00	50.00
Quite Successful	4	10	33.33	83.33
Successful	2	12	16.67	100.00
Extremely Successful	0	12	0.00	100.00
Totals	12	12	100.00	100.00

Section 7 and 8

No responses

Section 9

Question 41 – No responses

Question 42

Problems	Count
Stakeholders do not trust people as much when they are remote.	2
Easier to ignore people when they are remote	3
Different schedules makes setting up meetings difficult	2
Technological problems lead to focus on the technology rather than the content	1
Battling to get people to answer questionnaires	1
Cannot explain things as easily over a non-visual medium	1
Organisational politics are less easy to perceive and understand when remote	1
People are distracted by things that are going on at their physical site	2
Lack of adequate technological and environmental facilities at all sites	1

Question 43

Solutions	Count
Focus on one on one meetings	1
Send well prepared agendas to people before hand	1

Question 44

Problem	Count
User side is not as technologically competent	2
Time differences regarding synchronous communications	2
Maintain developer presence at site	1