Social Learning and Multimedia Innovation in a Corporate Environment

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Abstract of Thesis

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Corporate expectations for information servicing possibilities offered by Multimedia Technologies have been high. Hopes for fast adoption, encouraged by advances in networking technology and hardware processing ability, have met with frustration.

Rapid technological progress within multimedia systems development coupled with the absence of established models to guide innovation has created great uncertainty. As a result organisations have made costly mistakes when selecting technological direction and engaging innovative development.

This study investigates the innovation process for multimedia within an organisation to gain insight into its operation and factors that impact on its trajectory.

The isolated case study method, commonly used in this study area, was abandoned. Instead, a participant observer with access to a series of linked projects including the pre-project phases was used. The case studies follow an organisation navigating complex technological choices requiring readjustment of the application of expertise and reconsideration of the technology supply model. The first case study covers the successful testing of a bank's network capability to evaluate its potential to handle rich multimedia applications. This is followed by involvement in the assessment of the technology group's pilot intranet prior to its rollout to the wider organisation. The third case study sees both initiatives combined to provide a distributed Training and Communications Network for the corporation.

Interdisciplinary consideration of multimedia innovation was required due to the range of social, political and economic factors that combined to impact technological decisions. The use of Actor Network theory enabled the mapping of relations between the variety of actors aligned around shared agendas for multimedia innovation. Technological convergence resulted in actors from previously disparate groups being drawn into a new relationship model. Organisational theory aided the assessment of the emerging tensions and dynamics. The revised relationship model extended across intra-organisational units, lines of responsibility in addition to interactions with external suppliers. Here the model of technology supply was reconsidered in light of the componentised standards based aspects of multimedia, which allowed technologies to be 'mixed and matched'.

During the study we are presented with evidence that social and technical factors are intertwined and require joint consideration throughout the innovation

process. The pre-project phase plays a crucial role in the alignment and initiation of innovative activity, an operation strongly dependent on the activities of the project leaders. Through appreciation of the process across projects, we are able to define areas of focus for the successful management of multimedia innovation and offer insight into how the technology department's role has altered to meet this set of challenges.

Thesis Structure

Declaration of Originality

This is to confirm that the content of this thesis entitled 'Social Learning and Multimedia Innovation in a Corporate Environment' is the result of original work and research by the writer. Where reference is made to any concepts or ideas from any other writer, the literary source is duly acknowledged and listed in the Bibliography.

David Scott Gallacher

Acknowledgements

"There will be times during your study that you will feel no one else cares about your work": I was advised by my CASE studentship interviewer. Thankfully, this fear proved to be unfounded. It cannot be said that my study was without stress and difficulty, but these have been overshadowed by both the value I've gained from doing it and the satisfaction of having completed it. During my study I was also fortunate in having the opportunity of meeting and working with many people from whom I gained much intellectually and socially.

My greatest debt remains to my father and mother who have been supportive above and beyond levels normally demonstrated by parents. Indeed, the thesis is more of a family achievement than an individual one, with an equal billing for them completely appropriate. The fourth member of our family, our dog, Kirky cannot go unmentioned as in her own special way she maintained spirits even during the most stressful periods.

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As with every journey there is a beginning and an end. I feel indebted to the casts in the rooms that set me on my way and then drew it to an end.

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Lastly, I would like to thank anyone reading this dissertation. Its creation was a rewarding experience which provides value each day in my working life. I hope that whatever your reason for interest you find something relevant to you within these pages. For those currently engaged in study of any sort, I wish you the best of luck. If you find yourself in the situation described by my opening quote, please persevere. It really is worth it.

1. Introduction

Social Learning and Multimedia Innovation in a Corporate Environment

This study investigates the innovation process for multimedia within an organisation in order to gain insight into the operations and factors which impact on its trajectory. The objective was to provide indicators of success in order to assist organisations in selecting and supporting innovations in a more predictable manner.

Effective performance of this task required consideration of the existing theoretical perspectives in order to identify and understand theoretical constructs of potential benefit to my study. The implementation of technological systems has become increasingly complex as they have evolved from automating simple processes and record keeping to supporting information rich user activity.

This thesis has been drawn into three broad areas. Within Section I, the existing state of understanding of multimedia innovation and technology implementation is considered, covering what issues existed and how the study was designed to assist answering areas of uncertainty. Section II contains the case studies covering three linked multimedia projects within a BigBank. Section III applies the theoretical lens of Section I against the case data of Section II to draw common themes and findings which contribute to our understanding of the process of multimedia innovation within a corporate environment.

Section I: Literature Review and Research Design

Literature

In this section, we consider how to approach the issues set by our study. The expanding range of knowledge required by technology studies presents a daunting task for comprehensive consideration. In order to focus our consideration I pose two simple questions:

1- What innovation theories are applicable to multimedia?

2- How is technology affected by a corporate setting?

Consideration of these two areas will produce a range of theories and hypotheses that can guide research design and form a lens through which to view the data gathered.

Technology Innovation theory uses a macro social studies perspective to view existing models of innovation. The applicability of these models to multimedia technology is considered given its specific characteristics. Market characteristics and elements of past study are also discussed.

The consideration of organisational theory focuses on the specific theatre of multimedia development for this study, the corporate environment. Technology's

role within this setting is considered as are impacts of organisational dynamics upon its operation. The manner in which organisations have attempted to manage these impacts through development methodologies and techniques is examined in order to understand how they attempt to gain an accurate match between user needs and technology functions.

The disciplines of human computer interaction and contemporary technology development (RAD[1], RUP[2]) share a common critique of traditional models with social shaping proponents. They both contest that previous theories such as waterfall development and technological determinism, respectively, allow only limited consideration of the users and settings.

Although newer theories such as social shaping of technology and iterative, incremental development methodologies acknowledge the importance of the user and the complexity in predicting the trajectory of technology development, no cohesive model has emerged. Observations and guidance offered remain on a broad, macro level.

Where theory has been applied to real life settings, it has often been through isolated case studies, with post-project interviews. This is not to say that this technique is not valuable but, in order to gain a more rounded perspective and understanding of such a complex area, alternative study approaches should also be attempted.

Research Design

The isolated case study method, popular within this area of study, was abandoned. Instead, a participant observer with access to a series of linked projects, including the pre-project phases was used. A participant observer was placed within a bank research group which assisted the acquisition of credibility and entry into projects. This approach was designed to enable deep insight into all aspects of the innovation process across various bank settings and connected technologies. Whilst this approach required subjective prediction of the evolution of cases, the resultant series of innovations provided a well linked picture of development.

Section II: Case Studies

The case studies follow an organisation navigating complex technological choices requiring readjustment of the application of expertise and reconsideration of the technology supply model. Due to the sensitivity of the information contained

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[1] Rapid Application Development
[2] Rational Unified Process

within this thesis, the organisation is referred to as 'BigBank' to conceal its identity. A background to the organisation is contained in appendix Chapter 12.2 although with anonymity. The case studies, titled Networked Multimedia (NMM), Praxis and Training and Communication Network (TCN), are outlined in chronological order in Diagram 1.1 below.

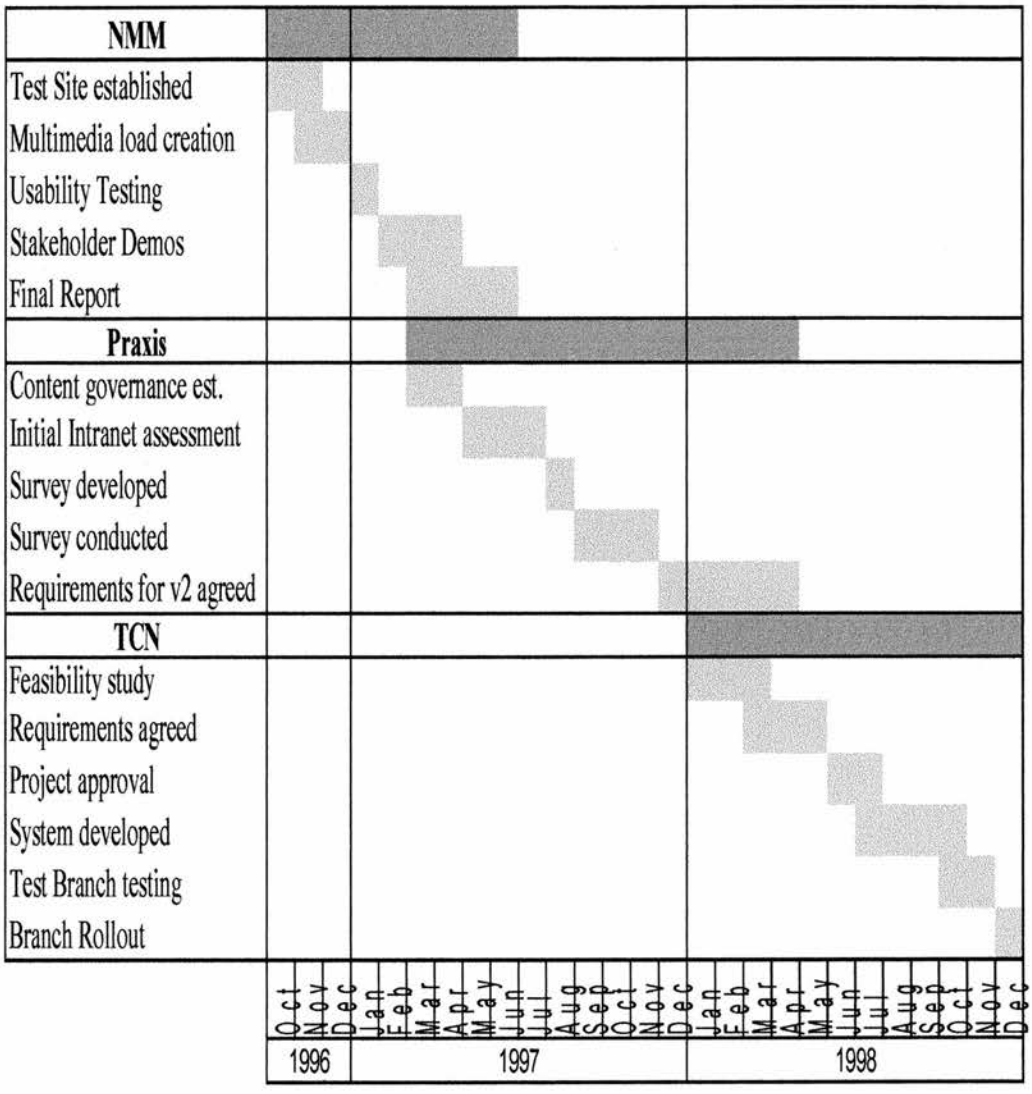

Diagram 1.1: Projects' Timetable Outline

Networked Multimedia (NMM) Case Study[3]

This case is about the bank Technology Department's testing and assessment of their technical infrastructure's capability to handle rich multimedia applications. It shows enrolment of external expertise to supplement gaps within BigBank's expertise, formation of innovation networks between suppliers and users and the impact of alterations of perceived 'reality' of technology. The positive findings from this case alerted actors to a wider range of technical possibilities. Appreciation and exploration of these possibilities drove the use of multimedia broadcast within the subsequent Training and Communications Network (TCN) project.

Praxis Case Study[4]

BigBank's intranet pilot was given the title 'Praxis'. Its first evolution consisted of a pilot system limited to the Technology Department. This case study covers the second evolution of 'Praxis', the Technology Department's intranet system and corporate pilot. The case shows organisational efforts to apply formal process and governance to the technical operations and content requirements of the system. We witness actors employing socio-political strategies to legitimise power and the navigation of power structures surrounding information ownership.

Training and Communications Network (TCN) Case Study

This case details the development of a corporate-wide distributed learning system delivered over the bank network. The system is created through a combination of innovations and social learning of the NMM and Praxis projects. Complex social, technical, economic and political factors are displayed as the project is presented to the Board for approval. Intensive socio-political activity is evident as

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[3] Findings from this case study are also featured in PROCTOR, R., A. McKINLAY, S. GALLACHER, (2001), 'The Influence of Network Quality of service factors on the Usability and effectiveness of multimedia internet broadcasting', in: A. Sloane, and D. Lawrence, (Editors), Multimedia Internet Broadcasting, 35-52, (Springer).

And

PROCTOR, R., A. McKINLAY, S. GALLACHER, M. HARTSWOOD 'An Investigation of the influence of variable network load on the effectiveness of multimedia presentations', in: C. Simone, and S. Weisband, (Editors), Proceedings of Group '99, the International Conference on supporting group work, 160-168, [Phoenix, AZ:](Arizona: Phoenix: ACM Press).

[4] Findings from this case study are also featured in GALLACHER, S., R. PROCTOR, R. WILLIAMS, (2001), 'The Politics of Intranet usability: can one size fit all?', in: J. Bawa; P. Dorazio; L. Trenner; (Editors), 'The Usability Business: Making the Web work', (Springer).

actors seek to establish positions of power and marginalise competitors, demonstrated by internal and external parties challenging the Technology Department's orchestrating role.

Section III Analysis and Conclusions

Section III extracts themes and important factors from the study with the aim of drawing attention to important areas of consideration for corporations engaging in multimedia innovation. 'Analysis' considers the drivers for innovation and the impacts multimedia systems have had upon the bank. Attention is drawn to the enrolment and operation of the innovation networks or 'communities of interest' composed of actors and artefacts that provide the framework for innovations to develop.

Consideration of these aspects allows us to detail some key findings within the 'Conclusions' chapter. Use of participant observation across linked projects allowed valuable insight into the pre-project environment and the operations of actors to align innovation networks. We reflect upon the impact on organisations of multimedia innovations evolving into integrated, networked systems. Revised considerations surrounding delivery methods, content requirements and corporate standards are necessitated. Appreciation of these aspects suggests areas of focus for the successful management of multimedia innovation and insight into how the technology department's role has altered to meet this set of challenges.

Study Chronology

My study commenced in October 1996. The Network Multimedia (NMM) project had been in existence since January of that year but development work began in December. The project ran until May 1997, at which point I moved onto the Praxis intranet project which I worked on until June 1998. In January 1998 I began to divide my time between Praxis and the Training and Communications network (TCN) project, transitioning to the latter full time in June 1998. This project ran until March 1999, although due to illness, I was only involved until December 1998.

My illness required a break of 8 months, although during this time I was able to gather data on the culmination of the TCN project by phone and e-mail. I moved to London in September 1999 for employment and remained there, working full time, while completing the dissertation document. My thesis was finally submitted on 1st January 2003.

Definition of Multimedia

As multimedia is the focus of study, I feel it is important to define my perception of it for this study. For clear definition I draw upon Williams' elucidation: "Multimedia refers literally and most generically to the facility to present information in a variety of media" (Williams, 1997: 31). Multimedia technologies define themselves from other information technologies through their convergence of media or 'multimedia-ness' (Williams, 1997) and opportunity for the user to interact with the system which Schmutzer (1999) suggests should be seen in two dimensions of user control in terms of content of communication and flow of communication. Indeed, it has been proposed that increased control and choices offered to process information are key aspects of multimedia (Williams, 1997: 32).

The technologies accepted as multimedia within this study allow users control and options concerning the type and timing of the information provided via a range of channels. This includes stand-alone systems, e.g. CD ROM based, and although all of the multimedia innovations studied are networked, this is not a defining characteristic.

LITERATURE REVIEW

2. SOCIAL SHAPING OF TECHNOLOGY

LITERATURE APPROACH

OVERVIEW

Chapter 2 Social Shaping of Technology

This chapter offers a macro overview of innovation theory relating to multimedia and associated technologies.

Technology innovation is discussed broadly and the applicability of various models to multimedia technology is considered. Frameworks for organising the various aspects of innovation are considered along with a review of studies within the multimedia market and aspects relevant to the innovation process.

Chapter 3 Organisational Theory

This chapter considers the environmental setting of our studies within corporate organisations. Organisational structure and dynamics and technology's role within that setting are examined, focusing on the various strategies and tactics by which organisations have attempted to maximise their relationship with technology.

These strategies and tactics include the adoption and application of standards, management of expertise, a range of development methodologies and techniques to understand user needs.

These are consolidated to provide a number of considerations and questions to pose against our case study findings.

2 SOCIAL SHAPING OF TECHNOLOGY

2.1 INTRODUCTION

Investigation of the innovation process for multimedia within an organisation requires multi-disciplinary considerations. The uncertainty surrounding multimedia innovations suggests a complex problem necessitating rounded consideration. A range of literature sources were consulted and insights collected relating to the core issues of investigation, what model of innovation exists, how does it operate and what factors impact its trajectory.

Technology innovation theory offered two models for innovation: linear and interactive. The interactive model produced by social shaping theorists opposes the linear model of innovation of technological determinism. In attempting to answer

widely acknowledged defects within the 'linear model' (Newby, 1992; Fairclough, 1992), the interactive model argues that social and technical aspects interact to shape each other and must be jointly considered within the innovation. Social Shaping of Technology (SST) calls for consideration of economic, policy and social factors. Applicability of each model to multimedia technology was considered.

Technology determinism's linear model of innovation appears inappropriate for Multimedia innovation. Multimedia technologies feature componentised offerings requiring local configuration necessitating environmental consideration and supplier-user interaction. This interaction implies the existence of choices and therefore unpredictability within the technical trajectory. This is in opposition to the pre-determined trajectory proposed by determinism, but compatible with the interactive model of social shaping.

Information Technology was also considered as a useful point of reference due to technological similarities to multimedia, greater market maturity providing evidence of its adherence to the interactive model of innovation.

Application to real world scenarios is necessary in order to properly assess technology innovation's opposing claims and assist investigation of multimedia innovation. SST has offered some frameworks to map and assess the creation of innovation networks. Frameworks allow a homogeneous appreciation of how and why actors become involved in innovation networks.

Multimedia is an emergent technology, consequently studies are limited and focused on societal adoption and policy. As a result of the need for supplier-user interactions, Multimedia innovation study often features suppliers attempting to include users within the innovation process. Debate exists around how achievable this is and the best method to achieve it.

Elements which have emerged through this review, that appear relevant to our investigation, are that technology is a complex process requiring appreciation of both technical and social factors. This creates an interactive model of innovation which is evident in the markets of Information Technology and Multimedia where components are configured into solutions tailored to their specific setting, a task requiring user involvement. Interactive innovation is conducted through the creation and operation of networks. A number of frameworks have been presented to assist in the analysis of this process. We also gained an understanding of the studies conducted for multimedia innovation and the means by which the interactive process has been enabled. With these insights, it is clear that we need to gain a clearer understanding of the organisational setting and the users within.

Organisational theory provides insights into various social, political and economic factors at play within this setting. In particular the ongoing struggle, identified by Burns and Stalker (1961), between the formal and informal structures resulting in internal political activity. Within this struggle, actors and groups leverage power resources to assist their activities and technology artefacts serve as power resources. The formal organisation has to establish mechanisms to mediate conflict between groups to ensure its benefit to the organisation. The operation of standards is a core tool in this activity. Additionally, organisations need to consider how best to accommodate the existence and application of expertise within their structure.

The tactics used by the organisation are focused on maximizing economic benefit and minimizing risk from technology activities. In addition to deployment of standards and application of expertise, management organisations also employ processes to manage technology development.

Management of technology development has received considerable attention due to the frequent and costly failures experienced by corporations. Studies by writers including Tidd, Bessant and Pavitt (1997), have sought to identify the roles that should be present within successful projects. In parallel a number of possible methodologies (RAD, DSDM) have emerged to minimize risk and tactics to capture user requirements effectively.

The team roles identified appreciate the hybrid nature of technology innovation and the need for consideration of aspects beyond the purely technical. Parallels can be drawn between the evolution of innovation theory and development methodologies. As technology theorists have developed an interactive model to oppose the traditional linear development, methodologies have moved to iterative, incremental models accommodating increased user input departing from the classic linear waterfall model. Iterative models have increased the frequency and opportunity for user input during development. In order for this input to be effectively captured and applied, techniques including user observation, and cognitive modelling (Preece, 1994), from the discipline of Human Computer Interaction (HCI) have been enlisted. These techniques are driven by the objective of system usability which ties back to the importance of local tailoring for multimedia systems.

The combined learning from this literature review provides us with an understanding of the theoretical terrain surrounding this study. It arms us with perspectives and insights through which to consider the phenomena we will encounter within the case studies. The existing understanding of multimedia

innovation provided by Williams et al. (2000) is that it is a complex process requiring consideration of both social and technical aspects and seemingly compliant with the interactive model of innovation. It requires the configuration of various components to meet localised needs effectively, a process requiring the creation and operation of a network. Offerings within this market have sought to empower the user and enable user-led innovation. The organisational environment we will address is considered to feature both a formal and informal structure. The formal structure attempts to create and enforce methods to moderate the political conflict within the informal organisation. As a result of the importance of technology, these methods have included the use of technology standards and related expertise management. We also considered aspects of the management of technology to aid success and minimise risk. Broadly, aspects considered are team structure, development methodology and user understanding techniques.

2.2 TECHNOLOGY INNOVATION THEORY

Technology affects society. On this point technology theorists are agreed. Debate arises on how it affects society and whether it, in turn, is affected by society.

The traditional concept of technology development presented a linear process dictated by an inner logic. It was believed that technological change caused necessary and determinant impacts producing social and organisational change. Technology was perceived as a 'black box' offering a stabilised design to be deployed in a consistent manner unaffected by the nuances of the specific setting. Academic observers kept the technological 'black box' intact considering only the effects of the technology and not the causes.

Opponents of this 'black box' approach argued that understanding of the inner workings of the development cycle was obscured through treatment of various categories of technology such as Computer Aided Design (CAD) as a homogeneous class of objects, uniform in characteristics and stable over time (Fleck et al., 1988). Cursory observations of the technology industry cast doubt over this assertion. When we consider, for example, the software product and service market, the range of organisations and their differing offerings within these categories combined with organisations such as IBM Global Services, Accenture, Cap Gemini, Ernst & Young whose technology consulting business model is reliant on implementing technology to suit individual technology purchasers' requirements, a 'plug and play' technology scenario appears unlikely.

The impact of the implementation environment was encountered during implementation of packaged systems which were promoted as a 'technical fix' to the

problems of UK manufacturing organisations. Initial supplier offerings to these organisations were often rooted in large US corporations manufacturing complex assemblies with formalised information and decision procedures. Requirements of this software were far removed from the haphazard data collection and idiosyncratic planning practices present in many of the UK firms who tried to adopt them. This misalignment between the technology requirements and the organisational setting caused frequent failure during initial implementations (Clark and Newell, 1993; Fleck, 1993; Webster and Williams, 1993).

This study demonstrates the impact of the implementation environment on the performance of the technology. As such, it questions the premise that the technology will arrive and a set of outcomes will occur, suggesting a possible bi-directional relationship between the environment and the technology.

The SST perspective supported the existence of this bi-directional relationship. Developed as a critique of the technological determinism viewpoint, social shaping argued that the trajectory of technical development is not only influenced by technical considerations but is subject to social, economic, cultural and political factors (Williams, 1997; Edge, 1988). The field of study sought to assess the manner in which these elements affected the trajectory of the development, the constitution of the technology and the manner in which various societal groups are affected by it (MacKenzie and Wajcman, 1985). This opposed the various flavours of determinism. SST rejected deterministic views instead proposing a process impacted by a combination of factors.

Social Shaping proponents argue that a variety of environmental factors impact the development process. SST suggests that social settings shape the technology as much as the technology shapes the setting (MacKenzie and Wajcman, 1985; Edge 1988). As Williams proposes; "SST studies show that technology is a social product, patterned by the conditions of its creation and use" (Williams, 1997: 2).

SST sought to open the 'black box' to examine the science and technology required (Latour, 1986; Latour, 1988), in order to look beyond what the technology was and what it did. Interest was focused around the content of technology and the processes that created that content. In viewing this aspect, SST offered one of the core concepts that form its basis: within the development of technology choices exist. In addition, these choices each provide the opportunity for the technology to develop in a different direction. As Vergragt notes:

> The fundamental point here is that, in the early stages of the innovation processes, choices can still be made between alternatives. These choices are influenced by economic and political interests of the actors involved (Vergragt, 1988: 484).

Analysis of these choices is concerned with understanding how social, economic, organisational and political factors affect:

> i) the direction as well as the rate of innovation,
> ii) the form of technology: the content of technological artefacts and practices,
> iii) the outcomes of technological change for different groups in society (Williams and Edge, 1996: 868).

Through appreciation of the roles of these various factors within the existence of choices during innovation, SST accepts that technology is negotiable (Cronberg, 1992) impacted by this interaction between social, economic, organisational and political factors. As such, technology is open to multiple outcomes. The irreversibility (Collingridge, 1992; Callon, 1994) of these outcomes and resulting impacts on the possible direction of subsequent choices and technical trajectory (Rosenberg, 1994) are considered. The outcome of choices can become entrenched creating closure around a choice and trajectory stabilising elements of the innovation (Pinch and Bijiker, 1984) although the possibility of decisions being reversed is also acknowledged (Latour, 1988).

In considering the process of technology innovation, SST acts a 'broad church' drawing from a range of disciplines to provide rounded consideration of the area. This amalgamation does not seek to create a united theory or even construct a permanent relationship instead facilitating a cross-pollination of theoretical perspectives providing opportunity for further evolution within the field.

Common interests are evident across the academic disciplines when examining the process for gaining and applying power within technological innovation and the role of knowledge in these endeavours. The disciplines enlisted are Sociology of Scientific Knowledge (SSK), Sociology of Industrial Organisation, Technology Policy Studies and aspects of the Economics of Technological Change.

SSK employs perspectives found within history and the Sociology of Science (Shapin, 1982) where the development is assessed to identify points where contingency or 'interpretative flexibility' occurs. At these stages, they attempt to understand why particular choices were made in preference to others. This field of study observed that the reasons were never solely technical but instead contained a strong social aspect shaped by the environment surrounding the development.

This questions the existence of closure around choices and has been an area of debate between the other areas that feel that tangible technical impacts from decisions exist and the factors influencing choice cannot be divorced from them. SSK originally established the theory around the social construction of scientific truths, expanding this to artefacts presented under the phrase Social Construction of Technology (SCOT) (Pinch and Bijker, 1984). Whilst the heavy leaning to the social

aspect of decision making is open to debate, this theory does provide a useful appreciation of social factors within the development assisting consideration of elements such as reputation and status amongst actors. The theory surrounding social negotiation process advances the SSK view that technological facts are in part a matter of perception as opposed to technological reality. Schmutzer (1997) argues this subjective aspect:

> Studying the social shaping of technology makes us aware of the two 'realities' of a technology: on the one hand, there is the reality of the technical features and on the other hand, there is the reality of how people interpret a technology. The social shaping perspective emphasises the ideas evolving from the interpretation of a technology which are shaping its actual development and therefore its technical reality (Schmutzer 1997: 1).

The perception of the technology by various actors, which is both a product of and factor within the negotiation process, is therefore important. This draws on Latour and Woolgar's (1979) argument that scientific 'facts' are constructed and negotiated by scientists. As a result of the breadth of actors and range of backgrounds they possess, the communication setting and manner in which the technology is presented are arguably important factors influencing the success and direction of the innovation. Vergragt notes "In the industrial firm, scientific knowledge is generated which is biased by various interests towards certain solutions" (Vergragt, 1988: 485).

While these 'facts' are constructed and negotiated by scientists there is also a strong contextual character to them (Collins, 1981). This contextual nature has influences beyond the traditional limit of arguments between scientists, affecting the feasibility of tackling these problems. "'Doable problems' are the result of alignment of experiment, laboratory and social world by coordinated efforts of various actors" (Vergragt, 1988: 500).

While SSK and SCOT argue the importance of the micro social relations of actors, the Sociology of Industrial Organisations adopts a reverse approach. The social processes, agendas and objectives impacted by technical change are identified in order to trace these impacts to the influence of the changing technology. This area of study was principally driven by Braverman's (1974) application of Marx's analysis of the labour process. Marx ([1867] 1976) presents an adversarial scenario where technological development is focused on labour force marginalisation in order to enforce the desires of management. Initial studies, such as that of Noble (1979) noted study of the innovation of numerically controlled machines tools echoed Marx's view with technology decisions influenced by management desire to reduce workers' influence. Later work drew attention to the complexity of interests across

the diverse range of organisational units affected and the rich array of management strategies that could be applied (Wood and Kelly, 1982). Sociology of Industrial Organisations provides an important appreciation of the organisational environment in which technology can be applied. While this theory supports the presentation of the importance of this area, the organisational literature within the next literature chapter will attend to discussion around the drivers and actors that affect its implementation at meso and micro levels.

Technology Policy Studies (Molina, 1989) are understandably focused on the macro environment but do provide some aspects that relate to the meso and micro environments. The sociology of industrial organisations focuses on the organisational setting while technology policy studies expands beyond this restriction encompassing institutional and societal aspects such as markets, legislation, culture and politics. This serves to provide a macro perspective of the environment against which technology is developed. The principal source of tension between this and the other theories exists around the implicit absence of choice presented. Technology Policy focuses on the absence of choice contained within a particular selection ignoring the possible alternatives. Features of the macro social environment are the recurrent reason for this restriction of alternative avenues. While this theory offers useful insights into the macro environment, appreciation of the existence of alternatives is crucial if we are to really understand the dynamics of the technological 'black box'.

As technology studies have sought richer explanation than offered by technological determinism so has economic study investigated beyond the neo-classical approach. In studying the economics of technological change, approaches have focused attention on supply side issues and technical development. Historical observation has identified unevenness of the process and qualitative shifts. This wider view has led to accusations of generalisation with focus upon long-term patterns.

Writers such as Dosi (1982) have sought to identify stable periods within techno-economic paradigms which generate innovative advances in an attempt to understand why some periods generate rapid advance whilst others show little growth. As the other disciplines assist in assessing a breadth of inputs, this method adds a dimension over time although at a macro level.

2.3 SOCIAL SHAPING OF TECHNOLOGY: A CONGREGATION OF PERSPECTIVES

While each theory within the 'broad church' of SST provides distinct approaches and presumptions, they all approach the same fundamental issue: the creation of stable networks (MacKenzie, 1992). While SSK believes in dominant influence of individual actors contrasting with social policy's emphasis on macro-structures, they are merely different starting points for investigation of the dynamics of network creation.

When we consider the wide complex of factors involved, the benefit of these various approaches becomes clearer. The complex of factors requiring consideration from the various theoretical approaches accommodated by SST constitutes an innovative model contrasting with the traditional uni-directional, linear approach (Lundwall, 1993). The alternate model argues that innovation is a complex social activity created through a bi-directional relationship between technology and environment. The interactions between the various actors and institutions present, fuel an iterative, spiral evolution of technology. The evolutionary aspect draws on Hard's (1993) depiction of innovation as a struggle engaged in technical problem solving with various interests articulated and learning outcomes processed. The information capture and knowledge application implied plays to the importance of actor's expertise and the manner of communication during the innovation process (Fincham et al., 1995).

2.4 THE INTERACTIVE MODEL OF MULTIMEDIA AND INFORMATION TECHNOLOGY MARKETS

Without the application of innovation theories to real-world examples these theories serve merely as interesting counter-arguments (MacKenzie, 1999). The existence and operation of this interactive innovation process can be observed within markets: indeed some are critically reliant upon the existence of this interaction.

Markets can be viewed as social constructs impacted by a variety of legal, political, cultural and knowledge processes (Green, 1992). In short, they are a particular network of various actors.

Classic economic theory depicts the market as a sterile environment fuelled by complete knowledge and operating perfect competition. The multimedia market displays characteristics that break these assumptions and can be modelled more appropriately. Consideration of Information Technology is also valuable due to its close technical similarities to multimedia and greater market maturity providing

richer material. Multimedia and Information Technology are markets supplied with technological artefacts that are unfinished commodities. A collaborative development and implementation process between supplier and user is required to complete these commodities. This represents a hybrid between the classic ideal market relationship and social, inter-organisational interaction (Brady et al., 1992; Lundwall, 1993).

The collaborative, interactive process required rejects the applicability of the traditional linear model. The Information Technology market displays the use of component offerings and interactive innovation process when we consider the assertion that, "The very structure and architecture of contemporary information technology is itself a product of historical processes of social and economic shaping" (Williams and Edge, 1996).

This appears a strong indicator that the environment might exist to support the interactive model. The historical processes referred to stem from the segmentation of the Information Technology market not through technical need but due to regulatory intervention. In order to prevent IBM from bundling their hardware and software sales, these products were separated by regulation creating an independent software supply sector (Pelaez, 1990).

The market underwent further hierarchical division (OECD, 1985) with companies specialising in certain areas such as Sun Microsystems focus on systems & utilities with Solaris and Java. The segments created initially were:

Systems/Utilities: Including operating systems, programming languages.
Application Tools: Generic data management systems & tools.
Application Solutions: Catering to specific uses such as accounting and payroll.

Markets of component offerings were created requiring purchasers to combine elements from each segment in order to create an overall solution. The rationale would be that through specialism a number of 'best of breed' components would exist to be combined. To enable these configurations, common interfaces were created for suppliers to adhere to if they wished whilst retaining autonomy for their offerings development.

This allowed organisations to configure a variety of components into a system to meet specific business requirements whilst leveraging standard elements. The existence of integration possibilities was viewed in some cases as a competitive advantage. Lotus Corporation positioned the compatibility of its development suites as its key feature providing significant corporate value. This feature contributed to

the higher price commanded by Lotus product suites relative to competitors' products that did not offer this compatibility (Swann and Lamaison, 1989).

The types of IT applications created can be drawn into three broad categories: discrete, integrated and inter-organisational networks. Early IT productised applications were discrete, client-based applications applied to specific or tightly associated functions. They served to automate well-defined operations lending themselves to standardisation and wide market distribution. Market relationships typically existed between single suppliers selling to a single operational unit within an organisation. In contrast, integrated applications link together complex, wide ranging activities often requiring the networked configuration of various supplier offerings. Customisation of the various components may be necessary to tailor networks to the specific organisational setting (Fleck, 1988b). Inter-organisational networks require this operation to extend across a number of organisations.

Configurations developed are adapted to the needs of the specific organisation, a process requiring both breadth and depth of expertise. This body of knowledge requires inputs from a range of groups, external and internal to the organisation. While the suppliers may offer a range of roughly generic components, the knowledge of the individual organisation's business and operational practices is at a premium (Fleck, 1993). These engagements may provide insight which can beneficially be applied to suppliers' future offerings, a practice which has assisted the evolution of technology markets (Fleck, 1988a).

Configuration of componentised technology to form solutions positions Information Technology as a 'configurational technology'. Configurational technologies conform to the interactive model of innovation and emerged as part of the criticism surrounding the linear model of innovation with technologies. The concept refers to:

> Situations similar to system technologies in that the whole complex works together and is made up of component technologies.....Configurations of component technologies may be made up of a very wide (if not arbitrary) range of patterns; the mutually interacting (but not necessarily mutually constraining) components may be deployed in a very wide, possibly arbitrary, range of ways in order to match externally set requirements (Fleck, 1988: 20).

This allows the system to adapt to particular user requirements and the social setting of the technology, a feature present within Information Technology. The concept of configurational technologies implies the relevance and importance of the user and setting to the innovative process.

It would therefore appear that the theoretical perspectives of SST provide benefit in assessing Information Technology innovation. Indeed, Fleck (1988b; 1993;

1994) identifies IT systems as examples of configurational technology. Since our study is concerned with Multimedia innovation, are there sufficient similarities to presume similar analytical benefit? Williams' definition of multimedia provides this clear linkage. "Multimedia refers literally and most generically to the facility to present information in a variety of media" (Williams, 1997: 31).

Multimedia technologies define themselves from other Information Technology through their convergence of media or 'multimedia-ness' (Williams, 1997) and opportunity for the user to interact with the system which Schmutzer (1999) suggests should be seen in two dimensions of user control in terms of content of communication and flow of communication. Indeed it has been proposed that increased control and choices offered over medium and timing for processing information are key aspects of multimedia (Williams, 1997: 32). The information processing capability forms the core commonality between IT and Multimedia.

The facility to transfer information is core but the presence of component offerings is also shared with interactivity being achievable through a number of different technical configurations (Curry, 2000; Schmutzer, 1999). Collinson (1996) identified a three-layer model of innovation within multimedia, expanding upon the hierarchical segmentation for Information Technology outlined previously, which consisted of:

> *Applications*: Specific configurations, services, applications and products, within particular sectors and contexts.
> *Delivery Systems:* Combinations of technologies for storage, display, delivery, distribution.
> *Components:* Basic building blocks that can be combined to enable product and system development.

This model shows the complexity within the development of these systems and the degree of modularity that exists between the various components. The possible combinations allow a range of various systems to be created. As such we see multimedia's configurational nature requiring user input and environmental considerations (Williams and Proctor, 1996). The concept of configurational technologies further supports the existence of the hybrid market of user-supplier interaction proposed (Brady et al., 1992; Lundwall, 1993) as Fleck asserts "for configurational technologies, in a very real sense, industry is the laboratory" (Fleck, 1988: 52).

Within this process, interaction between user and supplier is crucially important and is seen as a primary influencer for the future direction of multimedia

(Williams, 1997: 33). The emergent nature of the multimedia market heightens the importance of this interaction. In markets where the market and offerings are undergoing rapid developments, in the face of great uncertainty, close forms of user-supplier 'coupling' are likely (Freeman, 1984). This can occur horizontally to share risk between players or in the case of IT systems in financial services (Fincham et al., 1995) vertically between user and supplier. The latter format allows the sharing of technical opportunities and user needs to identify matches thus creating markets for particular solutions.

It therefore seems logical that in order to consider multimedia innovation effectively, account of both social and technical factors should be taken. In this regard, the theories we have discussed under the SST banner offer useful insights but difficulty remains around how best to organise and assess the various actors and artefacts operating within the innovation process. This would at least assist in creation of a framework to understand and minimise the uncertainty and risk currently present within these undertakings. These aspects align to enable 'doable problems' defined by Vergragt (1988), a process which requires structured examination of network construction.

2.5 NETWORK CONSTRUCTION

Across the disciplines encompassed by the broad church of SST, a number of frameworks have been presented. They tackle the alignment of resources and application of knowledge around innovation from differing perspectives. Included are 'sociotechnical systems' (Hughes, 1983), 'sociotechnical constituencies' (Molina, 1990) and the operation of Actor Networks (Law and Callon, 1992). They each carry a degree of theoretical baggage from sociotechnical constituencies grounding in technology policy to actor networks links to SSK. Each framework attempts to tackle the issues concerning the initiation and operation of innovation by studying the enrolment of actors within a network (Law and Callon, 1992) and Molina's (1989) investigation of expectation alignment around realisable objectives. This investigation is conducted with an appreciation that the 'inner technical logic' of determinist theories can be replaced by restricted information and Whipp and Clark's (1986) 'bounded rationality'. This produces decisions not grounded solely in technical purity but linked instead to economic considerations and social relations. Molina's concept of sociotechnical constituencies was born from study of technology policy. The 'constituencies' approach starts from the realisation that all

processes of innovation and technology development imply the creation of 'sociotechnical constituencies.'

> These are dynamic ensembles of technical constituents (for example machines, instruments) and social constituents (for example organisations, interest groups), which interact and shape each other in the course of the creation, production and diffusion/implementation of specific technologies (Molina, 1989).

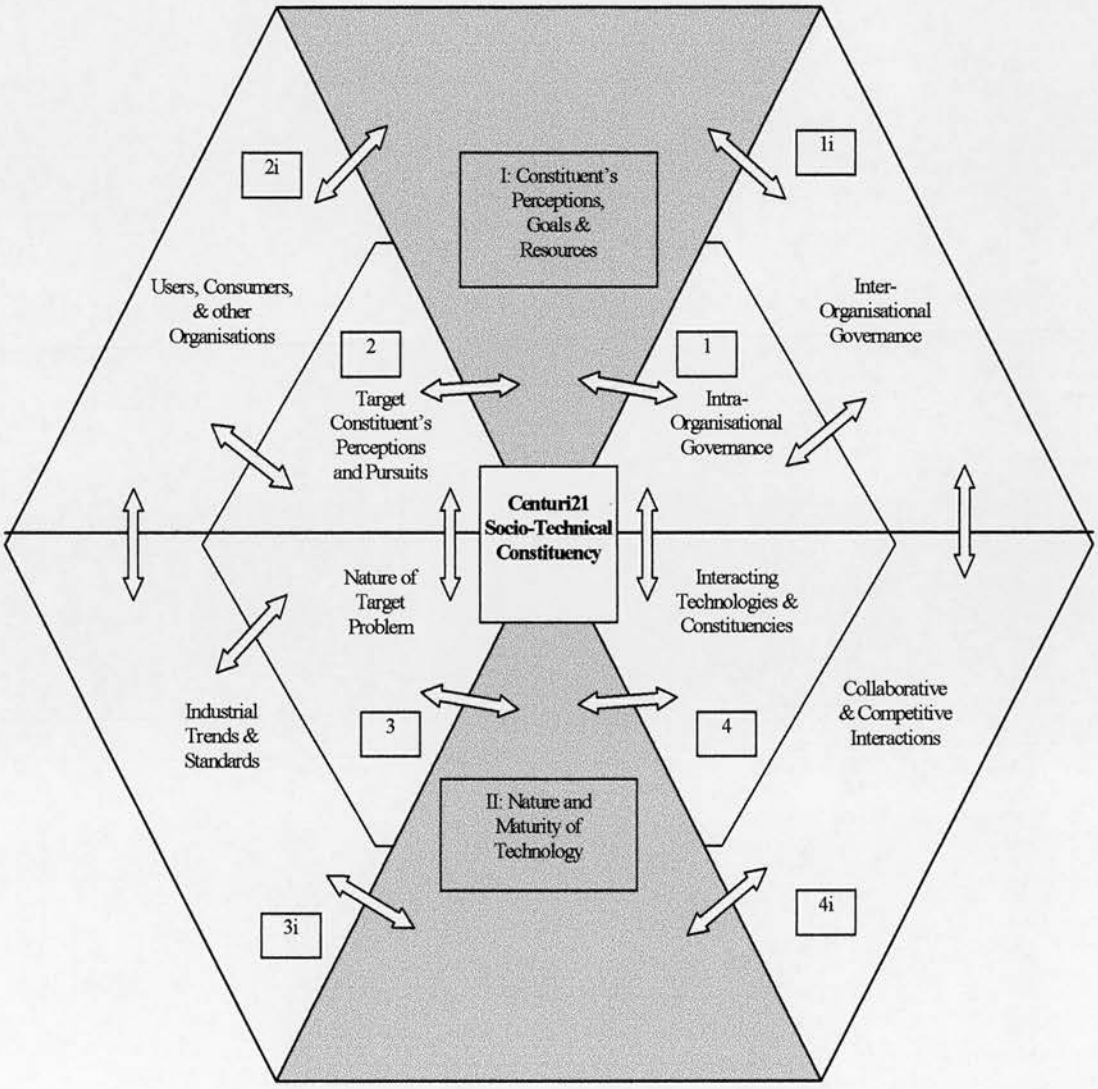

Diagram 2.1: 'Diamond of alignment' (PACE Case Study 1 – Project Centuri21 (2001))

These constituencies are created through the process of 'sociotechnical alignment' captured in the 'diamond of alignment' as shown in Diagram 2.1 above. This process of alignment is conducted by social constituents (however consciously, successfully, partially or imperfectly) when they are promoting the development of a

specific technology either intra-organisationally, inter-organisationally or even as an industrial standard. 'Sociotechnical alignment' may be seen as:

> the process of creation, adoption, accommodation (adaptation) and close or loose interaction (interrelation) of technical and social factors and actors which underlies the emergence and development of an identifiable constituency (Molina, 1990)

The alignment should neither be seen as an ad hoc accommodation of several static available pieces nor as complete and permanent, once achieved (Molina, 1997). Instead, the 'diamond of alignment' accommodates the rich picture of competing influences and trends, across institutional settings and governance systems. As such, the 'diamond of alignment' is the conceptual tool developed to provide a structured framework with which to analyse processes of alignment. The concept of sociotechnical constituencies has been applied (Molina, 1990) largely within macro environments leveraging its inherited appreciation of policy issues.

By contrast, Actor-Network theory's early application possessed scepticism for the influence of broader social and economic structures. Actor-Network Theory evolved during the mid-1980s as a theoretical concept concerning the constituent parts (actors) and their relations and methods of interaction. Actor-Network Theory attempts to understand the process of enrolment for actors within the networks and the translation of each actor's agenda to achieve the shared objective of the network.

> ANT attempts to place a fabric or structure combined with social theory around the arena of science and technology within society attempting to place an order around seemingly unordered elements (Latour, 1997: 1).

The 'actors' are not limited to individuals or social groups: they may also be technological artefacts themselves or other non-human elements. In common with the interactive market theory, Actor Network acknowledges the existence of imperfect knowledge and bounded rationality. These postulate that the organisation and decision-making processes during technological innovation and development are based on a limited or 'bounded' understanding of the full environment. Inherited from its association with SSK the practice of actors making decisions based on their perceptions is incorporated. It is considered that they become enrolled in networks based on their existing understanding of the benefits they may gain.

Actor network theory appreciates that while each actor may perceive different benefits from the project their interests can align for collaborative development based on decisions from the bounded rationality they operate within. Interpretative flexibility, also drawn from SSK, complements Schmutzer's (1997) theory of different realities of a technology resultant from this flexibility. It remains crucial that the perception of actors creates a shared interest in the project linking the global and local networks, as

> it is the degree and form of mobilisation of the two networks and the way in which they are connected that determines both the trajectory and success of the project (Law and Callon, 1992: 47).

This process for obtaining resources for innovation creates negotiation space. It is within this negotiation space that local networks appear to develop the project. Pinch and Bijker's work examines how interpretative flexibility allows different actors to perceive the shared agenda differently dependent on their own agenda and knowledge. As a result, management of this perception is a key enrolment tactic.

> Interpretative flexibility allowing each actor to consider the project from their individual perspective (Pinch and Bijker, 1984: 24).

Actors become enrolled within the network forming nodes on the network linked to each other. The links and the nodes on the network are fluid and require maintenance as they alter and change dependent on various environmental impacts and the management of relations between nodes. As such the networks are processes or achievements as opposed to relations or structures established by a given order.

Network alignment requires a 'community of interest' to be created around a shared agenda. This relates to the discussion within organisational theory around the informal organisation and how groups within it may seek to exert power over technical resources to advance their own positions. This complements the discussion around the politics of technology (Winner 1977; 1980) where the neutrality of technology is contested by the view that it is engaged by groups to maintain or alter their social setting (Hard, 1993) applied as 'politics by another means' (Latour, 1988).

One of the critiques of Actor Network theory is the assumption that the networks and the technologies they create are built from a clean slate as purported by some authors (Latour, 1983; Latour, 1986; Latour, 1988). In addition, actors at a local level are afforded large amounts of influence over technology. The focus of early work on emerging innovations in Research and Development facilities has been accredited with fostering this perspective. This led to difficulty in accounting for the influence of other networks within the macro environment. As a result, efforts were made to appreciate the stability of larger structures, one of these being the use of the concept of obligatory points of contact.

The concept of 'obligatory point of passage' has been presented by Law and Callon (1992) and relates to the node that provides a link between a local network and external networks. The existence of this contact aids analysis concerning the marshalling of actors and resources within the innovative process, discussing actors' roles and effects upon the operation and placement of other actors within the process.

The theory considers the linkage between micro developments and a global network constructed from relations between actors created during resource acquisition. This theoretical addition has helped in accounting for macro themes within Actor Network studies. The concept of the 'obligatory point of passage' is described as such:

> The concept implied centralised control. It suggested that a single locus should shape and mobilise the local network and that this locus should have control over all transactions between the local and global networks. It should, in short, become an obligatory point of passage between the two networks (Law and Callon, 1992: 48).

Law and Callon's paper provides an anecdotal case study of how this position was established as a result of official designation and subsequently failed. The concept remains of interest as it provides an initial tactic to link the micro considerations held within SSK to the macro factors of policy and economic theory. By this we see how nodes can act to enlist and manage the timing and deployment of resources. The tools of this include management of expertise, knowledge and perceptions. The importance of these intangible knowledge-based resources within multimedia development is emphasised by Miles,

> One key factor shaping technologies is the distribution of technological and other knowledge among different actors. Knowledge is power: different knowledges have a distinct power in shaping of multimedia technologies (Miles, 1997: 1).

The role of expertise within technological development is discussed more fully in the literature discussion on organisational theory.

The concept of obligatory point of passage is of particular use within analysis of multimedia innovation as it presents the concept of a group acting as a marshalling force for the various actors and knowledge within an innovative process. The group acts as the 'obligatory point of passage' in a style similar to the system integrators discussed in the sections on Organisational Theory (Chapter 3) and the Management of Technology (Chapter 3).

These frameworks are broadly homogeneous and require application to a particular situation to be useful. In this instance, the situation is multimedia innovation within a corporate environment. In order to do this we will explore organisational theory and the way in which technology is applied within it. Before doing this it is useful to consider multimedia innovation studies generally.

2.6 EMERGENT STUDY OF MULTIMEDIA

Multimedia market maturity has been an area of debate. The influential Bangemann Report (European Commission COM (96) 607 1996) purported that 'off the shelf' multimedia offerings existed that provide cost-effective solutions to the

consumer. This represented a considerable advance as suppliers have traditionally struggled to produce offerings with appeal across a wide base of users. Initially offerings consisted of replicas of existing products and services (Collinson et al., 1995). While this has evolved, the market is still searching for a killer application (Dutton et al., 1995) to drive growth and Bangemann's market scenario has been contested. While Bangemann presents product diffusion and market growth as key activities, other studies (SLIM report, 2000) have presented a more challenging environment. The SLIM initiative was a major EU supported project to investigate the process of innovation in multimedia: the convergence of information, communication and broadcasting technologies, highlighting the role of social learning, the widely dispersed interactions between producers, intermediate and final users and policy-makers which are critical to the future evolution and success of multimedia.

The SLIM report questions Bangemann's stabilised 'black box' perception. Instead echoes of the interactive market scenario are heard, with unstable offerings requiring careful implementation present rather than finished commodities. Indeed this situation seems distant. Williams et al. (2000) foresee the requirement for considerable innovation activity within all market actors to identify relevant and useful applications for consumers.

The interactive nature of multimedia technology has provided channels, such as email, Internet, user groups, to facilitate this interaction. These provided timely bi-directional communication allowing suppliers and users to share experiences regarding application of multimedia offerings (Williams and Proctor, 1996). An effective method of communication between supplier and user is vital if the benefits of feedback from innovation are to be realised. The electronically enabled feedback systems mentioned previously assisted the communication within communities of interest in multimedia technologies.

The electronic channels assisted both the speed and access within the communities allowing faster and richer interaction than traditional channels, such as traditional mail and phone, between geographically distant groups. Feedback was quicker and users were provided with the opportunity to test prototype 'beta' versions of applications, simply by downloading them. This dynamic improved the speed of the feedback loop and assisted the use of iterative, incremental development style as described in the design literature. This is supported by the now standard use of 'interim'; version n.1, etc. patches and upgrade releases. This increased involvement in the design process has acted as a catalyst for many users to increase their involvement and actually become designers themselves. This role is further

aided by the increase in the number and standard of development tools available. These enabled users to adapt and/or develop multimedia applications suited to their needs.

The capability to adapt multimedia applications to users' individual settings aligns with the interactive model and attempts to avoid difficulties due to lack of fit and inapplicability to social situation as noted by Webster and Williams (1993). Multimedia projects have been noted for their experimental nature featuring numerous pilots, feasibility studies and commercial trails. While these have attended to different configurations and questions of multimedia, the possibilities they offer for social learning are consistent. Social learning seeks to provide an inclusive framework for analysis expanding on Fleck's conjecture that for configurational technologies, industry is the laboratory (Fleck, 1988) to consider the whole of society (Herbold, 1995). Sorenson (1996) states:

> Social Learning can be characterized as combined act of discovery and analysis, of understanding and giving meaning, and of tinkering and the development of routines. In order to make an artefact work, it has to be placed, spatially, temporally, and conceptually. It has to be fitted into the existing, heterogeneous networks of machines, systems, routines and culture.

Social learning involves two related processes, Innofusion and Domestication. Innofusion is discussed further with our consideration of the organisational environment but in principle is concerned with innovation that occurs as technologies are implemented and used in a particular setting. Domestication concerns how end-users incorporate artefacts within their local operations. The configurational aspect of multimedia makes both these aspects important. Unfortunately, focus on unique application has obscured common lessons that can be drawn. Current literature's focus on analysis of isolated case studies has arguably promoted this habit. A snapshot makes it difficult to fully understand where knowledge has been gained and where it will be applied.

The recognition and capture of social learning can provide benefits in three modes: learning by doing, learning by interacting and learning by regulating (Williams, Slack and Stewart, 2000). Knowledge gained by application has been a consistent aspect of technological development from Hughes' engineers to Fincham's hybrid experts. Learning by interacting attends to the process whereby locally acquired knowledge may be transferred and applied to other contexts. Transportation of social learning is complex requiring translation, cross-pollination with other knowledge and transformation. This dynamic is core to effective supplier-user interaction aiding product advancement.

Development tools incorporating these insights have been designed for use by technically unsophisticated users offered at low cost (Williams and Proctor, 1996) and combined with these channels of information, assisted in neutralising skill barriers thereby aiding wider adoption (Mackay, 1992). The adoption of user-friendly multimedia development tools has been observed during multimedia developments within organisations (Proctor, Williams and Cashin, 1996).

These technical offerings and communication channels are considered to have aided the possibility of user-led innovation. The question remains as to whether the negation of skill barriers can allow end-users to become truly empowered to master these tools and increase the possibility of user-led innovation. Since we have agreed upon the applicability of SST theory to this area of innovation, we must then concede that a wider set of environmental aspects must be aligned to enable this scenario.

The third element of social learning: learning by regulating draws attention to wider social aspects. Broader circumstances are needed for technology to establish and operate technology. Formal state regulatory activities which include private and public players attempt to create technological infrastructure and standards required for technology operation. More general application is the enrolment and organisation of actors around particular technology agendas, polices and strategies.

> In order to examine this aspect and how multimedia innovation is shaped by the various factors outlined we must consider the specific aspects of the corporate environment. Following the theory examined, 'technology' and 'organisation' cannot be considered in isolation. Instead they share a mutual relationship (Edge, 1988; MacKenzie and Wajcman, 1985).

It is therefore logical that technologies definition incorporates the social relations within which it emerges and becomes embedded (Hill, 1981; Clark et al., 1989). It is with this understanding that we direct our attention to theory of the organisations, the environment for our study of multimedia innovation.

Social learning theory has implications for the enrolment and alignment of networks. "Social learning takes place where it is in the interest of players to collaborate and exchange information" (Williams, Slack and Stewart, 2000). Social learning groupings are markets of sorts with actors accepting a level of investment to partake. Continued value must be experienced by parties involved for ongoing commitment. The perception of value can differ from actor to actor, and can alter from the publicly stated to privately held. Williams et al. offer an example of this as:

> The various players involved tended to have a wide range of commitments and interests in a project at a number of different levels. For example a technology supplier might have several goals: to forestall and warn-off competitors, to align expectations of potential customers, to signal competences and establish a reputation as a future player in this and

related markets which could be more or less closely geared to what they might expect to learn from taking part in an experiment (Williams, Slack and Stewart, 2000).

Goals and interests driving multimedia projects have been observed as complex and occurring on a number of levels and dealing with a variety of issues. Projects can be concerned with operational assessment, application experimentation and developing alliances. Each can have equal importance overall and varying priority to actors simultaneously. This leads to confusion and multiple perspectives on the success of projects. For each actor, a large component of this judgement relates to the future opportunities it provides them. If there are no subsequent opportunities to apply the knowledge gained then it would be difficult for the actors to argue the success of the project in terms of their benefit. The time frame for consideration is an important factor and, while immediate opportunities may not arise, possibilities may emerge over a longer period causing perceptions of success to alter.

Social learning theory also identifies the need for 'key intermediaries' (Williams, Slack and Stewart, 2000) to help steer the process of creating 'learning communities'. This role may also require them to enrol required actors and resources, drawing parallels with sociotechnical constituencies and actor network theory. Intermediaries exist to mobilise, formal and informal, sociotechnical constellations of players. These sociotechnical constellations link players to advance technology development and enable knowledge flows and social learning. Sociotechnical constellations serve as means of acquiring, generating, enhancing, and exchanging information. Two distinct types of sociotechnical constellations have been identified: application development and appropriation. The former involves suppliers and intermediate users while the latter, and more common, is concerned with technology consumption and use.

The intermediary role may be shared amongst various actors who emerge through the course of multimedia developments instead of gaining formal appointment. This role is most evident at the intersection between organisations, indeed the ability to mobilise knowledge and resources internally or externally to the intermediary's organisation is a crucially important capability. The boundaries that intermediaries intersect may be between corporations, internal departments, or expert groups and may occur in parallel across a number of different levels within innovation.

Studies, contained within the SLIM project (Williams, Slack and Stewart, 2000), of multimedia offerings for consumers have highlighted the importance of 'appropriation intermediaries' who play an essential role in configuring multimedia

systems to particular user groups. This task requires a hybrid knowledge of technical possibilities and the local environment.

Appreciation of differing agendas and motivations of actors holds an important role within innovation. Understanding of the factors at work within the innovation environment is therefore important. In order to gain an understanding of these, Chapter 3 of the literature review deals with the organisational setting.

3. ORGANISATIONAL THEORY

3. ORGANISATIONAL THEORY

3.1 INTRODUCTION

The area of organisational theory provides us with an understanding of this particular social context in which multimedia are being applied. Theory as discussed in this section attends to the organisation's characteristics created as a result of it being a co-operative of individuals. This creates internal politics forming informal structures often at odds with the formal recognised structure. The role technology plays in assisting or impeding actors' political activities is then discussed. This role affects power and political relations, often creating specialist groups around the technology. These groups trade on perceptions of the technology's importance and their expertise in its operation. These aspects create social-political interplay as in-fighting occurs with groups trying to legitimise their status and expertise. Formal structures need to impose measures to ensure that in-fighting serves the core organisational objectives and is not destructive.

3.2 ORGANISATIONAL LITERATURE

The interactive model proposed for multimedia technology requires careful consideration of the innovation environment. Organisational theory provides insight into the social, political and economic factors at work within the environment relevant to our study. Some theorists have focused on the formal aspect of placing organisations as adjuncts to society formulated around charts and structure while driven by a solely economic agenda. The social aspect of organisation cannot be ignored and there has been considerable study of the role that these forces play.

Organisations are products of society offering forums and stages on which societal forces operate surrounding a common goal. As Burns and Stalker state, "Organisations are co-operative instrumental systems assembled out of the usable attributes of people. They are also places in which people compete for advancement" (Burns and Stalker, 1961: p.xii). It is this element of competition which is of particular interest as it drives the shaping forces within the company with each individual operating with a personal agenda.

As Burns and Stalker note, in addition to the organisational structure of the concern itself, other organisational structures are present through which individuals attempt to realise personal agendas. This private organisation is referred to as the 'informal structure', to distinguish it from the 'formal structure' of the management system (Burns and Stalker, 1961: 98).

These personal agendas are usually shielded from other organisational individuals and activities to advance them are pursued under the guise of actions promoting the formal organisational agenda. As such, it is important to attempt to comprehend these motives in order to understand how their existence affects interaction within the organisation. This interaction represents 'internal politics', the operation of which results in the formation of factions and groups within the organisation. These groups are themselves created from individuals united under a common banner with each perceiving an individual benefit from their alliance, much like the networks depicted by social shaping theory. Burns and Stalker additionally note: "The individual may be, and usually is, concerned to extend the control he has over his own situation and prospects to increase the value of the resource he represents within the organisation" (Burns and Stalker, 1968: xiii).

An informal organisation results from these 'internal politics' within the publicly recognised structure. This informal organisation exerts influence upon this formal structure but is also conversely affected by it. This interaction creates a 'league of influence' for groups and individuals within the organisation, an informal 'pecking order'. Therefore each firm contains not only a working organisation but a political system and status structure (Burns and Stalker, 1961: 6). The manner in which internal political decisions are made has been the subject of much discussion and draws on theories common to social shaping theory. Pettigrew (1975) attests that these decisions are blindly political, solely concerned with advancing each actor's own agenda. Whipp and Clark (1986) agree with the political aspect of these decisions but argue that they are affected by a 'bounded rationality'. The boundaries are set by the actors' knowledge and understanding of their environment with actors' decisions based on this. As these boundaries alter, their choices and reactions will be impacted. Whipp and Clark (1986) state and maintain that actors operate a structured repertoire of responses which they apply to given situations forming a de facto way of doing things. As their boundary of understanding alters, the content and/or range of repertoire can change based on the new understanding. These new ranges of solutions are then applied to the organisation.

The environment within which this political activity occurs is influenced by the formal structure surrounding it. Awareness of the formal structure is a consideration factor for the actors.

3.3 MECHANISTIC AND ORGANIC ORGANISATION STRUCTURES

The recognised formal structures of organisations exist in infinite variety, but in an attempt to improve understanding, Burns and Stalker (1961) attempted to draw two 'ideal' types:

Mechanistic organisations divide tasks between sections of the organisations. These sections are defined by individual methods, responsibilities and powers with boundaries established as a result. In mechanistic systems, the problems and tasks facing the concern as a whole are broken down into specialisms. Each individual pursues his task as something distinct from the real tasks of the concern as a whole as if it were the subject of a sub-contract (Burns and Stalker, 1961: 5).

A hierarchical system, allocating power and position within the organisation, exists with those at the top of the hierarchy passing instructions to those beneath them. This system operates under the assumption that the possession of the greatest knowledge of the organisation rests with the most senior management. Interaction with the management tends to be vertical, i.e. between superior and subordinate (Burns and Stalker, 1961: 5).

Organic organisations avoid boundaries, instead tasks are undertaken in accordance with the individuals' own skills and knowledge in relation to the task as a whole. Organic systems are adapted to unstable conditions when problems and requirements for action arise which cannot be broken down and distributed among specialist roles within a clearly defined hierarchy. Individuals have to perform their special tasks in the light of their knowledge of the tasks of the firm as a whole (Burns and Stalker, 1961: 6).

The BigBank studied did, in fact, conform to a hierarchical model. Our discussion will, therefore, focus on the factors applicable to this framework.

The structure of hierarchical organisations has a pronounced effect upon the internal politics at work. Individuals in attempting to advance their own ends often cause conflict among individuals of differing status within the organisation. Often in an attempt to gain political leverage versus hierarchical superiors, subordinates will seek to band together under a common banner utilising possession of some quality or resource that is or will be of value to the organisation.

3.4 RESOURCE POWER

Access to, and control over 'structurally endowed resources' (Burns and Stalker, 1961: 262) also requires the application of exploitative skill to benefit the group. Power gained by this means allowed groups to gain status and position above

those with restricted access. Groups can attain legitimacy through establishing themselves as 'points of passage' for resources with perceived organisational importance. This dynamic serves as a considerable motivation for individuals seeking advancement within the organisation. As a result, opportunities to gain this role will be actively sought out and aggressively pursued. Technology is a common arena in which these opportunities occur.

The introduction of new technology causes fundamental changes to the ways in which organisations function. Technology has been perceived as the answer to economic challenges with many industries attempting to replicate the success of others (Kaplinsky, 1984). The improvement potential for organisations is vast but the process is complex. As a result, these radical changes in organisational performance have only occurred on a small number of occasions (Senker, 1987). This is frequently because problems in applying IT have occurred due to underestimation of the complexity required by organisational members to make this work within the organisation (Quintas, 1993). Organisations must seek to manage both technology artefacts and associated expertise coherently.

The factions within the informal organisation constantly seek to possess the technological device of ultimate importance to the organisation to assist their pursuit of personal aims. Latour (1997) discusses actors using a number of ploys and tactics to enforce their importance to the organisation. Establishing knowledge claims and expertise is an important strategic aspect to gaining control over technology power resources.

The enhanced strategic role of technology for many organisations has led to conflict between existing hierarchical power structures and technology experts. The value of experts' knowledge has afforded them unofficial status within the organisation. This status allows them considerable influence on strategic technological choices for organisations as they can vet and present information to official decision makers in a manner benefiting their personal agendas. Expertise owners and influencers of technology resources possess formidable tools to assist their own agendas via the operation of 'internal politics'. The formal organisation also faces structural challenges due to the pace of technological change. Re-organisation of resources is often necessary, altering existing relations and fuelling the political atmosphere as groups act to maintain or enhance their situation.

The perceived value of technological knowledge has radically changed relations within hierarchical organisations by challenging the premise on which they are structured – ascending knowledge. Formerly older, experienced and usually senior employees were assumed to possess the greatest and most useful knowledge

of the enterprise accumulated through years of experience. The growing importance of new technological knowledge has invalidated this assumption. The expertise required to engage technical artefacts has been the possession of the young specialists who are equipped with up-to-date knowledge of the latest developments. They view experience as merely outmoded and of limited value. Fincham's study (Fincham et al., 1995: 2) reaffirmed Burns and Stalker's observation of this trend. Changing occupational structures creates contradictory pressures on management. Power tends to gravitate away from hierarchical management and towards possessors of specialist knowledge, as myriad specialist knowledge groups seek to control different functional areas.

Owners of specialist knowledge band together, if successful their role and status is validated and they evolve into formal sections within the organisation. Informal knowledge groups are thereby transformed into specialist occupations. By this means, the informal structure impacts the formal with these actors gaining official influence and power. This also provides the opportunity to impact the formalisation of organisational standards which are an important tool for the formal organisation to control the informal. Before we consider the role of standards formation, we will consider theory around the evolution of specialisms.

3.5 SOCIALLY SHAPED SPECIALTIES

The perception of specialisms as ideal-type professions in comparison with executives has been challenged by the growing belief that specialisms develop through an emergent process. This process occurs over a period of time as a result of social establishment. Pettigrew (1975) usefully identifies some of the key processes of establishing specialism. An important process is the creation of interdependencies within the specialty and across other specialisms sharing a common task environment. Linked to this is the manner in which a specialist group defines its task. The methods by which the group protects its identity by the development of a system of values and linkage with the activities of interdependent specialties will be determinant factors (Pettigrew, 1975: 260).

Establishing legitimacy often creates conflict and emerging occupational groups are often accused of encroachment and charlatanism with existing groups. As a result, existing groups often apply power maintenance strategies. Tactics include the placement and employment of key personnel, influence over recruitment of new personnel and control over the training conducted within the organisation. The circulation of 'fictions' or rumours about the rival groups have also proved a popular

power maintenance tactic. These 'fictions' would concern the competence and perceived expertise of the group with the aim of undermining their status. These practices suggest that possessing knowledge is not sufficient. In order to achieve legitimacy, the holder must be able to articulate and gain recognition for knowledge claims.

Some commentators (Wood and Kelly, 1982; Cockburn 1985) have viewed skill and skilled status as a result of broader political processes, as credited by Burns and Stalker (1961). The validity of knowledge is affected by membership of 'reputational networks' (Whitley, 1988). Expertise as a social construct, therefore, may be defined as the capability to authoritatively apply special knowledge or skill which has been tried and proven by experience (Fincham et al., 1995: 19). Linking this to the discussion of bounded rationality (Whipp and Clark 1986), we see how expertise is a valuable asset. The input of new knowledge can expand actors' understanding and perspective of the organisation allowing them to apply new sets of solutions. The discussion on these changes also involves assessing the appropriateness of different models and tools for local circumstances (Clark and Staunton, 1989). This adds a grounded aspect to the interpretative flexibility of SSK with perception altered by actual technical changes. SSK can cross-fertilise this view through its understanding of the importance of social articulation of knowledge.

The validation and legitimisation of expertise are further complicated by the nature of expertise required by organisations implementing configurational technologies. Expertise requires an increasingly social element which evades quantification.

Implementation requires successful change processes and systems patterned by the structures of expertise and the continuous interplay between technical and non-technical knowledge (Fincham et al., 1995: 308). This complexity of forces requires technology to be perceived from different levels of social action, from specialist know-how through to architecture of generic designs, to the crystallisation of knowledge of specific applications (Scarborough and Corbett, 1992: 3).

Technology's rapid pace of development has driven an expansion of knowledge requirements, creating demands beyond many organisations' existing resources. Friedman (1989) contends that organisations should direct their labour policy to address the principal area where this gap occurs, user relations. Friedman proposes that this obstacle is comprised of two elements: technologists understanding users and users understanding technological possibilities.

In order for the organisation to select and adopt new technologies effectively, it must apply knowledge of its environment in terms of standards used, business

objectives, departmental and end users to the technological opportunities it identifies. In enabling this process, organisations have facilitated or experienced the creation of groups displaying hybrid expertise. Hybrid expertise contains understanding of both business requirements and technical possibilities. This has been evident in studies concerning multimedia applications (Proctor et al., 1996: 74) as well as wider IT innovations (Fincham et al., 1995).

Hybrid groups arise to answer the fresh challenges posed by emergent technologies. Configurational technologies necessitate supplier-user interaction, generating additional expertise demands. These groups appear to act as a consolidating force for the firm's knowledge and expertise base (Fleck, 1988: 50) and possess information often crucial to the successful innovation and application of technology. This creates a form of hybrid expertise drawing from the different knowledge bases required for the technology in question.

> Requirements for hybrid expertise arise where new problem areas do not match the scope of the existing division of labour ... Hybrid groups may then emerge as intermediaries between existing functional specialisms where well defined occupational groups draw on distinct bodies of knowledge and techniques (Fincham et al., 1995: 23).

This adds another dimension to the supplier-user aspect as hybrid groups must act as a consolidating conduit between disparate internal sections and external parties. The recognition of this gap within the division of labour and the emergence of so-called 'hybrid expertise' have caused a re-appraisal of the role of technology departments within organisations. As opposed to the traditional roles of technology departments, either building items in-house or buying in standardised solutions, they must now seek to provide a means of developing solutions through a collaborative network with actors both within and outwith the organisation. The key appears to be sourcing the most useful knowledge required whether developed internally or brought in 'consultant' style from outwith the group.

The actors assembled will each offer to provide their own knowledge and expertise to the process which may be system design or the knowledge of user requirements. Technology departments marshal these networks to link both expert and user groups providing a mechanism for deploying expertise (Fincham, 1995: 22) and as a result hybrid groups are required to interface between the rest of the IT function and the organisation (Simpson, 1990). The concentration on broad and all inclusive sourcing of expertise appeared to suit organisations involved in the development of information technology as detailed within the studies of Fincham et al.

> The expertise focus, by addressing the particular kinds of knowledge which groups mobilise in the innovation process, and the role of occupational and inter-firm linkages

> in the transfer and validation of knowledge, was better placed to integrate local action within its broader context (Fincham et al., 1994: 298).

Fincham positioned technology departments as key mediators of technical change for organisations and facilitators of organisational learning. In occupying this role, technology departments act to identify new technologies which will have relevance to the organisation and facilitate their uptake (Proctor et al., 1996: 74). This role was witnessed across a range of organisations in studies conducted by Fincham et al. where:

> IS functions continued to act as the gatekeepers of external sources of knowledge, they largely determined the timing and scope of recourse to suppliers (which constrained interaction between in-house and external supply (Fincham et al., 1995: 307).

The IS functions utilised user involvement initiatives where they sought to elicit 'commitment' of user groups while retaining control of the system's development (Fincham et al., 1995: 307). This presents a challenge to the role of end-user led innovation. While the tools exist technically, organisations may wish to limit autonomy in order to maintain a unified technology policy. Within their revised development role, the technology department provided a bridging link between user and supplier, acting as system integrators. This role is apparent within the creation of configurational technologies and as such is particularly relevant to multimedia developments.

> At present system integrators are only just emerging, as a sort of generalist specialist, who tries to co-ordinate all the other parties involved in the development of new configurations (Fleck, 1988: 51).

As a result, technology departments bore the responsibility for effective execution to meet user needs, business objectives and economic restrictions. This required risk minimisation through careful consideration of the organisational setting and the technology opportunity.

> Implementation creates uncertainties around the technology, its development and its outcomes. We saw that uncertainties, though endemic to implementation, were relative; their degree and form depended on the organisational distribution of knowledge. The existing knowledge base, the availability of different kinds of expertise (i.e. together the structure of expertise) as well as the strategies of different groups, all bore on the extent to which uncertainties could be circumscribed (Fincham et al., 1995: 306).

The complexity of technological innovation presents the organisation with a number of challenges. The importance of technological artefacts and their role as power resources make them coveted by specialist groups. Combined with perceived expertise they allow 'power' to be operationalised. This competition can lead to groups constantly trying to influence the balance of power in their favour with each new technological development fuelling the search for a successor. The formal organisation must seek to ensure that this competition still serves the ends of the

entity instead of becoming self-destructive in-fighting as there is an increasing necessity for a unified approach given the vast potential for IT and the range of concerns and skills required to optimise utilisation. The formation and application of standards are important aspects in producing this united direction. In establishing standards, organisations will frequently look to the macro environment to leverage industry-wide agreements and select those which best fit their local environment.

3.6 FORMAL DIRECTION THROUGH STANDARDS

The use of standards within industry has been commonplace such as with transport networks and telecommunications. The establishment of standards has been employed to provide a guideline to assist coherent and beneficial development by society and organisation. This practice has been followed within IT necessitated by a number of factors: the increasing cross-fertilisation between IT and communications, the major importance of individual PCs and the resulting need to link them within networks, the increasing diversity of 'satellite' equipment and software plus rising demands of users for compatibility and inter-operability (OECD, 1991). The selection of particular standards also assists the organisation's focus on training investments and maintenance strategies. This produces obvious economic benefits as well as assisting the unification of technological efforts. The speed of the development, range of interests involved in IT development and the high cost of IT infrastructures have amplified these concerns.

The creation of standards within IT has been catered for at both global and national levels. In the UK, the drive to establish standards has been led at an industry wide level by the British Computing Society (BCS) which established a working group to tackle the issues.

The working group identified a number of needs which would be fulfilled by the introduction of standards. These were identified as:

- The need for a basis for communication and interchangeability.
- The need for economic production and inter-working of standardised products and services.
- The need for adequate and consistent quality and fitness for purpose of goods and services.
- The promotion of trade through international agreement.
  (Ruggles, 1990: 6).

While the needs identified relate here to trading benefits, the initial three hold relevance for corporations. As stated, the benefit is due to greater focus within their technology policy. This focus assists effective centralisation of technology training as well as support and sourcing strengthened by harmonisation within organisational culture and mission. These potential benefits are facilitated due to the standards

creating a formalised documentation of what was previously fragmented, local technological knowledge. It is one thing to identify the need for and benefits of standards, but it is another to establish how they should be constructed. The BCS working group sought to lay down principles on which standardisation should be built:

> The principles of standardisation are consensus, usability, feasibility, and harmonisation. It must be agreed that the standard is wanted. Its intended application should be clearly understood at the start and borne in mind throughout its preparation. The decision to standardise must be based on the user community's agreed needs but must not inhibit technical innovation. The process of standardisation should embrace existing standards in order to achieve harmonisation (Ruggles, 1990:6).

This statement reinforces the view that standards seek to create a common dialogue and forum between users and suppliers (Cargill, 1989). This facilitates a formalisation of particular features and needs which have to be accounted for when implementing technologies and allows design feedback regarding how systems should be tailored to that setting. This echoes the interactive innovation model evident within the IT and Multimedia markets and supports the configurational aspects of these technologies. The need for users capable of comprehending local needs and translating them into technical possibilities is an aspect that we shall return to when discussing expertise.

While the theory of embracing existing standards is accepted, in practice considerable complications may exist. These complications do not arise in finding standards as they are plentiful in number but in identifying which ones will persist effectively. Organisations are understandably keen to avoid selecting standards that are subsequently abandoned, often heralding the costly obsolescence of technology constructed under their guidance. In assessing this element, it is important to remain aware of the socio-political environment surrounding the establishment of standards and also the importance they can hold.

> In a competition between standards, it is not necessarily the best solution which triumphs but rather that which has made the better start and managed to build up quickly a critical mass of users which will attract ever more new users (OECD, 1991: 8).

This consideration demonstrates the importance of external factors to the choice and implementation of standards. Another of these factors is the advice and opinions of experts within the field, standard setters, technical specialists and decision makers within user organisations. These individuals possess a considerable level of influence and power.

> The strategic implications of IT standardisation are now broadly recognised to be enormous because they will determine the future of individual firms, affect the competitive advantage of countries and even influence the development of whole

> technologies and their diffusion. Market mechanisms do not provide, as noted above, sufficient assurance that the best technology will prevail or that an obsolete one will be replaced in good time (OECD, 1991: 9).

This implication further illustrates the need for attention to the selection of standards with their political nature and increasingly important role within technological innovation. The importance of standards has not been solely recognised by the users. Suppliers have been quick to acknowledge the competitive advantages to be gained from products being viewed as an 'industry standard' (Porter, 1990). In order to attain this position, user support is crucial both for utilising the product and providing guidelines for requirements. This has caused suppliers and users to engage in greater dialogue and collaboration. This involvement has led to the establishment of joint projects and facilities catering for technological innovation. These relationships are likely to have an important impact upon the innovation process as a whole and are another area of important consideration within my research.

An added complexity in setting standards and selecting technology arises through addition of an expanding range of 'experts' to the innovation process producing new interest groups each with their own agenda. Decisions concerning standard adoption offer the possibility of conflict between interest groups operating separate agendas. This expanding range of interest groups has largely been a result of the increasing range of knowledge which is required for the successful innovation, implementation and utilisation of technology.

While standards provide a useful technology boundary setting method, the department still has to successfully execute technologies that fall within these boundaries. In order to allow for innovation they will also have to cater for technologies that stretch resources and standards. The execution of technology development has been a long-term source of difficulty for organisations. Throughout our literature review, it has been accepted that the development of technology is a complicated process.

3.7 INNOVATION IMPLEMENTATION DIFFICULTIES AND APPROACHES

The impact of innovation complexity has been especially evident within the business world which has been littered with large and costly failures. In 1994, failed information systems projects in the USA cost $81bn annually which accounted for almost a third of total information systems development expenditure (Standish Group, 1995). In 2001, it was reported that only 28% of projects were delivered on time and on budget and of those completed, they contained only 67% of the

capability required (Standish Group, 2001). While these figures are not 'like for like', they translate to an unsatisfactory level of success and support the belief that the process of development is complex and problematic.

Some commentators have used the metaphor of a journey to describe the process of information systems development, highlighting that the main concern in any project is to avoid wrong turns on the way to the destination (Connor, 1985). There has been a great deal of activity directed towards creating an approach capable of, at least, minimising the likelihood of such failures by tackling the common causes.

Research by Flynn (1998) found that projects can fail either through unacceptable quality or poor productivity. In examining these areas further, the main issues appear to be due to a mix of poor understanding of requirements, environmental changes and inadequate project management. That these areas create problems is unsurprising. Given the emergence of hybrid expertise within organisations to accommodate skill gaps, it is logical for corporations to have experienced difficulty in capturing and matching user requirements to technical opportunities. If we accept the existence of informal organisations and factions within them acting to advance their own agendas, a state of flux within the environment is understandable. Therefore it would be difficult to operate a project management methodology which accommodates aspects which organisations themselves are still attempting to address. The inherent complexity in approaching these tasks is proposed by Rothwell as:

> Technological innovation is a complex technological/socio/economic process which involves an extremely intricate web of interactions, both intra-firm and between the firm and its economic, technical, competitive and social environment. It might not, therefore, be expected that success or failure will often be satisfactorily explained in terms of one or two factors alone, and indeed,... innovation studies very strongly underline the *pluralistic* nature of explanations for successful and unsuccessful innovation (Rothwell, 1977: 203).

Despite the daunting nature of this task, organisations have experimented with various approaches to address the key issues affecting development. These approaches include organisational considerations to create environments conducive for innovation, establishing appropriate team structures to navigate developmental changes, selection of an appropriate methodology to accommodate changes within the process and provision of an agreed structure for project management. The Human Computer Interaction discipline has also been enlisted to provide techniques to provide rich and effective understanding of user requirements.

Rothwell's (1977) commentary on the complexity of technological innovation in organisations was made over 20 years ago but in the intervening period, its ongoing validity has been supported by commentators including Tidd et al. (1997). Further research (e.g. Tornatzky et al., 1983; Frost & Egri, 1991; Wolfe, 1994 and Tidd et al., 1997) has given us a greater understanding of the key organisational features which aid the effective management of technological innovation. These features can be broken into two parts: the organisational environment and team roles.

In order for these individuals to operate effectively, the organisation must possess a number of environmental features. Recognition of these aspects represents an important shift within Management of Technology commentary. Writers such as Bessant (1985), Tidd (1997) and Pavitt (1997) had previously focused on the formal aspects of technology management. There has been a subsequent move to appreciate the 'softer' social aspects drawn from Social Shaping Theory and present within the work of Fleck et al. (1990). This appreciation has provided useful expansion of the elements considered in their analysis. An important environmental feature is that of alignment with the organisation's overall leadership and the will to innovate:

> There must be an acceptance of innovation as a benefit within the company to restrict different cognitive, behavioural and structural ways of reinforcing the status quo; the 'not invented here' problem; and the core rigidities (Tidd et al., 1997: 307-8).

To support the organisation's innovative vision, its managers must fight for the creation and maintenance of that kind of climate. These efforts include their involvement in the systematic development of appropriate organisational structures, communication policies and procedures, reward and recognition systems, training policy, accounting and measurement systems and deployment of strategy (Tidd et al., 1997: 326). In addition, it is considered vital that managers are able to effectively decide the most appropriate team size, structure, process, and how to achieve effective team leadership as well as to clearly define the team's tasks and objectives (Tidd et al., 1997). These elements within the organisational environment are felt necessary to support the operation of the team deployed for the technological developments.

The key role within the organisational team as identified by Bessant (1985) is that of the product champion. The product champion is a person prepared to champion a new or improved product, service or process by providing much energy and enthusiasm to help it to progress through the organisational system. Bessant, working with Tidd and Pavitt (1997) also built on Rothwell's (1973) concept of the technical innovator which represented the person responsible for an invention. The

technical innovator possesses a deep understanding of the technology behind the innovation, as well as the inspiration to solve any development problems.

Rothwell's (1973) business innovator role is now perceived by Tidd et al. (1997) to comprise three components often represented by different individuals: organisational sponsor, project team leader and a more narrowly defined business innovator. The organisational sponsors are bought into the potential of the innovation but do not require to possess detailed technical knowledge of the innovation. Their role consists of attending to resource requirements along with placating sceptics and hostile critics of the project. They require the power and influence to 'pull the various strings of the organisation (often from a seat on the Board)' (Tidd et al., 1997: 316). The project team leaders meanwhile are deeply involved in the project and have the organisational power to make sure things come together (Tidd et al., 1997: 316). The final component is the redefined business innovator who is considered to represent the broader market or user perspective (Tidd et al., 1997: 317).

These roles represent a more granular consideration of the hybrid expertise which has been observed in organisations. Another role observed in management of technology is that of the gatekeeper noted by Tidd et al. (1997) but identified by various authors (Allen, 1991) and Rothwell & Robertson (1973) among others. The gatekeeper is the key individual in the organisation's informal structure 'collecting information from various sources and passing it on to the relevant people who will be best able or most interested to use it' (Tidd et al., 1997: 317).

In addition to efforts to improve understanding of the roles involved in managing technological innovation, there has been development of methodologies to structure the innovative effort. Development teams have a number of possible methodologies which they can enlist to manage the process.

The classic approach is the Traditional Life Cycle (TLC) or the waterfall life cycle. This consists of a number of sequential steps through which the project progresses. The waterfall aspect is used to liken the difficulty of returning to a previous phase to swimming up a waterfall. This provided a useful model for distinguishing the different stages of a project and suggesting how they could be ordered.

These stages are depicted in Diagram 3.1 overleaf.

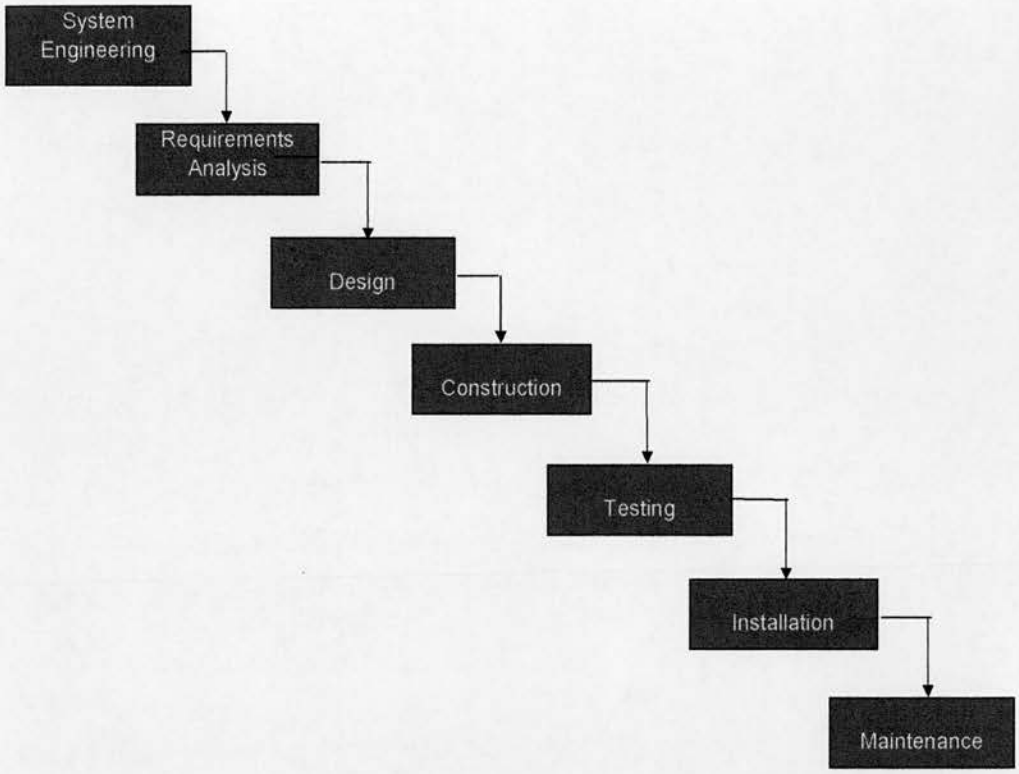

Diagram 3.1: Traditional Waterfall Lifecycle Model

The Systems Engineering phase is concerned with the architectural specification defining the interaction between the major parts of the system. In the Requirements Analysis stage, a number of fact-finding techniques are employed to aid thorough identification, definition, documentation and analysis of requirements. Defined requirements can be used to form the basis of user acceptance testing. The Design phase creates a plan to construct a system to meet the requirements which is converted into code during the Construction phase. Testing follows to ensure the system has met the requirements set. This occurs on a number of levels. Individual components are tested as sub-systems before then being tested together as a complete system. User acceptance testing must be performed before the system can be validated as complete. Once testing has been successfully completed, it is delivered to the customer and installed for use. The installation of any system requires careful handling in order to minimise disruption to the business. Ongoing operation of the system is then handled during the Maintenance stage. User involvement is usually restricted to interviews during the requirements analysis phases and the user acceptance stage by which latter point, however, changes would be very costly.

Variations of the waterfall model exist (Pressman, 1997; Sommerville, 1992). Key differences are the number and title of phases and activities performed in each phase. Proponents of the waterfall model and its variations argue that it provides a structure with explicit deliverables from each phase. Critics argue the sequential approach is not representative of real life where real projects seldom follow a simple sequential life cycle with phases often overlapping and activities repeated.

Additionally, system functionality iterations are frequently due to deficiencies in requirements analysis that become apparent throughout the project. This is because business needs change between the project initiation and completion and these changing factors need to be accommodated by the new system. Waterfall approaches are not designed to be responsive to these changes. In order for the Waterfall approach to succeed, the requirements phase should capture all needs adequately. These specifications must remain true until delivery given the project success statistics outlined earlier and fluctuating environments due to the formal-informal structural dynamic of organisations.

Subsequent methodological evolutions have sought to accommodate environmental fluctuations while engaging in an ongoing struggle to successfully build systems to meet business requirements. Methodologies have experimented with methods to effectively enlist end users in this pursuit.

3.8 METHODOLOGIES WITH USER INVOLVEMENT

The importance of user involvement in technology innovation has been noted across multiple disciplines. Technology innovation theory, management of technology (Fleck, 1988) and human computer interaction (Hartmanis and Lin, 1992) have acknowledged users' importance and sought to accommodate their insight effectively into the innovative process. The difficulties faced are noted by Williams:

> We still do not know how best to match user requirements to new technical possibilities whether the biggest contribution will come from building more societal knowledge into the design of new applications or whether to design generic offerings and let final users learn how to adapt supplier offerings to their purposes (Williams, 1997: 37).

In this pursuit, user insight has been considered in two ways: when to apply it and how to capture user input? In considering the first question, a variety of user roles have been proposed, including the limited 'end-customer' role of the waterfall approach to direct involvement with the development team in Dynamic Systems Development Method (DSDM) and Extreme Programming (XP) methodologies. The later methods promote a blurring in distinction between the positions of designer and user. User integration within the development process requires additional

considerations. Users participating within development are required to be cognisant of the needs and requirements of the wider organisation and user group. As users are further integrated into the process the team must act to ensure they maintain this user perspective and objectivity. User involvement across the full project lifecycle, from analysis to implementation, has also been acknowledged as important. Involvement assists buy-in, aiding effective adoption but also establishes implementation feedback recognising that innovation continues during technological diffusion.

> They (organizational commentators) ignore the important processes of social and technical innovation that arise when technologies are implemented, the struggle to get technologies to work and to adapt them to the social and technical exigencies of use (Williams and Proctor, 1996: 7).

Fleck's (1988) innofusion theory — a component of social learning — sought to capture this aspect and understand its place, and effect, over the innovation process as a whole. This represented a considerable perceptual leap as the implementation stage had previously been viewed as almost an afterthought to the process of innovation and design. The new theory called for a fundamental review of the weighting of the importance of the stages within the process adding benefit to the implementation stage.

The concept of innofusion or 'social learning' theory argues that innovation contains highly distributed processes of innovation in which a wide number of actors operate, as we established via the social shaping perspective, during the implementation and use of technologies. Innofusion is especially applicable for configurational technologies which by their nature require consideration of the implementation phase. Innofusion was originally presented by Fleck (1988) who stated that:

> Innofusion is a Lamarckian form of evolution, in that new characteristics may be explicitly developed in response to environmental requirements, and then directly transmitted to succeeding generations of technology (through straightforward replication, or incorporation as components in new configurations, for example) (Fleck, 1988: 24).

The need for consideration of this aspect further questions the suitability of the waterfall model for configurational technologies as it fails to account for the importance of the implementation and adoption of the technology. Instead it conforms to the conventional beliefs of linear innovation where technologies emerge as stable solutions to be merely plugged in and switched on in the diffusion stage. This ignores the existence of experimentation and innovation that occurs within the user domain, aligning instead with traditional supply driven concepts that place principal importance upon the design phase within which a Darwinian model of

evolution occurs with the most efficient technical solution emerging. Subsequent techniques moved away from this perspective eroding the perceived boundaries between the stages of design and construction, which even some of the proponents of the Waterfall model admitted were merely recognition of actual practice.

> In practice the development stages overlap and feed information to each other. The software process is not a simple linear model but involves a sequence of iterations of the development activities (Sommerville, 1992, p.7).

The use of prototyping was an approach introduced to allow for rapid iteration within the projects allowing gauging of user reactions and functionality prior to final delivery. This represented a departure from the waterfall approach but was not always suitable for applications which deliver rich functionality as the limited functionality included creates a focus on interface issues.

The prototyping approach introduced the aspect of significant user involvement to better alignment of technology goals with those of the business. In an effort to allow for iterative assessment of functionality, methodologies combined this with incremental releases. This policy draws upon Gilb's (1988) belief that successful large systems start out as successful small systems then grow incrementally. Smaller increments are completed, used successfully, and then supplemented. This process conforms to Fleck's Innofusion theory with the technological trajectory impacted by the manner in which users adapt to and use technology.

A range of frameworks have been proposed for iterative, incremental development methodologies. The most widely recognised of these is Rapid Application Development (RAD). During the early 1990s, RAD gained popularity as a way to match systems development with the rapidly changing business environment noted as a common problem in technological development. The concept of RAD can be executed in a number of styles dependent upon situation. In fact an issue around its early adoption was that there was no industry standard of how that should occur.

The Dynamic Systems Development Method (DSDM) consortium formed in 1994 sought to answer this by defining structure and controls for RAD projects. DSDM is an approach that is employed in projects where time and resources available are the primary considerations. It sets these considerations and then operates to establish what is possible within these constraints. This approach contrasts with other methodologies where requirements are fixed and then time and resources are matched against them.

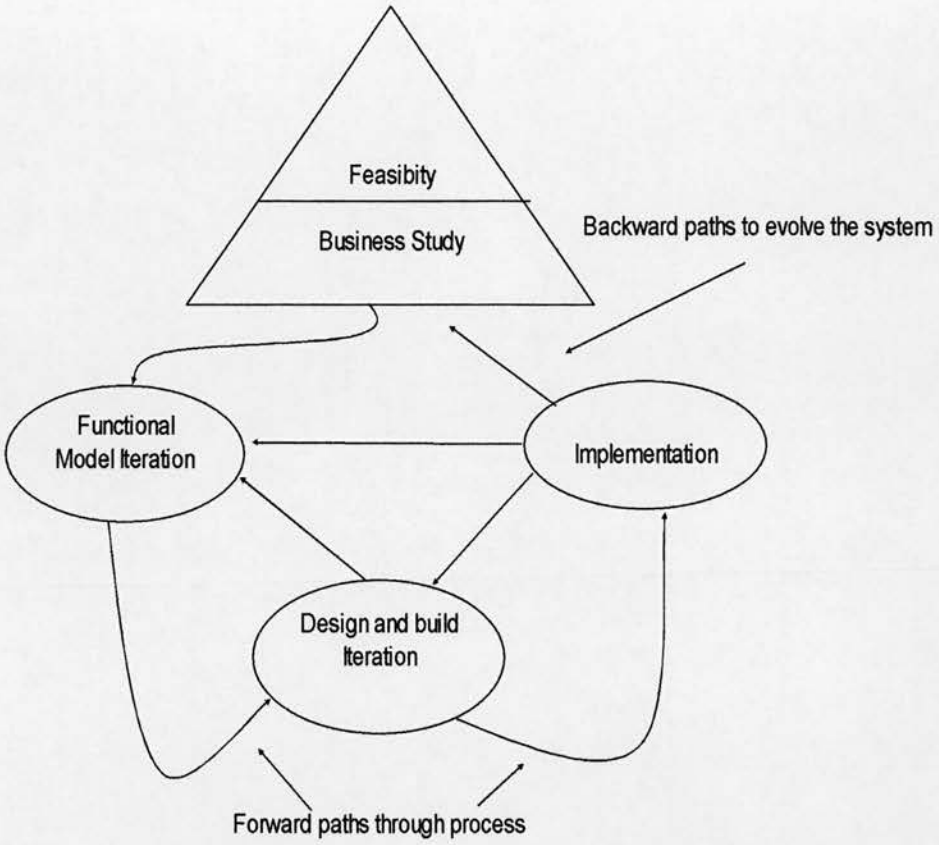

Diagram 3.2: Simplified DSDM life cycle (Stapleton, 1997)

DSDM set the project management controls but did not define development methodology. This allowed selection from the range of incremental, iterative methodologies that exist. Instead of exhaustively considering each and every variation, such as Unified Software Development Process (USDP) (Jacobson et al., 1992) and Extreme Programming (XP) (Beck, 2000), it is more useful to discuss the common themes as they all extend the RAD approach, overlapping and cross-pollinating, creating many similarities in approaches. The selection of the approach to be used is often based upon the previous experience of the team members involved.

The key aim is to provide a useable system which requires matching to the user environment. In order to do this, the process must keep track of the existing state. Methodologies incorporate rapid iterations to gain user feedback which can, if required, call for a complete reworking of the iteration. The critical focus on the system meeting user needs is exhibited by 'courage' as part of XP's core tenets. This captures the need clinically to discard anything that prevents achieving the objective. The parallelisation of activities was another departure from the waterfall model

which focused each phase on a specific activity. This is to appreciate the need for ongoing assessment and consideration of environmental aspects with respect to system users.

The desire to understand and track user requirements is a principal driver of these methods. Iterative, incremental methodologies allow for periods of user input to be leveraged during development but this is only beneficial if the insight is accurate and sufficient. In order to enable effective insight, techniques from the study of Human–Computer Interaction (HCI) have been increasingly utilised. The applicability of this area of study is obvious when we consider its objectives.

> Human computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them (ACM SIGCHI, 1992: 6).

Human–Computer Interaction advocates a user-centred approach integrating multidisciplinary knowledge in a highly iterative methodology involving testing of the design fit to users' requirements (Preece et al, 1995). This corresponds with the beliefs we have seen across the theories we have considered. Within HCI, the need for user-centred design of these technologies is essential as the most crucial property for an interactive system is its support for human activity (Newman and Lamming, 1995: 6). In providing this support, HCI draws on Usability (Preece, 1995: 14), one of its key concepts is concerned with ease of use and learning essential for systems adoption. In realizing these objectives, four central components have been identified (Bennet, 1984) and applied (Shackel, 1990). These requirements are learnability, throughput, flexibility and the creation of a positive attitude to the system by the users.

These objectives are common throughout the technological development but the key value of HCI is the toolkit of tactics it possesses to assist their realization. With these aspects in mind, designers have a number of techniques available from which to select the most appropriate dependent upon their situation and objectives. Questionnaires, work observation and conceptual modelling of the users' situation all possess their own strengths, weaknesses and cost implications. Questionnaires require the user to communicate what functions the system needs to perform. Many of the tasks they carry out may be due to tacit knowledge which they are unaware they are using. Such things may be picked up by observation or ethnography which has been accepted as a potentially valuable approach (Suchman, 1987; Randall et al., 1993; Cooper et al., 1995). It is posited that this would provide a rich and rounded view of 'the users' and how they operate and interact within their social setting.

3.9 SUMMARY

Throughout the literature that I have studied on innovation, we see a variety of approaches to tackle the same issue: so how do we understand and plan innovation effectively? The sheer volume and variety of perspectives support the consistent belief that this process is complex. Across the theories, a progressive appreciation of a wider range of factors is evident. Foremost of these is the need to understand the innovation environment and most specifically the user. No model has emerged that provides a comprehensive method of providing this understanding. While broad, high-level theory has been offered, it has failed to move from generalisation to practice and many studies made have focused on isolated scenarios. This offers a number of areas to consider during our investigation. Principally, do Interactive models of innovation operate in practice? If this is the case, how do they network and what factors affect them and thereby the technology trajectory? It is also important to consider how the organisation manages this process over time in terms of resource and expertise, aspects which may be accommodated via formal methodologies and social learning. Analysis of these areas should assist in identifying a model of innovation, or at least consistent themes, and guiding principles which allow some reduction of uncertainty.

4. RESEARCH DESIGN

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4.1 INTRODUCTION - CASE STUDIES DEVELOPMENT

Due to the pace and early state of multimedia development, it was difficult to pre-plan a set of studies that would provide a useful overall picture. Fortunately the cases that did arise in this study ended up providing a useful evolution of multimedia development with the technologies of both Networked Multimedia (NMM) and Corporate Intranet (Praxis) combining to create the Training and Communications Network (TCN).

NMM: Networked Multimedia is described in Chapter 5. This project was an opportunity to develop sponsor confidence through my role within the technical development of the project, demonstrating relevant technical skills plus the economic benefits of a postgraduate student resource. The writer was involved in a core role from inception to implementation within the development team.

Praxis: This case study, described in Chapter 6 on the Corporate Intranet had been an ongoing project but needed to be re-assessed and upgraded before a wider corporate rollout. Personally conducting the interviews and survey enabled me to spend time with key players in the project and end-users, to gauge opinions and to obtain history through a participative role.

TCN: The Training and Communications Network described in Section 7 was the extension of the preceding two projects so I was able to gain access from inception through being part of the evolution process with inherent knowledge. However, this was a longer running implementation project and due to illness I did not have full involvement to complete implementation. The high level profile and political activity around this project allied to the much larger project team size meant that I did not have access to all meetings.

4.2 BACKGROUND

My research project was conducted within the framework of a CASE studentship, involving collaboration between the University of Edinburgh and BigBank. The University was represented by advisors from the Department of Computer Science and the Research Centre for Social Sciences. The BigBank had a representative from the Research Group of their Technology Department.

The title of the study was 'Social Learning and Innovation of Multimedia in a Corporate Environment' in order to define the scope. This study analyses, assesses

and explains this phenomenon as it affected the BigBank. Further details of specific areas of interest within this research have been covered in the literature section of this document (Chapters 2 and 3). The study was of a conceptual nature as the BigBank was at an early stage in its involvement with multimedia and no real formal structure existed to manage this process. In absence of this central structure, decentralised groups undertook multimedia development to achieve their individual objectives. The company obviously wished to correct this process to ensure the technology was being developed in a manner beneficial to the corporation and as such, had an interest in research feedback for this purpose.

The research project provided me with an attachment to the aforementioned Research Group to provide a base of operations within the organisation. In this position, I was provided with access to company publications, communications and materials in addition to observation and/or participation in projects and meetings related to the project. This allowed access to information regarding reasons for choice of technologies, methods of implementation and assessment, actors involved therein and networks formed during the implementation. The effects of these issues could also be evaluated.

The nature of the Research Group meant it would be involved in the new technology activity within the BigBank. In practice, the level of their involvement varied by project. For the NMM project they had direct ownership, but in other case study projects, it was via their relationships with other technology players within the organisation. The Research Group was able to broker my involvement within these projects. The key benefit was that because of their role at the inception of new technology investigation, they were involved in the pre-project initiation stages. My link to the Research Group allowed this access as well. This was a key difference from many case studies of multimedia innovation where access to the pre-project stage of activity is unusual.

This area of research is extremely complex, fluid and dynamic with regards to both technologies and people. Multimedia itself is a complex area. This complexity arises from a number of features, principally vagueness of definition, wide variety of products and customisation of technologies. This can be seen from the studies themselves with each case study addressing a different variant of technology from NMM with a multimedia broadcast package, Praxis with the Intranet and TCN, a combination of the two. This demonstrates the variety of components within the classification. It was an important aim for the research to establish a tight definition of multimedia which is an ambiguous title in itself. Hix

and Hartson illustrate this by stating that "Multimedia itself is a rather confused word because *media* is already plural, so why put *multi-* in front of it" (Hix and Hartson, 1993: 88). For the sake of clarity within this study, I have adopted the definition of multimedia provided within the Introduction on page 11 and further discussed on page 25.

The breadth of this term is evident in definitions by commentators on this issue and my experience within the cases. Commentators, generally, agree that it is an interface which consists of more than one medium of input (Hix and Hartson, 1993) and output in combination (Preece, 1994). Clearly this provides a wide range of technologies although this research will concentrate on those which are predominantly computer-based. There was a link with the technology used in the cases which supports this perception, however the main connecting link through the cases was the people involved.

The above breadth of organisation, subject and technology factors provided a wide and diverse area of study which the research design needed to accommodate.

4.3 RESEARCH APPROACH

4.3.1 Case Study Research

The framework of the collaborative study dictated that the research was a case study of the phenomenon within the BigBank. Because of the splintered nature of the phenomenon's manifestations within the organisation, it was useful to treat these instances as sub-case studies of the overall case study, an approach that was possible due to the flexibility of the case study research. This flexibility occurred due to the provision for a number of method types to be utilised within its structure, both quantitative or qualitative as "the case study lies beyond the quantitative-qualitative debate and can employ the best of both methods" (Stoecker, 1991: 99). In practice, only qualitative methods were used but given the complexity and immaturity of multimedia study, the options allowed by case study research appeared a logical choice. It would allow alteration of research design in response to the phenomena observed. In Praxis, qualitative methods were used within the surveys. Richer more valuable information was gleaned from semi-structured interviews. In TCN, the key gathering information methods were the work journal and unstructured interviews.

Case study flexibility also allowed case study research to draw from a number of sources such as archive material (Littler, 1982), interviews, fieldwork results, each of which was required within my research. This was again of

importance within the thesis as a range of sources from interviews to internal reports to surveys was used to gain information. The case study approach can be applied through historical research (Hakim, 1987) or be based entirely on quantitative data (Yin, 1989). It is this flexibility that creates "the case study's unique strength ... its ability to deal with a full variety of evidence — documents, artefacts, interviews, and observations" (Yin, 1989: 20).

This notion of embedded units of analysis can be used as a design element to add greater versatility and enable the basic design to be adapted to meet the various theoretical and practical requirements. The ability to incorporate a number of sources of information, as mentioned above, was essential in this research as it required analysis of information drawn from e-mail, internal documents, computer-based data, meetings, observations, conversations and interviews. This strength allowed case study research to be utilised as "a way of organising data so as to preserve the unitary character of the social object being studied" (Goode and Hatt, 1952).

This was important as can be seen across the case studies where NMM places greater reliance on fieldwork and recording informal interactions with various actors within the bank. Praxis provided the opportunity for more formal interviews and data capture. For TCN, some interviews were conducted combined with observation and journal maintenance. Whereas the themes and areas of interest were common, the methods of information capture had to be appropriate to the specific circumstances.

The unitary character was further preserved due to the flexibility over the time period or frame that the research covers. This unitary nature is noted in Stoecker's definition of case study research as, "those research projects which attempt to explain holistically the dynamics of a certain historical period of a particular social unit" (Stoecker, 1991: 97-98).

Stoecker believed that the case study should be regarded as a "frame determining the boundaries of information-gathering" (Stoecker, 1991: 98). The frame may be either snapshot, covering the contemporary element only, or longitudinal which can handle both historical and processual aspects. This flexibility with regard to the time period allows the overall case study and sub-case studies to be conducted for the time required for successful observation. Within my studies, the time aspect of the case study made it an appropriate format as the case studies were essentially project-based and focused within certain time periods. The actual case studies focused within certain time periods although some of the information captured preceded my involvement which required my taking anecdotal evidence on

the earlier activities. This was certainly the case within Praxis and, to a limited extent, in NMM.

The use of several sub-case studies may seem excessive to many observers although an oft-cited critique of case study research is that it does not allow generalisation due to limitations in the scope of the study. The inability to generalise case study findings to other settings has been noted by a number of commentators, such as Smith and Robbins (1982) and Berger (1983). This was due to the inherent uniqueness of each specific case.

With hindsight it now appears that the basis for this criticism is unstable as it is born out of methodological confusion, a view supported by Rose et al. (1989), Mitchell (1983) and Yin (1989). This confusion is a result of quantitative standards being inappropriately applied to qualitative case study results. Quantitative proponents like Rose regarded generalisability as "the ability to extrapolate with statistical confidence from that sample of the population from which it was drawn" (Rose et al., 1989: 193).

While some common themes were developed, the nuances in each case were fundamental for a wider understanding and this is where the case study approach provided real value. However, this is at odds with the view of qualitative generalisability within case study research, as "the case study approach depends on the 'cogency of the theoretical reasoning' for the validity of any logical inferences from a case or cases" (Mitchell, 1983).

In light of this, we realise that the goal of case study generalisability is to "expand and generalise theories (analytical generalisation) and not to enumerate frequencies (statistical generalisation)" (Yin, 1989: 21). Therefore, in response to the critique of generalisability based upon the definition by quantitative advocates we could answer, "case studies, like experiments, are generalisable to theoretical propositions and not to populations, or universes" (Yin, 1989: 21).

This feature is essential if the results of the sub-case studies are to provide a cohesive, overall perspective of the phenomenon as it functions within the whole organisation. This was true of the cases as finding general theories was more important than numbers and statistics derived within the work. The quantitative elements played a role but more for the corporate purpose of the case when, for example, we look at Praxis where we see evidence of 'lies, damned lies and statistics' as there is an internal corporate pressure to gain a certain set of results. The greater lessons were from the actions of the people within the project and how the implementation and direction of the technology were affected by these activities.

In this research, we are concerned with the theory applied during the implementation and its effectiveness in contributing to a successful implementation. The rejection of this critique allows us to conduct a generalisation depending upon the adequacy of the underlying theory and related knowledge which must be qualified by the relevant contextual conditions (Mitchell, 1983).

These contextual conditions within my research relate to the technology used by multimedia and the fact that it is applied within the setting of the BigBank. The generalisation of the theory applied within individual situations provided an insight and guidelines as to how the implementation of multimedia technology should be approached. This was seen through the progressive development of the cases from which knowledge gained within NMM and Praxis served to provide guidance and best practice which was originally intended for application in later generations of these two projects but was more specifically applied within TCN. This generalisation benefits from the case studies exhibiting representativeness. Case study research equates representativeness to qualitative logic for the selection of cases of study as opposed to a quantitative logic of sampling from a population (Rose et al., 1989).

In accordance with this standpoint, Hakim asserts that case studies take their subject matter from "one or more selected examples of a social entity" (Hakim, 1987: 61). This assertion is enhanced by Mitchell's characterisation of the case study approach as "a detailed examination of an event (or series of related events) which the analyst believes exhibits (or exhibit) the operation of some identified theoretical principle" (Mitchell, 1983: 192). In practice, it was difficult to assess the representativeness of each case study when selecting and the options in selecting were limited due to the newness of the field generally and within the BigBank specifically.

Mitchell's view of case study research as discussed above advocates its usefulness for aiding our observation and understanding the theoretical principles within the implementation of innovations in multimedia as it is not a quantitative factor. It is the need for understanding and explanation that further recommends case study research as

> the essence of a case study, the central tendency among the types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result (Schramm, 1971).

This ability to analyse the total situation allows understanding of the nuances of each situation, permitting the overall theoretical framework to remain uncorrupted, thus aiding explanation of that theoretical process. The belief that all

research requires a creative leap from data to explanation (Mintzberg, 1979) points to the inadequacy of quantitative methods for this purpose as Mitchell (1983) argues that the "logical" relationship between two characteristics is based on the plausibility or logicality of the link between the characteristics. This link can be demonstrated by analysis of specific instances with attention to the historical causal process. The use of case study research for this purpose can be justified as "the case study can more effectively analyse causation than quantitative cross-sectional research" (Stoecker, 1991: 93).

In these case studies, the results or themes were difficult to quantify. The reasons for actions were more attributable to the dynamics between some of the actors within the initiative. This dynamic was specific to the activities within the individual case but by comparison with the other case studies it was possible to detect similar roles and tactics occurring in them. An example of similarity of occurrences is the existence of project champions within projects and some of the ploys of enlistment that they utilised.

The reasoning for this is provided by Scranton (1986) who notes that in single cases, the operation of certain variables is displayed which can be lost in cross-sectional quantitative research. This is because during generalisation in quantitative analysis the existence of idiosyncrasies within each case is marginalised (Kazdin, 1981). It is the process we are concerned with and, as Becker (1968) stresses, what the case study does best is study process, whereas " 'Process' is both historical and idiosyncratic, and statistical analysis is unable to capture either of those" (Stoecker, 1991: 94). Through the capture of these elements, we attain that knowledge of individual nuances which allow the formulation of theory towards assisting informed intervention, which "is crucial for any of us concerned with sociology as a progressive, useful craft" (Stoecker, 1991: 96).

It was also particularly relevant to this research as the BigBank required an informed observation of the implementation of these technologies. This observation was facilitated by the placement within the Research Group. This placement was also considered within the research design and, due to the use of case study research, fieldwork presented itself as a convenient method for utilising and holistically recording this observation.

4.3.2 Fieldwork

Fieldwork is an essential tool for qualitative research and aids the flexibility and depth of case study research. Fieldwork acts as "an umbrella of activity beneath

which any technique may be used for gaining the desired information, and for the processes of thinking about this information" (Schatzman, 1973: 14). This allows a multi-faceted approach which intrinsically "involves observing and analysing real-life situations, of studying actions and activities as they occur" (Burgess, 1982: 1).

This was exactly what the research project required due to its contemporary nature and the close proximity of the researcher to the phenomenon. The attachment to the BigBank Research Group is further accounted for within fieldwork as:

> The main instrument of social investigation is the researcher who has to learn the local language, live among the people and participate amongst their activities over relatively long periods of time in order to acquire a detailed understanding of the situation under study (Burgess, 1982: 1).

This participation was of crucial importance within the study, as all material hinged on my ability to achieve credibility, gain trust and have effective communication with the parties involved. I needed to contribute to and be knowledgeable in technology discussions as well as appreciate and have an understanding of corporate politics. This can, however, give rise to potential problems as, for the researcher "field work is his total life. He copes with it by using his whole body and personality in the same way that he copes with life when he is not in the field" (Gulick, 1977: 90).

It is difficult to preserve an outsider's perspective while gaining an insider's view (Powdermaker, 1966). This is because "one lives in two different worlds of thought at the same time, in categories and concepts and values which often cannot easily be reconciled" (Evans-Pritchard, 1973: 2-3).

During the course of my studies, I did find this role to be complex and demanding. As a result of the key role I played in some of the cases, it was difficult to balance my involvement with the role of observer as detailed below. One concern was to be able to act within the project teams while not overly influencing the direction. My position was buffeted by the often conflicting forces of academic principles and the corporate demands, e.g. in completing surveys for Praxis, the direction of the questioning was influenced by political desires of the sponsors. I feel my presence had an impact on the development of the projects. This impact is particularly apparent during the NMM project which had been delayed due to lack of resource. My inclusion, as a researcher and development resource, within the project alleviated this issue, allowing the project to progress. The results of the NMM project altered perception of the multimedia possibilities available aiding the creation of the TCN project. Arguably my involvement in NMM taking place impacted the creation of the TCN initiative. While alternative networks and routes

may have occurred through my involvement the phenomena of social shaping of multimedia innovation, to my mind would remain true, regardless of my involvement. Given the drivers, ingenuity and resourcefulness of the Technology Statespeople observed within the project, alternatives would have been employed. To provide this view it was important for me to retain objectivity during my study. I had to develop the ability to step outside interactions with subjects and view from an academic standpoint. This was aided by being able to return to the university setting at times to withdraw and reflect away from the BigBank environment. There were also complicated situations when I would witness the political actions of subjects who 'let their guard down' and put me in the difficult position of not knowing how to record and assess in light of relations formed with them as part of the work.

4.3.3 Participant Observation

Participant observation was obviously an extremely difficult task which was further complicated by its use as a principal method of conducting field research. However, this was an inevitable feature due to the collaborative nature of my research project

> The participant observer gathers data by participating in the daily life of the group or organisation he studies. He watches the people he is studying to see what situations they ordinarily meet and how they behave in them. He enters into conversation with some or all of the participants in these situations and discovers their interpretations of the events he has observed (Becker, 1968: 652).

There are a number of roles which the participant observer can occupy dependent on their level of involvement in the entity being studied and whether their research motivation is being concealed or not. The position for the overall case study could be described as 'participant as observer', where both parties are aware that the relationship exists due to the research as defined in the four 'master roles' (Gold, 1958). The researcher remains a 'stranger' while having an involvement in the situation under study (Jarvie, 1982) as I was as part of the BigBank Research Group. The degree of participation in the sub-case studies varied and required judgment in each individual case with the researcher required to take and use roles as one does in real-life (Circourel, 1964) with an additional element of evaluation (Burgess, 1982). The roles within each case did vary to a degree but this was more due to division of labour as a result of the team size as opposed to a change in role. Through each project, the team size increased as technology became more important to the BigBank's operations. NMM's core role in development of the Praxis project came in later to the project but impacted on the shaping of corporate rollout. A common

problem with participant observation is gaining entry to the group and establishing legitimacy with the subjects. Entry is facilitated by the collaborative nature of the study but gaining legitimacy may be more problematic. As a result of the technical nature of the research and the corporate environment, I expected to be required to demonstrate a knowledge and degree of competency within these areas. I anticipated that my previous academic qualifications would assist me as I hold a BCom in Business Studies and an MSc in Human-Computer Interaction. These provided me with a firm grounding in the theory of these fields and I possessed some practical experience as well. These credentials would aid induction into the fieldwork environment and continued legitimacy would be dependent upon effective interaction with the subjects based on observation and reaction to them.

From the outset in working with the BigBank, my previous academic qualifications and the current status as part of a PhD programme did serve to provide legitimisation. In fact for many of the projects, the University association and the inference of academic credibility were seen as attractive factors.

The work I performed within the NMM case study provided me with legitimacy for the succeeding case studies to the point where my presence was being sought instead of my trying to secure inclusion. The TCN project's reliance on the knowledge and experience acquired from NMM made my involvement a very straightforward process. I also had reflective opportunities through being able to withdraw from my participant role to discuss my work with my Research Group colleagues and supervisors.

4.3.4 Interviews

The research structure necessitated a high degree of interaction with subjects of the study. This interaction was written and oral. The oral element of the interaction via conversation was a crucial element of my data gathering. As Burgess states "conversation is a crucial element of field research" (Burgess, 1982: 107). This conversational interaction within social research included interviews where "the interview is shown to take many forms with structured interviews at one end and unstructured interviews at the other" (Burgess, 1982: 107).

My research utilised both formal and informal forms of interview to gather data. However, in practice I did not perform many formal interviews but instead relied on informal interviews which were recorded in log books and diaries of interaction. The informal, unstructured interview occurred on a daily basis within my

placement and provided an important opportunity to probe deeply and uncover new clues. The unstructured interview

> assumes the appearance of a natural interesting conversation. But to the proficient interviewer it is always a controlled conversation which he guides and bends to the service of the research interest (Palmer, 1982: 171).

In order to achieve this successfully it is important for the interviewer to "share the culture of their informants" (Burgess, 1982: 108).

In my particular situation it was important to have not only an understanding of the organisational environment but also to understand the multimedia technology. This understanding was essential in order to probe effectively into the particular idiosyncrasies of the situations that the technologies created.

The extreme form of unstructured interview and one which I used to a large extent was that of the conversation. This method is strongly advocated by Cottle (1977) who feels that it aids the researcher's involvement in the subjects' lives and assists effective research. Burgess (1982) raises questions over ethical considerations regarding privacy and investigator effects. He wonders whether personal accounts can be related while maintaining the subject's privacy and how the effect of the researcher's presence is described. These are questions which must ultimately be faced by the researcher alone. The researcher may wish to formalise the information gathering technique and conduct formal, semi-structured interviews. As a result of the number of unstructured interviews I held and the rich insights I gained from them, ethical considerations became an important aspect. I received insights into political activities and personal ambitions of many of the subjects which if shared widely could have career implications for the subjects. In completing the study I considered the impact and relevance of this information in order to provide an accurate story but without detrimental impact to the subjects.

Throughout my research, I organised semi-structured interviews. These interviews were important as casual conversational probing is not always possible with important actors within the corporate environment. An advantage of semi-structured interviews was that the interviewee was aware in advance of the topic to be discussed and could prepare accordingly which provided better considered, informed responses. Within the corporate environment there are, also, very important political factors to be taken into account. This could give rise to problems due to ulterior motives, desire to please or other idiosyncratic factors (Whyte, 1982). In order to minimise this element "the first concern of the interviewer is to build

rapport, to establish a relationship in which people will feel comfortable and confident in talking with him" (Whyte, 1982).

The manner in which this rapport is achieved is obviously heavily dependent on the individual interviewee. As such, it was difficult to precisely pre-plan how best to achieve this rapport but it had to be taken into consideration when planning each interview and in any interaction with possible interviewees. The semi-structured interviews conducted during the Praxis study were presented under the cover of the Intranet survey which created an environment in which the subjects were comfortable to talk about that subject while affording them the opportunity to talk about wider issues as they viewed this as a forum in which to expand their views.

4.3.5 Data Analysis

Analysis of case study data generated can be extremely difficult due to the diversity and depth it provides. As a result of the research aims of theoretical explanation and understanding, I felt it was important to set a framework for organising the data collection and retrieval. The use of the case study approach would allow the prevailing phenomenon to be assessed in manageable parts while retaining relevancy to the overall theoretical analysis.

4.4 RESEARCH DESIGN SUMMARY

As witnessed within this study, my research involved a highly social, corporate environment. The phenomenon being analysed, namely the implementation of innovations in multimedia, was concerned with a very fluid, contemporary, fast moving technological situation. The research design framework that I planned took the above factors into consideration while retaining an awareness of the need to adapt should changes be deemed necessary in the light of experience. The case study approach allows a flexible, combination of data gathering techniques which allow depth and aid explanation of complex situations such as those which faced me. The suitability of case studies to this type of research was noted by Yin who states that

> the case study is an empirical inquiry that: investigates a contemporary phenomenon within its real life context when the boundaries between phenomenon and context are not clearly evident (Yin, 1989: 23).

The ability to compare case studies through consideration of patterns and theories was important to this study. Comparison of theory between the sub-case studies within the research allowed identification of themes across the cases whilst allowing individual assessment of the idiosyncrasies of each case.

The ability to incorporate fieldwork, an intrinsic feature of this research, into the case study approach also favours this technique. This method also allows participation to occur, an element desired by the research sponsors, in a manner which does not discredit the findings. The issue of involvement has always been of concern to researchers but more so now as

> the research methods we often employ in contemporary case study research provide a moral obligation to focus enough of our attention on the case to inform those who are living it. The moral obligation results from the nuisance we make of ourselves and the time we take up asking questions and interviewing. We should be able to provide something in return (Stoecker, 1991: 100).

Providing value is of particular relevance within my case study as the collaborative title implies mutual benefit. The benefit was delivered to the subjects as they gained a low cost and proficient resource for their projects. The additional resource had a positive impact upon the progress of the initiatives, e.g. the fact that NMM had languished without resource before my involvement and its resulting eventual impact on the TCN project. The organisation also derived proven economic as well as technology delivered benefits. While commentators disagree on whether this exchange should take place, from my research, I side with Stoecker who argues

> the role of the case study in informing active intervention has always existed. But too many researchers have been hesitant to risk their reputations, and have too often confused advocacy with bias (Stoecker, 1991: 100).

In participating in this exchange, I had to ensure my contribution was effectively recorded and analysed. Information was captured within the work journal. Although this was helpful, ultimately judgment was required on my part to design and conduct the research in an effective, responsible and beneficial manner. This judgment responsibly applied should positively affect the "methodological issues associated with the case-study approach" (Stoecker, 1991: 107) which "are as much matters of conduct as they are matters of principle. It is therefore left to the researcher who adopts the case-study approach to do so in a spirit of self-critical endeavour" (Stoecker, 1991: 107).

Through adherence to this principle during my research and utilising the design framework that I have outlined, I believe beneficial results were achieved. In actuality the real value was from drawing understanding from the theory within the case studies. Mindful of these principles, I shall now attend to the practical considerations within my study relating to fieldwork generally and interviews specifically.

4.5 PRACTICAL CONSIDERATIONS

The research design section has focused mainly upon theoretical considerations pertaining to the organisation of the research and methods used. At this point, I feel it is important to discuss the practical considerations relevant to the implementation of the theory within my research.

The recording of information gained during fieldwork was obviously of great importance. It was important to ensure the recording of the information in a comprehensive, organised and accessible manner. In order to achieve this I recorded my research information using a number of methods. A general 'study journal' was maintained for recording general actions, events and observations which occurred during the course of the fieldwork, maintained on a daily basis. A similar journal was maintained for the purposes of recording relevant literature and academic sources. I identified a number of publications which were monitored and identified literary sources. This was a very useful process and was the key method for capturing and analysing the data within my study.

My fieldwork journal was used to record informal interviews which occurred as part of everyday interaction within my study area. An accompanying file was maintained containing copies of relevant e-mails and documents which were collated on file with an index being created.

As I have noted within the theoretical aspects of this section, interviews served as a critical source of information for my research. Individual subject interviews were recorded using a hand-held tape recorder with notes taken as necessary. These interviews revolved around set question areas, detailed below, but remained open-ended with scope to expand to any areas of particular interest which emerged.

Subjects were chosen according to relevance to the particular projects I studied within my research. Interviews were conducted at the initiation and termination of the projects allowing observation of any attitudinal shifts towards multimedia that had occurred during the course of that particular project. Informal interviews during the course of the project were used to add richness to the information gained from these interviews and identify particular areas of questioning for more formal interviews. It should be observed that the structured interviews were more difficult to organise and by their very nature created a setting where the BigBank subjects felt more guarded. The insight gained from the unstructured informal interviews proved to be of much greater value.

4.6 CONCLUDING COMMENTS

The questions providing the backbone for formal semi-structured interviews are listed in Appendices Chapter 12.1. Additional questions were added and others altered as necessary with regard to the particular subjects. In addition, flexibility in interviewing approach catered for other topics of interest to be pursued arising during the interviews.

These practical considerations combined with research theory provided me with a base and structure from which to pursue the investigation of my research topics. These were, however, not designed to provide a static mindset and continued research within this area was used to supplement these initial techniques.

5. NETWORKED MULTIMEDIA

CASE STUDIES OVERVIEW

The choice of Case Studies was more a consequence of opportunistic timing of investigation rather than strategic creation. My involvement was arranged through a few key contacts linked to the Research Group who appreciated the suitability of my capabilities and experience to the projects.

Despite the opportunistic nature of case selection, the cases which will be described in this chapter and Chapters 6 and 7 were remarkably connected and inter-related. This inter-connectedness is epitomised through the Training and Communications Network (TCN) in Chapter 7 preceded by project evolution from the Networked Multimedia Network (NMM) in this chapter and the Corporate Intranet (Praxis) cases in Chapter 6.

The NMM project tested and assessed the capability of the bank network infrastructure to handle rich multimedia. The Praxis case dealt with the usability assessment for a static html intranet system. These two systems were then combined for the TCN system which combines rich media broadcast with web-based content.

We were also able to view the various stages of technology adoption within the BigBank organisation. With NMM we witnessed the initial exploratory tests of a technology for BigBank. In Praxis we saw the initial rollout of the Intranet technology within one section of BigBank, the Technology Department. Finally in TCN we were involved in a project to implement a Training and Communication system across the whole organisation.

So the case studies combined to provide an evolution path in terms of both technological sophistication and challenge of organisational adoption.

5. NETWORKED MULTIMEDIA

5.1 PROJECT IDEA

A Change Planning Executive, who was a senior figure within the retail bank operations, had branded himself as being a technically savvy banker. He had come to BigBank from another bank where he had served as a senior technology executive. He moved into a role as a senior executive within BigBank retail banking. While the Change Planning Executive felt he was branded as being 'technically savvy', to many others he was actually branded as 'Microsoft savvy'. During both his previous bank and BigBank tenures, he had established a record of delivering Microsoft technology solutions. He followed Microsoft's activities and offerings by avidly scouring their web site daily for the latest news. In addition, his interest and relationships with Microsoft extended to the highest levels of the organisation. He was even invited to Bill Gates' wedding.

The Change Planning Executive, therefore, understandably took an active interest in Microsoft progress and new product developments. This interest had to be balanced with his day-to-day commitments within BigBank but his position within BigBank enabled him to call on sections of the Technology Department to investigate his designated topics. His interest prior to the emergence of this first case study was focused upon Microsoft NetShow.

Microsoft NetShow was a package which allowed the production and transmission of Multimedia content over the Internet. This content included text, slides, video and sound allowing a rich expression of information which at the time was revolutionary. The potential of this latest technology fascinated the Change Planning Executive although admittedly NetShow being a Microsoft product initiated that interest.

5.2 PROJECT INITIATION

In order to indulge his curiosity, the Change Planning Executive approached a department within the Technology Division with which he had close relations, namely the Research Group. The Research Group had the remit of investigating new technologies and avenues of advancement that could be linked to business drivers and needs.

This business needs qualification made the Change Planning Executive's initial request unfeasible. The Change Planning Executive initially requested that

they simply investigate the NetShow application assessing what it was capable of with no indication as to how this could benefit the business.

> We advised the Change Planning Executive that we needed a business reason to investigate the application. Because we had a good relationship with him and he was an important internal customer, we began to look for potential applications of the product so we could engage the project (Research Group).

The Research Group identified the possibility of transmitting Multimedia content over the BigBank's network. This potential of using the Internet for uniform multimedia content distribution was particularly relevant given the in progress Intranet project and similar investigations being conducted for the Internet. This technology could also allow communication of corporate information in a similar way that the video-based BigBankTV was used. Through this case, we see the strategies used by a number of parties to advance their own political agendas. The Change Planning Executive's interest was born out of an interest in the technology and a continued ambition to maintain his reputation as a proficient technology implementer. The 'Groups' within the Technology department each wanted to prove their value to the department. The Research Group wanted to be viewed at the forefront of technology discovery and understanding while the Technology Strategy Group wanted to demonstrate their ability to define how the bank would best utilize the technology and its implication for the present systems.

The Edinburgh University Computing Services (EUCS) team had interests in the multimedia area and also had consulting opportunities from which they stood to gain. Cisco also had a vested interest in that they were trying to sell more infrastructure equipment to the BigBank so they were interested in any opportunity to sell in their equipment and prove its capability. We also saw other sections within the BigBank operating to further their own objectives. By donating content, Corporate Communications and Learning Technologies wanted to create a link and influence into an interesting and potentially useful area of technology development.

The project scope and aim were built around the need to investigate the implications of the transmission of multimedia broadcast over the bank's network. This was judged a viable business reason. Normally projects such as this would include a package evaluation selection phase to determine the best fit technology to the business need. This phase was not done as the decision to use NetShow had already been made due to the Change Planning Executive's influence on the project. Microsoft NetShow would be considered the application that was the best for that task without conducting competitive analysis on other options.

5.3 RESOURCE PROCUREMENT

With the project aim and scope agreed, it was then necessary to enlist resources to take the idea through to implementation in order to achieve a specific business result. Resources would be required from a number of sources to provide the requisite variety of functional skills to meet the varied knowledge demands of the project.

5.3.1 Budgetary Considerations

A major stumbling block for the project was that the Change Planning Executive's department had no budget for the work. The implication of having no approved financing was that securing resources to carry out the project would be difficult. Normally the Research Group would not take on a project without an approved budget. However, due to the Change Planning Executive's position within the company and as an important internal customer for the Research Group, they were prepared to make special efforts in order to assist in the furthering of the project. By assisting him here the Research Group reasoned that they would gain an ally within the organisation.

5.3.2 Nature of Resources

The Research Group identified four elements that were required for the project: technology skills, facilities, equipment, and content. The Research Group then looked to identify from where they could enlist those resources. They considered the IT Services section, Property section and the Technical Strategy Group.

5.4 TECHNICAL RESOURCES

5.4.1 IT Services

IT Services are responsible for the maintenance of all of BigBank's Technical systems. The Research Group positioned their approach to pre-empt the eventual problems that the department would face when they would be responsible for the maintenance of the multimedia transmissions.

> We went to IT Services with the approach of helping them to prepare for multimedia transmissions over the network. This would allow us to get their buy in and hopefully use their budget for the testing work. They agreed that it was important but were unsure how to perform the testing most effectively (Research Group).

IT Services advised that these loads could not be tested directly on the BigBank network for fear of disruption of crucial systems as the network was the backbone

for all of the BigBank retail and corporate banking applications. The slightest disruption to any of these services would not be tolerated. As an alternative and more feasible suggestion, IT Services suggested using the test lab environment they had established. This environment was used by a number of projects so the testers would need to book time to perform the evaluation. This lab was the environment that IT Services used for acceptance testing prior to transfer of any new system onto the network.

This provided an ideal solution for providing facilities to perform the testing of the Microsoft NetShow package, the real reason behind the project. The support of the IT Services section was also politically important as it supported the Research Group's view that this was a project useful to the company. A window of time that the lab would be available was booked and the testing would be performed at that time.

Once the facilities were obtained, the Research Group needed to resolve the problem of assigning labour to carry out the work required. This was a significant problem as no one within the Research Group had the required type of skill set to execute this work. As a result, the window allotted for the testing passed due to the Research Group's inability to align the required factors.

Without either resources or facilities for the evaluation, the Research Group was unable to achieve any progress. The project entered a period of limbo as the team re-assessed how best to perform the work.

5.4.2 Technical Strategy Section

Functionally, the Research Group has close ties and linked responsibilities with the Technical Strategy section. The Technical Strategy Group was responsible for defining how best to handle technologies within BigBank. They would receive suggestions about new technologies from the Research Group, define the strategy, and then pass it to the IT Services section for implementation. The relationship between the Research Group and the Technical Strategy Group was confused at times as their work often overlapped as no defined boundaries nor interfaces existed.

In an effort to formalise this relationship, meetings had been established between the sections to discuss ongoing mutual projects and to define their relationship. During these meetings, the sections would discuss the work they were doing or attempting to do. As part of these meetings, the Research Group discussed their plans to look into Multimedia transmission. A member of the Technical Strategy Group present who specialised in Networks advised them that they were setting up a test facility in conjunction with EUCS to look at network load testing.

The Technical Strategy Group brought forward the need for the testing as it was an aspect that they would need to deal with eventually. One Technical Strategy Group member commented "When we realised we were exploring similar areas it seemed an obvious move to collaborate and share the facility". The Research Group now had labour, skills and facilities to do the project.

5.4.3 Technical Strategy Group / EUCS Links

The Technical Strategy Group had developed a good relationship with EUCS. Their initial contact had come through a EUCS Network Specialist within the relevant EUCS department. The Technical Strategy Group had contracted him to do some work on network configurations and testing for the BigBank facilities. From this consultancy, the Technical Strategy Group had arranged with EUCS to hire lab space to build a test network. It was in this lab space that the Multimedia testing would take place. Securing the space was crucial to the project as a principal barrier to making progress had been finding the facilities to do the testing. These resources provided the Technical Strategy Group with a powerful asset.

The Research Group also benefited in resource terms due to the EUCS Network Specialist's areas of interest. He was involved within the academic world with a number of committees involved in distance learning and the use of video conferencing via Multimedia use. The EUCS Network Specialist was personally very interested in this rapidly developing area of technology. He was involved in applications being developed in the EUCS for use in the University as a whole. In addition to the resource benefits from the unpaid time he gave to the project due to his personal interest, having the EUCS Network Specialist's support provided great leverage for the project.

5.4.4 Technical Strategy Group Links with Cisco

One of the Technical Strategy Group's functions was to identify and assess the best suppliers for the company. One key area was the supply of network equipment: the two suppliers selected were 3Com and Cisco. The decision to use two suppliers was a strategic choice because network equipment is absolutely crucial to the day-to-day operation of the bank's operations. The Technology Strategy Group argued that if BigBank had committed itself to one supplier then they would place themselves at a disadvantage when dealing with that supplier. The reasoning for this assertion was that if the supplier was to withdraw support the resulting replacement and technological redirection of the system would be catastrophic.

This two-supplier strategy was balanced against the importance of having a cohesive system with good supplier relations and the ability to order in sufficient quantity to gain bulk pricing discounts. In order to minimise exposure and attain these benefits, the Technical Strategy Group had two suppliers for network equipment so if one did not meet expectations for any reason, operations could be transferred to the single supplier until an alternative supplier could be found. This strategy also allowed the bank to play one off against the other during equipment tenders for which the suppliers had to compete, offering incentives, etc. for equipment benefiting the bank.

5.4.5 Cisco Facilities Option

This competition between the two suppliers resulted in each trying to gain the advantage over the other by offering price incentives and additional services. As part of these additional services, Cisco systems offered the use of their new facilities in the UK. These facilities were located near Heathrow in London and included a well-equipped demo lab for their equipment. The lab was also to serve as the focal point for the Network Multimedia Connection. The demo lab was a result of the collaboration of Intel, Microsoft, and Cisco for their joint offering of products and services. The lab would be used to showcase how their offerings could be effectively combined into a cohesive, functional solution. This solution covered all aspects from software through to processors and networking. This addressed the issues of infrastructure requirements raised by Multimedia products.

The relevance of this lab was the inclusion of Microsoft, the suppliers of the NetShow product on which the testing was to be carried out. The labs also provided an ideal set-up to conduct the testing as in addition they were expected to possess trained technicians. The level of expertise they in fact possessed was questionable as the demonstrator from Microsoft admitted:

> To be honest I've only been using NetShow for about 3 days. There isn't really an expert in it in the UK we only have a sales team which goes out to provide demonstrations. If you need any technical advice you need to contact our labs in the States (Microsoft Demonstrator).

The abilities and contribution of the Cisco lab supervisor was also in question as he had no knowledge of the product and was interested only in the more eye-catching features of the product that were not completely applicable to the work required.

There were, however, a couple of other drawbacks about the situation. Firstly, the site was geographically distant from the bank's Technology Division offices which would make it difficult to get contact and access to relevant parties for demos and consultation. In addition, the Technical Strategy Group was wary of

exposing too much information and placing a great deal of reliance on Cisco for this work. They were constantly concerned about keeping activities with 3Com and Cisco in balance.

The new UK facilities were designed to mimic facilities in San Jose where Cisco's headquarters are located. These facilities are used to gain a better understanding of client needs and produce greater collaboration. The basic aim, however, was to assist sales and the BigBank Technical Strategy Group's perception was that use of this facility could place the balance of power too far towards Cisco. This was an approach that they felt uncomfortable in pursuing in order to maintain an equitable balance in supplier relationships coupled with concerns over the objectivity level of the results gained in the lab due to Cisco's commercial interest.

5.4.6 University Facilities Selection

In the end, the Research Group decided that the Edinburgh University facilities would be a better option for testing. However, Technical Strategy still leveraged their relationship with Cisco and was able to persuade them to loan equipment for the lab with an option to use their facilities at a later date. The University facilities had the benefits of convenience and impartiality. With the BigBank Technology Division offices in Edinburgh, the costs of transportation between the two locations were minimised. This geographical convenience was an added bonus to gaining access to a University network with the capability of performing the same trials. The University also had staff available experienced in Network Administration and testing who would be invaluable for this work as well as the other work that they were performing with BigBank.

5.4.7 Equipment Resourcing

With the testing facilities, labour and some equipment identified, the only sourcing issue outstanding was the remainder of the equipment required. Collaboration again provided the means to resolving the issue.

> With all the groups involved in the project we were able to pool what were meagre resources from each section to provide the equipment necessary. Admittedly that pooling of resources often meant chatting about who knew where a spare piece of kit was lying but it all helps (Research Group and Technical Strategy Group budget explanation).

As explained earlier, Cisco donated network equipment (routers, hubs, etc.) as they perceived advantages for themselves in the project. They hoped that the results of the testing would demonstrate how suitable their equipment would be for this type of work and therefore aid their sale of that equipment while their facilities remained available for additional testing.

5.4.8 Network Established

The EUCS team along with the BigBank project team set up a network to mimic the BigBank HOLI network. In order to increase the validity of the results this was vital. Also a key concern was whether the network topology was correct as the tests would only be meaningful if conducted on an identical topology.

The network was set up via equipment acquired using a member of IT Services attached to the Technical Strategy Group and a EUCS contractor. The combined team ensured the accuracy and validity of the test network.

5.5 CONTENT RESOURCE

With the test network established, the team was ready to test. However, like a racetrack with no cars, the only way to fully test the track was to use it as it would be used in final implementation. The vehicles on this test network would be the multimedia content each with its own owner and chassis structure which would require NetShow to supply the wheels and transmission before it got on the grid.

5.5.1 Identifying / Enlisting Content Owners

While it was suggested that the test could consist of generic load types (i.e. audio, audio with slides), of varying resolutions and duration it was decided that in order for the test to be representative it must use loads representative of BigBank business operations. A list of prospective load types were drawn up and then mapped to existing situations within the bank. Those that had no match were abandoned while some new ones were identified.

There were two owners for the content identified: Corporate Affairs, represented by a Corporate Communications Executive, and Learning Technologies, represented by the Learning Technologies Manager. These were two very different departments with very different individuals. The Corporate Communications Executive was a shrewd political mover within the company, with an air of someone constantly formulating a plan, while the Learning Technologies Manager was searching for one. Business cards are said to say a lot about a person and the Learning Technologies Manager's card said almost everything with every certification of qualification he possessed displayed on it. As a colleague put it, "If I put all my qualifications on mine it would be as long, the only thing he's left off are his swimming proficiency certificates". The Manager's need to impress was much akin to the need for the Learning Technologies department as a whole to justify its existence.

Meetings were arranged with these individuals to discuss the content required. These meetings had an additional agenda other than the sourcing of content as a member of the Research Group explained:

> It is important to get the buy-in of the other sections. The fact that they get involved and think it is a good idea supports the relevance of the testing to the business. Also their input will help us in constructing testing which will provide information which is of use to the sections making it more valid (Research Group Member).

The other benefit would be that approval from certain groups within the organisation meant that, should testing prove successful, there would be an obvious route forward for the result. This would mean the sections enlisted would eventually own these technologies which for the individual involved would provide good profile, if successful, for the champions within these departments. This ownership aspect was a strong benefit for ensuring support. This support also made it easier to argue for funding for their budgets which could in turn contribute to the funding of a project. The principal benefit was however the political weight the enlistment of these sections could provide.

What emerged was an evolving network of interested, supportive individuals within the organisation all with their own contacts and resources which could be called upon. One of the key technical contributions these sections would make was providing an understanding of the real life applicability of these loads. As a result of meetings it became apparent that some of the load types initially suggested were not applicable to BigBank activities so the list was adjusted to take this factor into account.

With these inappropriate load types eliminated as being impractical, the identifiers of the relevant loads were specified. It was noted that the relevance of these loads was only on an historical basis, i.e. 'we've used them so they're relevant' which is not the best method to select for a forward-looking test. This raised concerns that the political perception of suitable testing being conducted was of greater importance than the technical validity.

The final list of content types was as follows:

- 10 minutes of real time video broadcast.
- 20 minutes of real time audio broadcast with (up to) four PowerPoint slides.
- 10 minutes of delayed transmission video broadcast.
- 20 minutes of delayed transmission audio broadcast with four PowerPoint slides.
- 12 PowerPoint presentations each containing two minutes of audio, prefaced and terminated by slides with one minute of video embedded in each.
- Technical training module.
- Professional Skills training module.

5.5.2 Acquisition of Content

The content provided by Corporate Affairs was in a number of formats including videotapes of BigBankTV broadcasts, PowerPoint slides and hardcopy of slides and audiocassettes. This represented the formats they could immediately source within the organisation. This content was taken from some recorded transmissions from BigBankTV on VHS cassettes and some audiotapes with presentations accompanied by the relevant slides.

Learning Technologies had referred the Research Group NMM project team to a third party whom they used to supply training material called NETG. NETG supplied CD-ROM based training material covering topics used within BigBank.

NetShow documentation gave simple, straightforward explanations of what to do with the content when it was in specific formats. What the documentation neglected to mention was the complications in creating the content in these formats.

The key issue for creating these formats was the availability of production facilities. A benefit of the location of the test site at Edinburgh University was that the site contained a 'Multimedia Lab'. This lab catered specifically for the capturing, manipulation and production of video, audio and static content possessing a wide range of tools for this work.

A difficulty of being at the forefront of change is that you are required to solve problems that have never been solved before solely to sustain progress. At the time of the project, data capture facilities for multimedia were relatively scarce and immature. Facilities, where they existed, did not have the power or capacity to handle the rich file types required.

The files for multimedia content were unavoidably large due to the complexity of the data required in creating a package. These files created challenges for storage, capture and processing which few systems had the capability of meeting. Only a few dedicated facilities had the ability to handle this load complexity and those that did would usually charge a premium for that service and this was a premium that was beyond the budget of the project.

5.6 PROJECT DEVELOPMENT

5.6.1 Original Content Generation / Quality

A key requirement within this multimedia capture and development process was minimising any degradation of content quality. Quality degradation was determined by two factors: generational proximity to the master and the format of the original content. The closer the generation of the content to the original master

copies the better the quality of the recording. The more generations it was put through, the more the quality would degrade. As a result of this consideration, the team responsible for converting the content contacted the owners to obtain the earliest generation of content available.

The Corporate Communications Department had contributed a number of audiotapes that contained presentations of new company initiatives. These tapes had been used to disseminate information throughout the organisation prior to the arrival of BigBankTV. Since then, the medium had become redundant but it was felt that it still represented a meaningful test for the network.

Despite attempts to obtain the best version, the remaining tapes were at best second-generation copies. The original and masters of these tapes had long since disappeared. This caused immediate problems as NetShow recommended the use of audio direct recording or CD quality.

In order to maintain an acceptable level of audio quality, high quality capturing techniques needed to be used. Initial attempts using standard methods resulted in muddied reproductions which were unusable for testing. Conversely, the PowerPoint slides provided no added complications because, being a Microsoft Technology, they were in an immediately acceptable format and version.

The Corporate Communications Department also owned the BigBankTV videos. These formats were more recent and were produced in a studio managed and run by a third party contractor, Studio Videos. The Research Group project team was referred to Studio Videos for previous versions of the videos.

5.6.2 Capturing Facilities

The Research Group project team requested the recordings either in the form of a digital master or if possible delivered in an .avi format immediately compatible with NetShow. In pursuing these loads, it became apparent that Studio Videos were not as capable as the Corporate Communications Department believed. The first concern was over their initial assurances that they could deliver the .avi format but at a price of £250 for 5 minutes of footage. Unfortunately, the project budget was effectively zero so even this modest cost did not seem to be a viable solution. As a result of discussions between the project team and the Change Planning Executive regarding the requirement for this input material it was agreed that this cost could be met. A request was made to Studio Videos to provide the file and, at this point, Studio Videos advised BigBank that they were not actually able to provide this format.

Further doubts were raised about the quality of input materials available when the tapes were passed to Audio Visual specialists within the University. On viewing the tapes, they advised that the production quality was very poor. They firstly identified that the recording had been made on equipment which had 'dirty heads' that degraded the quality of the recording. In addition, they noted that the studio team had neglected using basic techniques such as backlighting during the production of the programs. These factors meant the overall quality of the videos was adversely affected at the earliest stage.

When the best versions available had been gathered together, they needed to be captured and converted into formats suitable for NetShow. For transmission, the content needed to be placed in NetShow's proprietary .asf format, for which the package had a number of conversion tools. The accepted formats were .avi for video, .wav for audio and images in .jpeg or .gif formats.

NetShow's instruction manual writers had given a great deal of assurance that these formats were readily available for the target audience of their package. This was an unrealistic assumption as facilities capable of providing all of these formats were relatively rare.

The problems centred on finding facilities that allowed the capture, handling and transfer of large file sizes. Media files are by nature large with size rising in accordance with the complexity of the data, image files are large but dwarfed by video formats. A number of facilities had been designed to cater for multimedia but had focused on the wider need for dealing with graphic files such as .jpeg and .gif providing hardware capable of handling these files and their manipulation with resource intensive applications, e.g. Photoshop. Storage requirements for these files comfortably exceeded floppy disk capacity and required more robust .zip and Jazz drives which could contain these files on expensive disks.

These facilities were becoming more commonplace as the PC revolution had been embraced by the graphic design community who had suddenly equipped themselves with those tools which had previously been the domain of the expensive studios. Some of these smaller facilities thus extended their services to the handling of audio but video required such a significant leap in equipment that few catered for this area.

5.6.3 CD ROM Training Package Conversion Problems

A major problem had been identified when using the training CD-ROMs for testing. The content of the CD-ROMs was designed to run on a single machine from the CD as part of an integrated software package. This made the solution very

proprietary and difficult to re-appropriate for other platforms. As a result it could not be converted into a format within NetShow. To place it within the package would require the content to be available in a base format and to be completely rebuilt within NetShow.

NETG were re-approached about the possibility of Web enabled training packages being available for the test. The NETG Training Consultant advised:

> We are developing some Web enabled training packages, most probably Java based but they're still in development. For the timelines of the testing we wouldn't be able to provide anything suitable (NETG Training Consultant).

5.6.4 University Graphics and Multimedia Laboratory

With a limited budget available, the Network Multimedia team had few options for content capture and conversion. As a result of the inclusion of the writer, a student, in the project team, there was the possibility of using some of the facilities available to students free of charge. The most comprehensive of these was not surprisingly the Edinburgh University Graphics and Multimedia lab located at King's Buildings campus in the same block as the testing lab.

This was a facility for students and provided ample resources for the capture and treatment of images. It also allowed some resources for audio and surprisingly video, although with limited access. This posed a number of advantages for the project team. It was convenient, had the required facilities and was free. The only real issues were in obtaining timely access to the equipment and in transferring the data once captured.

While the labs had .zip and .jaz drives available, it would also be necessary for the receiving environment to have the equipment capable of reading these formats. As a result of budgetary constraints, the Networked Multimedia project could not source these drives and thus eliminated this possibility. This would prove a show stopping issue for this lab idea.

The project team believed that there was no resolution to this situation but the EUCS Network Specialist felt he could investigate other possibilities, as he explained.

> I'll have a chat with the people from the lab as I know them quite well. It should be possible to slip the files across the university LAN. It is not normally allowed but I'm sure I could get them to agree to it (EUCS Network Specialist).

The EUCS Network Specialist's assurance proved to be reliable and after some discussions with the team in the lab they agreed to transfer the files to the lab via this method. In addition the lab would assist in the capture and conversion of the content. The EUCS Network Specialist, himself, assisted during the process and it became

obvious that a major reason for that assistance was a personal interest in the area. As one EUCS Laboratory Engineer commented "It is not often we get to really use this equipment, so it is a good excuse. I want to do more stuff like this". With the content captured and transferred to the testing lab in the relevant formats, the next step was to convert it into .asf format.

5.6.5 Editor Options

The NetShow package had a number of tools to convert content dependent on media. These tools were titled VidToAsf(Video), WavToAsf(Audio), and AsfEditor(Audio + Static). The first two editors were DOS environment command line operations, a spartan text based environment seemingly incongruent with multimedia creation and transmission.

The command line editors (VidToAsf & WavToAsf) produced favourable results with the converted formats when played displaying retention of quality. The converted product of the AsfEditor was not satisfactory. The AsfEditor is a GUI system that presents a timeline through which items of content (sound, image, etc.) can be dragged and dropped onto and arranged for presentation. This presentation can be reviewed as it is built as opposed to the other editors which do a bulk transfer with no incremental changes.

5.6.6 Degradation Problems

It was during these reviews that the development team identified marked degradations in the quality of the output. The audio became garbled and muddled which made it difficult to discern. A number of different conversion codes were applied but each still produced substandard output. What was even more alarming was that this degradation in quality also affected the PowerPoint slides which were in the ideal format for use. The legibility of the slides decreased following conversion.

A number of different formats were used with the slides, .jpeg and .gif, but there still remained the same inadequacies in the retained quality. This presented a sizable problem as the substandard content would deeply affect the usability tests and could potentially make them unusable.

It was at this point that the development team discovered that the NetShow manuals and marketing information glossed over and in some cases completely ignored very important issues with the development process. There was no information which covered any of the issues that were being experienced. The application came with a number of NetShow broadcasts which provided tutorials on

the use of the system. These were referred to in an attempt to gain a better understanding of the system and the ways it could be used to eliminate the problems. But the tutorials were too simplistic and a number of them did not actually work, so confidence in the tool was diminished. The recordings would stick at certain points or jump. This did not provide a good advertisement for the package itself. The next options were to contact the Microsoft support and to speak to the Network Multimedia Connection labs in the Cisco offices.

5.6.7 Lack of Microsoft Support

Microsoft support was contacted regarding the difficulties. Unfortunately, due to the nature of support lines and the work that the project was undertaking, the results were not as desired. Support lines feature operators who are seldom deeply versed in the actual products they support although they will have, at least, a cursory knowledge. The levels of knowledge are graded by 'lines' of support and problems are escalated through the levels as required to find someone with the knowledge to resolve the problem. The third or fourth line of support will often include members of the Microsoft R&D team who were involved in the design of the product. Each line of support will have access to a log containing all the issues that clients have called them about and the progress made on resolving those issues.

As the application had only just been released, the number of issues that had been raised on output quality degradation was sparse in both complexity and volume. The Microsoft support team members advised the BigBank project team that most of the issues centred on base installation and the product capability of dealing with live feeds of content as opposed to converting existing content into .asf.

The early levels of support were unable to assist and they advised that they would have to pass the issue back to their colleagues in the USA to assist with the problem. This was a positive move but after calling each day for a week there was no further progress and the development team were unable to speak directly to the person who was dealing with the issue. The initial Microsoft support contact in the UK advised that because of the skill sets of those involved in third and fourth line support, they are often required for fresh development work and have limited time to support issues.

Finally, Microsoft Support advised that the problem "May be an issue we will be looking at for later releases". This is a way of saying that it is bug without a resolution in this version of the software while not admitting that it was a software fault. This was not a surprise to some people at the BigBank. As one developer said:

> Microsoft are famous for doing this, releasing buggy (fault ridden) software and getting the users to find and correct the issues. It is only by about version 4 or 5 that their

> packages are ok. I mean who do you know that ever used Word 1 or 2? (BigBank Developer).

This still left the problem of how to produce content usable for the usability testing. The next avenue of enquiry was with the team at the NMC lab at Cisco's offices in London.

5.6.8 Unrealistic Guidelines for Corporate Environment (CD quality, etc.)

The manuals for Microsoft NetShow provided guidelines and best practice for how to produce optimum content for transmission. For video transmissions they recommend the use of 'talking heads'. This is when the picture only includes the head and shoulders of the speaker. The aim is to cut down the range of motion that the transmission has to cover because when low frame rates are used, movements appear 'jerky' and can put the viewer off. The other key recommendation is that the audio when recorded is done so in a quiet environment with minimal background noise and a single voice that is clear and at an acceptable level of audibility. Discussion also centred on the direct recording of the content into the system.

These guidelines were not practical for a corporate environment. Firstly, it required the existence of a studio that could record and produce the appropriate formats which was costly. Secondly, corporations would have a lot of content that was pre-existing and would not want to entertain the cost of having all of that content developed again. As one of the BigBank team expressed:

> We can't justify reproducing all the content in terms of time or money. The worry would also be that we produce it all for Microsoft's proprietary standard then we have to redo it again when we shift in a year when another standard emerges (BigBank Developer).

The limitation of the use of 'talking heads' for the videos was unacceptable as it was inapplicable to the type of content the BigBank would plan to use which required wider screenshots and activity.

5.6.9 Web Page Alternative

The problem regarding the quality of the converted PowerPoint slides was of major concern because this represented a problem when the recommended procedure had been followed. The team acknowledged that alternatives would need to be sought.

One of the team had discovered that the command line editors allowed the linking of calls to web pages during the broadcast. In order to do this, the developer needed to know the timing of the call and the URL of the page. This would mean that the slides would need to be converted into HTML pages and a web site for them

set up. The team estimated the level of effort to be a couple of days work and could be performed by the team already assigned to the project.

This solution also appealed to some of the NMM Project team members involved in the project particularly those from the Intranet team as it demonstrated another means of enhancing the value of their project. It was believed that this would successfully avoid the degradation problems as the results of the audio conversions by this method had been successful and the pages would undergo no conversion as they would be called by the package.

Another benefit of this approach was that the content was more easily updated. With the pages not being part of the compiled package as long as the URL remained the same, the page content can be updated and still be called within the package. Possibly the biggest factor was that no other possibility seemed to exist which retained the use of NetShow and as a result this method was chosen.

The results from the preliminary work were more than acceptable. One issue that appeared was the timing of the calls to the pages. Because they had to go across the network there was a delay for the call to the page appearing which put it out of sync with the voice. This was because the timings had been worked out under the belief that the slides would appear immediately. Some experimentation to place the call prior to when it needed to appear solved this issue. This provided the test with appropriate content for the audio and static information usability testing.

5.6.10 Construction of Video Loads

The construction of the video loads was the source of some of the greatest concern and problems within the project. This was the area anticipated from the outset of the project to hold the greatest complications and consequently certain avenues of investigation were curtailed on the presumption that they would not be possible. A key example of this is the choice of frame rate. TV broadcasts are transmitted at 25 frames per second and the development team did not believe that broadcasting content at this frequency would be possible on the network. As a result it was decided to record at rates of 15 and 5 frames per second as these speeds would create smaller file sizes that the network would be able to handle.

The effect of lower frame rates is that the picture has a 'jerky' quality similar to a strobe effect as the changes between frames are more perceptible to the human eye and it sees the changes from one frame to the next. As a result movement is not as easily tracked since the changes between the frames were quite obvious.

In order to minimise the visibility of this effect, footage was shot in a way to reduce possible changes between frames as discussed regarding the 'talking heads'

practice noted previously. However, this was not a model useful for the BigBank videos which required a wider range of shots. Therefore, it was decided to experiment with the different frame rates to see how much the user experience was impacted by the lower frame rates. It was also decided that the screen size should be explored as a factor in the user assessment of the content.

It was felt that if the full screen size was used the user was more likely to draw comparisons between the NetShow transmission and TV which would adversely affect the evaluation of the experience as they would perceive it as a poorer TV rather than an enhanced computer experience.

Another reason for the use of a smaller screen size was consideration for the viewing situation. As opposed to full screen TV style viewing where the participant sits approximately 1 to 2 metres away from the screen, the user in the corporate environment would be positioned about a foot and a half away from the screen. Therefore the smaller screen size would be more acceptable. It was thus decided to use the default size and half of that as the two viewing sizes.

5.6.11 Audio Construction

The type of audio used also impacted on the content and use. As noted previously, the recommended practice was the use of a single voice against a quiet background that was recorded to CD quality. The tapes that the bank supplied which were deemed representative of the type of audio to be used did not possess these characteristics. The tapes featured less than CD quality sound but also featured speakers with a lot of background noise as well as occasional music. It was during the capturing process that the impact of the lower quality sound was first experienced.

To ease the burden on the network the team wanted to create files of the smallest size possible. In order to do this the lowest resolution of recording was used. On the facilities available this would be 8-bit sampling but the content and sound quality suffered to such an extent that the result was unsuitable. As a result the higher resolution 16-bit sampling mode was employed, producing results which would be usable for the testing.

5.7 DEMONSTRATIONS

With the test environment established and the content complete, a number of pre tests were completed to check the functionality of the system. The next stage was to begin the planning of the user tests. Prior to planning user tests the project team decided that it would be beneficial to provide demonstrations of the test to the

various project stakeholders. As the BigBank NMM Project Manager explained "It was a good opportunity to show the various people who had backed and contributed to the project".

5.7.1 Stakeholder brought in for Demonstration

The audiovisual nature of multimedia lends itself to effective demonstration to an audience which does not possess technical knowledge. One of the political benefits of the demonstrations was that it allowed the stakeholders in the project to demonstrate to their superiors and colleagues the value of the work in which they were involved, adding to their status in their sections. This would also gain additional support from other individuals in the organisation who now felt part of a select group having had special access to the project. This early participation of these selected attendees would lead to greater word of mouth discussion about the project which would increase interest in the other groups who should benefit from the testing. This would also ease adoption of any of the findings from the research following its conclusion.

The BigBank staff were not the only ones who had demonstrations at the test site. A number of the University staff who had assisted during the site set-up invited colleagues to view the work that was being done. This provided some spin off benefit for the university as the EUCS contact explained.

> It was very useful having the site at the university as it gave the opportunity to demonstrate the site to other departments. Some of the other departments have seen some opportunities within the application for use in their distance learning programmes. It sparked off a lot of ideas which we are now going to look into (EUCS Spokesperson).

While the usability testing was required to validate the work, these demonstrations allowed an initial qualitative evaluation of the content from the user group. This allowed some discussions to be initiated regarding future work while waiting for the report. This was valuable but would be useless without subsequent testing, a fact acknowledged by the Research Group representative who commented "If we hadn't done the usability testing there would have been a huge gap in our credibility".

5.7.2 Addition of Video Conferencing to Demonstration

The University test site had also been used for testing of other technologies not involved in the main project. One of these was NetShow's sister product, NetMeeting, an application aimed at video conferencing. This application allowed the use of audio and video plus content exchanges via a whiteboard function and file

transfers. The team had done some linking to remote locations to demonstrate this application.

This was incorporated into the demonstrations of NetShow allowing an effective example of a related technology which the demonstration audience felt could have relevance to other operations within BigBank. The stakeholders felt it added to the value of the project and also provoked some other ideas regarding its use.

5.7.3 Multimedia Technology Presentation

Because of the nature of multimedia technology, the best way of presenting it is to demonstrate it, as the BigBank NMM Project Manager commented. "The thing about multimedia is that you can't really describe it with the same impact as a demonstration. You have to show it to people". The proximity of the test site to the BigBank offices made it easier to arrange the demonstrations. This meant that it would require less time out of the office with no cost for travel or accommodation and little travel time. This meant they could be arranged quickly and made to fit around the schedules of the executives. With the lab being off BigBank property, the Research Group were still able to control who had access to the site and the time.

An important political aspect to consider for the demonstrations was expectation management. The Research Group was aware of the complications that raised expectations could cause.

> The problem is that when some people, especially those without technical understanding, see something they immediately think 'I want that' and with their expectations of what is possible raised, their desire and demand increases. They don't consider the effort required to produce these things. This causes problems for the Technology department who are then under greater pressure from these expectations (BigBank Research Group).

In order to make the audience appreciate the effort and complexity required to produce the content, the demonstration walked them through all the stages of production. This included all the complications such as the degradation issues caused within the AsfEditor.

In order to further manage the expectations, the relevant section's relationship manager also attended. Within the BigBank, the Technology Department assigns a relationship manager to each section it deals with internally. These managers have the charter to maintain this relationship, a key component of which is the setting, maintaining and meeting realistic expectations. By attending the presentations they were able to understand and get context around any expectation changes that may be caused.

After each presentation they would hold a debrief between the section members and the relationship manager, to discuss the impact of the presentation on the section's technology plans.

5.7.4 Research Group Promotion

For the Research Group these demonstrations served to promote the work they were doing.

> The demonstrations allowed us to show the relevance of the work that we were doing. Also because of the nature of the work, using multimedia, it was eye-catching and interesting. This promoted interest in other things we were doing but also prompted some of the sections to approach us about other spin off projects with them (BigBank Research Group).

A major advantage for the Research Group was the ownership of the lab facility which, as discovered at the outset of the project was a very rare commodity. The ownership of this resource combined with the evidence of the required skill set to perform the work was viewed as an important value proposition.

5.8 USABILITY TESTING

5.8.1 University Contacts for Labour

In order for the testing of the system usability to be as relevant as possible, the test sample group needed to comprise as wide and large a number of subjects who were representative of the end-user group. The acquisition of the number of these test subjects also had to be cost effective.

The location of the lab on the University campus allowed these requirements to be met reasonably easily. The campus catered for a large number of students and administrative staff so sourcing large numbers of subjects was not a problem. Members of the University staff used their knowledge of the student and staff body to recruit resources with the benefit of knowing the volunteers well enough to select ones who best matched the characteristics of the end-user base. Payment for the testers was reasonable with £15 for participating and no additional transport costs as they were located in or near the test building.

5.8.2 University Improved Standing

The BigBank Research Group felt that the collaboration with the University for the project brought additional benefits over and above the cost effectiveness of the labour. Other parties within the bank perceived the project as having a level of academic validity due to this involvement. They also felt that the University provided a more independent standpoint and it was not just another BigBank

department trying to push its own agenda. As members of the BigBank Research Group commented "People looked at the project in a different way from other internal bank projects. Having that academic angle made it appear more valid".

5.8.3 Network Characteristics Affecting Testing Scenarios

The main investigation for the testing was how the bank network would actually handle the traffic created by the new multimedia applications. The plan was to test the usability of the multimedia loads under different network load conditions. The initial aims were to test under perfect, medium and intense loads. The perfect situation would reflect a scenario with no load present on the network. The medium condition speaks for itself while the intense condition would reflect the network under a load that was close to its failure point.

The initial preconception of the test team was that Ethernet would be the superior framework for the network. Many in the Technical Strategy Group felt that the token ring framework was not robust enough to handle the required load. The token ring system establishes a ring of network nodes around which a token packet is passed. This packet needs to reach the master node, having completed a circuit of the network, within a set time frame. If this does not happen, the network assumes there is a problem and shuts down and restarts, an activity which understandably causes mass disruption. Until this point the network treats all nodes fairly and each is unaware of other traffic on the system, just concentrating on what it receives at that time.

5.9 REPORTING (BigBank REPORT)

5.9.1 Sponsor Concern with Problems Identification

The project sponsor and the EUCS consultant felt that the testing report had created a negative slant upon the application by detailing problems which needed to be remedied in order to use it effectively. While these problems were valid, their discussion detracted from the positive Public Relations zeal.

The testing and resulting reporting raised awareness and altered perception of both the BigBank Network and the various parties involved. The perception of the bank network altered in that it was acknowledged that it could handle richer data types, a capability which had previously been considered absent.

The Research Group gained credibility in terms of expertise within Multimedia technology laying the foundations for the opportunities for further projects and work. The new perception of the network opened possibilities for new

avenues of development on the Intranet as we shall see explored within the following Praxis (Chapter 6) and TCN (Chapter 7) cases. The Research Group would be called on to provide myself as a resource to work on the projects as a result of the expertise gained within NMM. The Research Group also displayed the results of the project as one of their key pieces of work at the annual Technology Department exhibition to further enhance their new reputation.

5.9.2 Pathway to Further Studies

The resultant access to other projects and positive perception of the work were surprising and welcome to me. Surprising because at the start of my involvement within the NMM Project, it was of low interest and priority within the organisation compared with other burgeoning CD ROM based multimedia projects, intranet and internet projects. It did not seem an enticing project to allow me credibility and access to the organisation. However, it did create the credibility and organisational access which provided a privileged vantage point to view a micro political environment within BigBank. In addition, the NMM Project gave an overview and understanding of the technical and organisational infrastructure of BigBank which would aid my passage into the Praxis Intranet project whose goal was to create a web technology system to share information amongst the Technology Department.

Useful insight into the technical systems of the bank was afforded during these studies as well as into the organisational and personnel aspects of the business.

6. CORPORATE INTRANET (PRAXIS)

6. CORPORATE INTRANET (PRAXIS)

6.1 PROJECT IDEA

Personal advancement and the pursuit of job satisfaction were demonstrated to be common motivators for the individuals within the Praxis project. Their desires were often the drivers for innovative ideas especially when they were looking for ways to enhance their role. The Praxis Intranet began from this situation. A Research Group Project Manager had completed a project dealing with multimedia producing some Human Resource related CD-ROMs. From this project, there was no obvious next step so she was left to identify a new area for investigation.

Around this time, a lot of interest was being raised within the media concerning Intranets and their potential use by companies. They were being viewed as a major future growth area. The Research Group Project Manager began to look into this area and produced some papers on the subject.

The rapidly accelerating interest around the area of Intranets naturally extended to many technology executives. By way of discussions with executives from other organisations, the Technology Director in BigBank became aware that a number of companies had projects dealing with Intranets. He felt that if other organisations were investigating this new phenomenon then so too should BigBank. The Research Group Project Manager was aware of the Technology Director's interest in Company Intranets via her friendship with the Technology Director's Executive Assistant.

6.2 PROJECT APPROVAL

As with any project, a business case emphasising the benefits to BigBank would need to be identified. One benefit of Intranets is that they allow for the organisation of significant and often sensitive business information within an easily navigated system.

The existing system for holding such information was exactly the opposite in terms of ease of navigation. The 'J-Drive', as it was known, was a hard disk drive attached to a central server that was used to hold shared files. This system was technologically unsuited to the task. While it could store a large volume of data, it possessed few tools for the effective organisation and maintenance of the information held there. Consequently, the information recorded there was largely out of date with the most recent documents difficult to differentiate from earlier, now obsolete, versions. In addition, a number of 'orphan' documents remained on the system with

no author or department attached to them.

Searching for documents was very difficult with the file structure confused and no naming conventions in place for the files. A text search was unlikely to assist you to find the right document unless you knew the exact name. These problems were the result of no-one having defined responsibilities for the upkeep of the drive. No person had assigned responsibility to maintain the 'J Drive', no standards existed in terms of structure or change procedures if the corporate structure changed and sections ceased to exist. It was proposed that the Intranet would be used to replace the J-Drive eliminating these inefficiencies. Another key benefit of Intranets was their capability to provide an additional communication channel. This was aimed at eliminating an abundance of global emails which circulated the company taking up a lot of bandwidth and storage on the system. The Intranet would allow one central reliable source of information. As the proponents of the system advocated, it would provide the 'one true word', a concept which included the documents as well.

Despite these valid reasons for developing the project, the project initiators, themselves, admitted privately that the business reasons were not the primary drivers for the project being approved. As the Research Group Project Manager admitted

> It was a leap of faith by the Technology Director. He just thought it was a good thing to do. I think his industry colleagues were talking about Intranets and how they had one and BigBank hadn't. So he was quite keen to say "We're doing something in that" (Research Group Project Manager).

So the project was approved and the team had to begin to investigate and plan the construction of the system. Two critical risk areas were identified: building the technical infrastructure and sourcing content.

6.3 INTRANET DEVELOPMENT

6.3.1 Operating System

The new system needed to operate at an effective level and this required an appropriate technical infrastructure to be put in place to achieve this objective. A network was needed which would transfer the required data with equipment having the capability to process and deliver it effectively as well as facilitate input by the Content Co-ordinators. The Research Group Intranet Praxis project team began by researching what was possible on the existing system.

The BigBank was in a process of transition regarding the platform on which they ran their MS client systems. The bank's standard operating system was being upgraded from Windows 3.1 to NT. This process took several months. The rollout had to change over the systems in a manner which caused a minimal impact on

BigBank's operations and would keep any problems raised during the process on a manageable scale.

Until this rollout change process was completed, the Intranet would need to accommodate the restrictions of the lowest common denominator system. The Windows 3.1 system only allowed the use of a limited 16-colour palette as opposed to the more hospitable 256 colours available on NT. This limitation imposed restrictions in the design possibilities for the system.

In addition to the colour limitations and the inherent design limitations, a combination of the limitations of the existing system and the current network restricted the system's speed which in turn determined the system capacity and how much data could be processed for each client. This meant that the Praxis project team had to consider the 'weight' of processing required for each page and the nature and volume of data contained therein.

The limitations of the system had a knock-on effect which affected the capability of the system to accommodate multitasking. Some client machines could not operate other applications whilst using Praxis. This made use of the system more time-consuming and less appealing. Most users would prefer to have the application opened in the background so they could refer to it as necessary. Having to close down applications they were working on and open up the Intranet browser was a considerable barrier to its use.

The overall network speed was a crucial performance issue since it would affect the system's capability to handle network traffic and could therefore impact download speeds. The Praxis project team would need to take into account that the network speed in some areas was superior to others with the London network operating faster than the Edinburgh network.

The use of email within the Intranet system was viewed as highly desirable but the team discovered that some shortcuts had been taken when the email system was set up. A consequence of these shortcuts was some of the fields, including the email server details for each employee, were unfilled when the directory was populated with user information. The information held within these unfilled fields was crucial for the email system to be applied across both operating systems. Without these fields being populated, the email could only be set up for either NT or 3.1 — an unsatisfactory solution. The other possibility would be for someone to populate these fields but that would require a large number of man hours to perform. This effort would be a relative waste of time since the company could wait until everyone was on NT then implement email without this effort.

The important ramifications of the NT rollout upon the performance of the Intranet meant the Praxis project team had to have a good understanding of when it would be rolled out and who would experience it first. The Business sections within the bank had priority in the rollout to initially receive NT, the closer a section's proximity to the business units denoted their priority for upgrading. This meant that the Technology Department were, at best, of secondary importance in the queue for upgrading to NT.

6.3.2 Content Considerations

Irrespective of the high reliability and processing speed of a system infrastructure, an Intranet will only be useful if the quality of the information content is of a high standard. In fact, the system may even go relatively unused as a result of poor information data content or presentation irrespective of processing capabilities. The Praxis project team had to define what the value proposition of the Intranet information would be and how to ensure that the desired quality level would be met. This required standards to be established and applied.

The core value of the information to be held on the Intranet was that it represented the repository of 'the one true word'. This value was a direct pitch against the J-Drive. In contrast to the J-Drive, the Intranet would provide a centralised, consolidated, reliable source of information in addition to reducing searching time. In order to draw people to use the system, the content would need to 'add value' to business functions. This information value would determine the usage of the system: the greater the value, the greater the use.

A key metric for selling the Intranet within the BigBank would be the system's ability to improve the efficiency of the banking operations and thereby profitability. To bankers, the bottom line was always the ruler. The importance of this aspect of the internal 'sale' of the system was as important at the top as the bottom of the hierarchy. If the value was only apparent to the executives and not reflected in individual users' day-to-day activities, they would not use and populate the Intranet with information from their sections. The users populating the system with their information were crucial to the value proposition of the system. The value of the system was directly related to the quality of the information held on the system and this had to be provided by the users. If the users saw the system as being a valuable channel to share information, they would provide appropriate information and create a greater bond with the Intranet, heightening its use and increasing the level of user buy-in.

Users needed to be convinced initially to appreciate the value of the system and relate it to their activities. If valuable, they would be encouraged to devise applications for their area or identify anything which, if added, would further increase the value of the system. The momentum of the access and populating cycle was vital for the establishment and development of the system. The system needed to build to a 'critical mass' of users to both access and input data. This would drive acceptance of the system and the perception of the 'one true word'. If few people accessed the system then it would be harder for people to justify the time to input information. It was vital to reach this 'critical mass' point as quickly as possible because if momentum was lost, use and adoption of the system would drop quickly.

Accelerating the possibilities of adding new information to the system was important in building value. It was also crucial for the initial system to be capable of leveraging and enhancing existing information to obviate the time consuming task of re-entering such data. This would allow for the consolidation and creation of the core value of the 'one true word'. As a result, the Praxis system could 'hit the ground running' with an easy conversion path for existing information from previous systems. Without this capability, the information would remain decentralised on existing systems. This migration path would need to be built around the J-Drive information as this was the primary repository to be replaced.

6.3.3 Presentation

With an infrastructure and content positioned, the user still needed to find the system usable and be able to extract the desired information. In order to do this the appearance and presentation needed to be right. The options for design began under the known limitations imposed by the existing operating system and the network capability. The guiding role in this development was taken by a Contract Web Developer who had been engaged by BigBank and his decisions were largely a matter of individual taste. These would then be approved by a steering committee although this was a rather ad hoc process. As a result of the lack of web skills and knowledge held by people within the bank, the Contract Web Developer's views met with little resistance as he was viewed as the expert.

> The graphics were certainly done in consultation with the Research Group Project Manager and JW. I just sat down at Photoshop and produced loads and loads of different styles and logos and people just said I like that one, I don't like that one and a graphics style emerged from that and I suppose I slotted it into my minimal page layout style and it kind of came to be as the standard (Contract Web Developer).

The Contract Web Developer worked under the guideline of a basic design with few colours to minimise the download time for the resultant pages.

> While working on the Intranet I did develop a minimal style to reduce download times. You tend to find a lot of HTML designers use tables to layout things in an interesting way. In my experience that just slowed downloading of the page. So I developed a style which allowed me to layout a page while keeping the use of tables to an absolute minimum (Contract Web Developer).

Red and grey were selected as the principal colours for the site and this could be seen as odd given that these are not the identifiable BigBank colours but this was a decision taken by the Contract Web Developer which he explained, as follows;

> I had to design the system for the lowest common denominator which is Windows 3.1 which only has a 16-colour palette. The red was the colour I thought looked best out of the palette so I used that (Contract Web Developer).

Each page's design was simple with a 'wallpaper' effect which noted the section the page belonged to, aiding navigation. Each page would also contain the Pi symbol which had been adopted as the Praxis logo.

Coupled with the design, the navigation of the page needed to allow effective location of information. This had been one of the key failings of the J-Drive. The information on Praxis needed to be readily accessible as well as accurate. A search engine was proposed but it would only be possible to use one with limited functionality due to operating system issues and the timescale for development. Consequently, the organisation of the information was of even greater importance for aiding information access.

6.3.4 Structure

In order to make the structure easily understandable to BigBank staff users, it was important to provide them with a familiar structure which would become intuitive. To achieve this familiarity, the Praxis structure mimicked the organisational structure giving users a familiar point of reference for navigation. It was also felt that the users should always have a base point to which they could quickly return. This is why it was a standard requirement that the Praxis logo be placed in the top right corner of the page containing a hotlink to the home page so users could always return there from any point.

In order to provide a familiar structure, the sections were organised in line with the organisational structure with, in addition, each section being given an explanatory title, e.g. Tech Strat. = Know the Ropes to describe the function of the section. This title was then incorporated into the wallpaper feature for each page belonging to that section to further aid identification.

The Intranet content needed to retain value within the framework of the system. This value was influenced by how effectively it related to business function. The extent to which this was possible was heavily reliant upon the capabilities of the

system. For some sections, the nature of the functions they served could not be accommodated due to the limitations of the system. An example of this arose with the IT Services section whose task was to maintain the system, reacting to any faults as they occur. This function required immediate notice and action when a fault occurred and real time tracking of progress of its resolution. Praxis was to use a practice of overnight publishing meaning a delay in information transfer which was unacceptable to this section's activities. As such, Praxis did not represent a realistic alternative to their existing methods in the initial launch. The Praxis project team understood that for the system to expand and grow they would need to identify these gaps and the possibilities for closing them thus setting a roadmap for further tools development.

6.4 IMPLEMENTATION STRATEGY

6.4.1 Organisation

The Praxis project team had to set up a framework within the organisation to manage the rollout and introduction of the system. They sought user feedback to enable response to specific needs in order to tailor the system and the contents to fit the organisation requirements. The Praxis project team decided the best approach to obtain content from each of the sections and spread the word about the system was to establish a team of Content Co-ordinators and get live feedback through them.

Each section would have a Content Co-ordinator acting as a system champion as well as ensuring the quality standards for content were applied. Setting up the Content Co-ordinators in each section would provide the first step for decentralised publishing for the Intranet. As the Research Group Project Manager explained:

> It was essential that we made each section handle the publishing of their own content. We couldn't justify the cost of having one centralised team publishing content and also it would slow down the publishing process with another person involved in the process...Also having a section owning their publishing, they get a greater responsibility and feel more involved in the project. It assists buy-in as well as spreading the word (BigBank Research Group Project Manager).

The Content Co-ordinators would also be responsible for the content being published or, alternatively, taking the responsibility to identify and select the person to act as publisher for the system. Another aspect of their role would be to guide the potential uses of the Intranet by their section. This was a very attractive aspect of the role as they experienced increased involvement as was intended by the Research Group Project Manager responsible for developing the Intranet. As alluded to in the Research Group Project Manager's comment, a key aspect of their position was to act as the channel of communication between the sections and the Praxis project

team. They would be the bridge to allow knowledge transfer from the Intranet Praxis project team throughout the organisation, transferring skills and expanding the knowledge base. Getting users familiar with this process was not an instant happening.

> There are quite a lot of people who want to publish but haven't got the hang of the idea that they have a Content Co-ordinator in their section and end up contacting me directly. I then refer them to their Content Co-ordinator (Contract Web Developer).

While the value and benefits of the position were clearly understood, the cost implications were another issue. As a result of the low budget attributed to the project, the time required and cost incurred for the Content Co-ordinators to fulfil these pivotal roles could not be funded from the Praxis project. As a result, the departments would either need to accept that time and costs were being taken from their budget or the individual would need to perform the work in their own time. This would require the understanding and acceptance by the departments of the additional value from performing that role.

One important benefit that the Content Co-ordinators and the Content Publishers in each section would receive was training. Courses were organised by the Technical Strategy Group and were designed to create the skill base required for decentralised publication and effective use of the Intranet. These course costs were budgeted within the company spend and the cost of individual's training billed to each section. They covered Web technologies and the use of the designated publishing tool, Microsoft FrontPage. As a result of the popularity of Web technology at the time, these were popular courses with a number of people keen to attend them. However, access to the courses was limited. Employees involved in the Intranet project received priority.

Some of the courses were further restricted by the Technology Director to prioritise attendance by members of the Technology Department. The rationale was that this would benefit in the handling of initial expectation management. If business users attended the courses prior to the technical staff designated for support, they were more likely to push the technical staff to provide things they believed could be done from their perception of the technology derived from the courses. The wider and fuller implications of these requested actions on the BigBank systems are often not appreciated, thus creating development at an uncomfortable pace. The opportunity to attend these courses and learn useful skills was a big sell to employees but it also allowed the Praxis project team to establish standards at an early stage.

6.4.2 Standards

> People started to build sites before we had these courses for them to go on and receive a bit of indoctrination. As part of the course we've told them not to use frames. There has been a couple of instances of sub departments publishing their own sites and what they've been doing has been utterly different from Praxis. For instance, the use of frames which is something to which we're very allergic (Contract Web Developer).

Setting standards was further complicated by the loose approach favoured by the Praxis developers who did not have a formal set of guidelines.

> My instinct is to take an informal approach but it could be storing up trouble for later. There is no prescriptive style guide. Even though it doesn't exist, the way its been violated by people producing their own sites is quite telling. Perhaps we ought to publish it and set it in stone (Contract Web Developer).

Despite these issues, the Praxis project team's personal preference was to maintain this way of working.

> It is very informal and I hope it stays that way. I sort of prefer that informal way of working. It has been possible to maintain that way of working (Contract Web Developer).

The Praxis project team had selected Microsoft FrontPage as the designated publishing tool and there were a number of reasons for this choice. The actual developers preferred it due to their familiarity and experience with the software

> There are a number of HTML editors available each with their own peculiarities. I wanted one which we could use as a standard and I'd used FrontPage before and found it performed most of the things I needed it to do (Contract Web Developer).

There was a more economic reason, however, which the Research Group Project Manager explained.

> Due to the amount of software we get from Microsoft we could get this really cheap and it was compatible with the Microsoft platform. For decentralised publishing we needed to have a number of licences available in the company so it needed to be financially feasible. FrontPage allowed this (Research Group Project Manager).

The motivation behind the Content Co-ordinators was the need to create a decentralised publishing model. This would require an established and agreed set of standards across the system. In order to establish these practices a centralised system was initially implemented with the Intranet development team operating out of the Communication Group responsible for all content published. The Communication Group would then assist and train the Content Co-ordinator network and rollout the decentralised process with established standards across the organisation.

The initial centralised process required each section to submit their content in a compatible format to the communication section to create the HTML Intranet page. This was then placed on a Staging server. Staging servers operate as a replica of the live server but are not available to the main system as they are used to preview data

before a public release. A URL for the page on the Staging server was supplied to the section Content Co-ordinator who would view the page and approve it as presented or request amendments. Once the page had been approved on the Staging server it would be transferred overnight to the live server for public view on the Intranet.

6.4.3 Currency

New additions to the Intranet were publicised via global emails circulated at the start of each week advising of the new pages to the Praxis system. It was important that these pages stayed current maintaining the 'one true word' and avoiding the information obsolescence that had been experienced on the J-Drive.

In order to maintain the currency of the information, a life expectancy was placed on the document ranging from 3 months to 1 year maximum. When this period expired the document owner was contacted, or the relevant person from that section, and the page was reviewed, updated if necessary, then another life expectancy was assigned or the page was removed. This process was established with the Content Co-ordinators who would maintain it in their own sections as the decentralisation was enabled.

6.5 ORGANISATION STRUCTURE

The Praxis system went live but a place within the organisational structure was required from where the ongoing use could be monitored and the system maintained and further developed.

6.5.1 Communications Group

It was decided by the Technology Director that the Communications Group within Technology would be the most logical place for monitoring, maintenance and further development responsibility to sit. There were two principal reasons for this decision. The communicative nature of the Intranet made this a logical location for this responsibility to sit. Furthermore, this Group sat outside the rest of the Technology Department with a direct reporting line into the Technology Director via his Executive Assistant. This provided the Communications Group with important formal recognition and leverage. The team was placed within that section and the Research Group Project Manager passed over responsibility for the Intranet to the newly appointed Head of the Communications Group.

The new Communications Group Head had worked within the Technology Department but did not have much technical knowledge and his abilities related more to the communication/marketing aspect of the work. The Communications Group

Head was excited by his involvement in the Intranet project as he commented "It gives me the chance to get involved in something that I can use later and is seen as valuable".

Ownership of the Intranet gave the Communications Group another avenue for growth beyond their existing printed publications. The longest serving member of Communications Group commented. "Communications have grown a lot. When I came here two years ago there was just one person. Now the new Communications Group Head has taken over and there are four or five people".

The Communications Group had a strong compatibility with the Intranet which would serve as the key communication device of 'one true word' as that section had been responsible for raising awareness of technology within the bank. A primary method for communicating this was the Renaissance program.

> The rest of the bank don't think of technology as useful to them but I think that has changed in the last few years and that was the purpose of the Renaissance program — changing things about technology but also the way it is perceived. It started about 93-94 and it was a vision about changing the culture, the way they trained staff and making sure they developed staff in the way they should be. It was making sure that the rest of the bank saw technology as something which could add value to what they were doing. It showed the department as really professional and making sure that people who had contact with the bank developed the right kind of relationships and gave a good image and impression (Communications team member).

This role placed the Communications Group as a point of contact between the Technology Department and the rest of the BigBank.

6.5.2 Ownership Transfer

The ownership of the Intranet was transferred to the Communications Group after the site had been running for 3 months. They wanted to get an understanding of how it had been received and what improvements could be made. In order to expand the reaction to the Praxis Intranet system, they decided to undertake a survey of the departmental users of the system.

6.6 PRE-SURVEY INTERVIEWS

The process of conducting this survey of Intranet use would take a number of stages. The first preparatory stage was to interview a number of employees relevant to the system, principally the Content Co-ordinators although other employees were included.

From the issues raised in these interviews, a survey would be constructed that would be distributed to the Technology Department as a whole which was approximately 1200 people. The Communications Group asked the Research Group

if I would be available to conduct this survey and it was agreed that this would be possible. Through interviewing, I had access to a number of key persons within the BigBank on a one-to-one basis in order to gather the general view via the survey.

6.6.1 Factors affecting use of Praxis

The initial interviews yielded a number of factors which were felt to strongly limit the usability of the Praxis system. While the positive comments related to the user experience, there were two emerging complaints which were caused by technical constraints. The lack of colour options and the style was a common complaint which led into the overall presentation of the information. Specifically, the layout and style were deemed unsatisfactory. A key negative factor was also the speed of delivery, processing and access to the system. This was a major area of frustration.

Beyond the method of delivery, the actual value of the information in relation to the BigBank's activities was also subject to some reservations. Interviewees expressed the feeling that much of the information held on the system was ignored due to its perceived lack of relevance to day-to-day activities. If the system was to work and gain user 'buy-in', this relevance to users' activities was a key aspect that had to be addressed.

It was felt that much of the material held on the system was 'Brochureware', meaning it was simply 'Hello, I'm here' as opposed to 'this information will help you'. Many felt that the system lacked a 'killer application' an essential 'value add' not available in another medium. This confusion was baffling, when to interviewees there were a number of possibilities that would provide this added value. An online phone book was the option that many advocated. As one interviewee expressed it

> I don't know why we don't have the phone book online. Our current procedure is so inefficient. It costs us £30,000 to print a phone book each six months which by the time it reaches the first desk is out of date with people moving all the time. Everyone would use this because we need it all the time and it saves hundreds of calls to the switchboard to get the most up to date numbers (Technology Manager, London).

The proposal was that this book would be placed on the Intranet and be updated frequently keeping the information current and readily accessible while saving printing and production costs of the phone book. The Technology Manager from London explained that setting this feature up would be a simple task.

> I'm surprised it hasn't been done already. The operators have a system that holds all the information required. All they would need is a feed from that system to the Intranet which would not be a lot of work (Technology Manager, London).

Inclusion of the company floor plans was another feature that was believed likely to encourage frequent use. Another interviewee from Human Resources

expressed "People are always moving and finding out where they sit and what they look like is not straightforward. If this information was placed on the Intranet it would be easy to access and very useful". The information was readily available but would need someone to keep it up to date.

The need for an email facility was another area of concern that was highlighted. Some of the interviewees felt that it was such a fundamental facility that it should be included on the system.

One of the possibilities which was championed by the Human Resources department and supported by a number of other sections was online training. This related to two main aspects of training. One aspect was the booking of training online with course availability, information, etc. encompassed. The other option would be to run interactive training on the Intranet instead of providing the CD-ROMs presently in use for personal study. As a Human Resources representative explained

> We have a number of courses on CD-ROM but we always have the problem of the CDs being sent, then lost or they go out of date and we have to make new ones incurring more cost. If we could have them on the Intranet we wouldn't have to worry about the CDs and we could update the training when necessary (Human Resources Representative).

Discussion groups were also suggested as another key function for the Intranet. This was generally put forward by those with a greater knowledge of the Internet. Discussion groups are a common feature on the Internet and are used for encouraging regular visits from users who post messages on the group. BigBank employees felt this would be of benefit for the Intranet encouraging participation and interest from users. This would provide a benefit for the bank as these discussion boards would help generate suggestions and also offer a substitute for meetings on the subjects which would have the employees taking time out from other work.

With the Intranet being presented as providing an improved alternative to the J-Drive, it was not surprising that users would immediately compare and contrast the two. While it was agreed that the J-Drive was a poor system, there was still a pressure resting on Praxis to prove itself. Unfortunately, the promise of Praxis to maintain current information had been harmed by visibly out of date pages remaining on the system. This caused concern among users as it brought back memories of the J-drive and raised doubt about the effectiveness of the system overall. As one interviewee put it, "When you see something that is obviously inaccurate like that you wonder how reliable the rest of the system is" (BigBank Interviewee).

6.6.2 Web Technology Awareness

A rather ironic theme which was exposed during the interviews was the lack of knowledge and experience of web technologies which members of the Technology Department possessed. This situation had surprised the lead web developer for the Praxis project.

> It has been surprising to me how naive some of the IT professionals are about the web. I suppose even though they've been in the trade for years or decades they won't necessarily have experience of the Internet or have an Internet connection at home. Without an Intranet in their place of work why should they have experience of it? But I have been a bit surprised how naive some of them are. They're very highly qualified, very professional people but they know next to nothing about the Web and what's involved and that's the problem explaining what you can and can't do (Praxis Lead Web Developer).

Some of the more experienced staff members provided insight as to why there was this lack of knowledge which in part seemed to be due to the nature of their day job as one explained, "I spend my whole day at work staring at a computer screen, the last thing I feel like doing in my spare time is doing the same thing" (Technology Department Member).

Their experience of technology also meant that they did not view the Internet with the same wonder that others did. This view was expressed by one employee from the IT Department team who had worked in IT for 20 years. "I've seen all this stuff before but with different names. People always think it will solve everything until they try to do something with it" (IT Department Employee).

In contrast it was the younger staff that possessed greater enthusiasm and knowledge of the technology involved and the potential it allowed. Their exposure had usually come at college or university. Also many of their peers from these arenas were involved in web technologies.

Without this broader knowledge and insight into different applications that the technology had provided in other arenas, the users could only judge its scope by what they had witnessed without appreciating the wider future possibilities that lay before them.

What they saw was a system that suffered from a lack of dynamism with limited interactivity. As discussed before, the delay in publishing time meant its applicability to a number of business functions was restricted. In the light of these drawbacks and due to an ignorance of the possibilities the web presented, some users condemned the system. Those parties that understood the possibilities and had access to the requisite skill and knowledge embarked on their own projects. This was

particularly true of operations in London.

6.6.3 Informal Communications

Experience of Web technologies in other contexts was not the only means by which BigBank employees could gain an understanding of the potential of the system. The proximity of a section to the Communications Group socially and geographically had a bearing on the perception of the system. Departments with closer physical proximity to the Communications Group had a greater understanding of what was going on in the system as they would more regularly come into contact with members of the section who would relay information on developments and plans for the system. One of the opportunities for an additional forum for communication was the location of the drinks vending machine!

Within BigBank, a number of vending machines are available with approximately one on each floor. People will visit these regularly to get drinks either for themselves or members of their section. One of these machines is located next to the Communication Group so everyone on that floor visits it. This provided frequent contact with the Communications Group as people would stop and chat. A number of interviewees stated, "I often speak to the Communications Group Head when I go for a coffee" (Human Resources Representative). Another employee provided a term for this communication system. "There's a lot of 'coffee chat' that goes on in the bank. It's the best way to find things out" (Human Resources Interviewee).

Employees' social links with the section were also an effective route of communication about Praxis. Some of the sections while not having the geographical proximity had close links with members of staff in communications. As a member of Human Resources in London admitted, "The Communications Group Head and I get on really well and when he is down here (London) we normally meet up for a drink so I get to find out everything that's going on then" (Human Resources Employee, London).

These informal routes of communication whilst aided by geography and existing social relationships were often driven by political motives. These motives were to achieve 'buy-in' from certain influential parties within the bank who were termed by the system development team as 'friends of Praxis'. This group was privy to new information but also had input into shaping the system with their plans for projects receiving assistance first. One example of these concerns was the lack of dynamism of the site. The resolution proposed by Praxis Lead Web developer was to use a technology called active server pages (hereafter referred to as ASP). ASP is a programming language which allows certain functions and interactions to be

performed within the web pages. By using ASP, it would be possible to provide a range of applications, such as the room booking system, which could link to and display information from other data sources. In order to do this, a developer knowledgeable in this language was required and the Communications Group managed to find and recruit such a developer who would work on projects for the system. Only some of the friends of Praxis were initially made aware of the new resource and presented with the opportunity to propose projects for their sections. Consequently, one of the first projects progressed was a room booking system for administration sought by one of the 'friends'. The responsiveness of the Communications Group and usefulness of the new functionality helped ingrain a positive future perspective of the system.

This positive future view had to be tempered by realism and some practical considerations. As a result, this information was best shared with this smaller group who could then support and advocate the development of the system. The need for achievable expectations to be set around the system was to ensure that unrealistic deliverables were not requested and subsequently avoided causing people to lose interest and faith in the system. This necessitated getting buy-in and maintaining completely realistic expectations of what the system could deliver. This meant selecting and working with a restricted group of allies to build proven successes before gradually moving to meet the needs of the wider group as resources and capabilities allowed. With a limited number of developers only a limited number of initiatives could be undertaken. It was important, therefore, to focus available resources on the ones that could be delivered fastest. The 'friends of Praxis' owned these 'faster' initiatives.

6.6.4 Edinburgh / London Divide

For Edinburgh to establish itself as the base for the Intranet development, it had to gain the buy-in of business owners in London as well. Therefore, the Research Group Project Manager had to go and sell the system to the London business units. There was a perception that the Research Group Project Manager was guilty of overselling the system in some instances which caused difficulties for the London technical teams supporting these business units

> A number of trips have been made by the previous Intranet manager 'selling' the system and technology to the business down here (London) without any contact with us. This causes a big problem because we're the ones who have to deal with these raised expectations and supply the systems. The business doesn't care that we have to make sure it's compatible with existing systems and can be supported. If we don't provide it then they're educated people and will go and do it themselves but come back and dump it in our lap when the problems start (London Technology Manager).

The need identified by the Praxis project team for Edinburgh to establish ownership was an effort to alter perceptions about the Edinburgh technical capabilities and those of London. London, in fact, possessed a skill-set more suited to these technologies due to traditionally handling client-server technologies while Edinburgh handled the mainframe. In order to counteract this skills imbalance, the training course was pushed to cater initially for the Edinburgh sections.

While the ability to learn these new skills was an incentive, the fact remained that the work was not part of the Content Co-ordinators' specified jobs within their respective departments (HR, IT Services, etc). Their day-to-day tasks meant that they had limited time to devote to experimenting with Praxis. Through the initial interviews, a number of themes developed around the system. These revolved around the manner in which the Praxis project team related to users and content providers for the system and their perceived attitudes.

A number of interviewees indicated that their section's presence online was viewed as being a direct indicator of their interest in the system. Those with little information online were viewed as being uninterested and were consequently given less attention and assistance. The interviewees used a common term to describe this situation 'publish or be damned'. This captured the feeling that they had about their treatment if they had limited content online and underlined the importance of visibility. If you were not seen to be doing something you were perceived as doing nothing and therefore uninterested in the system. This was often not the true situation.

The informal communication network acted to dispel this perception in some cases, so those with good personal relations with the Communications Group were able to make their genuine interest apparent and appreciated. The reverse was true for those with tenuous communication links with the proponents of the system but strong links to other sections who had limited presence on the system. These relationships served to reinforce their perceived negative view of the system through exposure to others with similar experiences.

As a result, the people who felt unsupported tended to have common geographical and sociological characteristics. The geographical factor was that they were located in London. The sociological factor was that they belonged to sections with certain capabilities and histories which were linked to the historical roles of Edinburgh and London. As a London Technology Manager explained:

> It is surprising that Edinburgh is doing work of this type. Traditionally it has been London who dealt with Client-Server technologies whilst Edinburgh handled the mainframe systems. Now they're moving into client-server (Technology Manager, London).

This move to Praxis Intranet being centred in Edinburgh was contrary to the North-South divide that existed between the sections.

> There's a definite North-South divide. There is a North-South divide in terms of what the business does with retail in the North and corporate down here that has led to a difference in systems. We're much more client server versus mainframes (Technology Manager, London).

This created two issues. Greater competency for web technologies existed in London. Therefore, Edinburgh taking this role caused friction. On the issue of competency a London Technology Manager stated.

> There's certainly more people in London with the appropriate skill set for this type of work. The Internet is more PC based so it's logical that it would be handled in London as we deal in client server tech (Technology Manager, London).

The fact that the Praxis team had focused their communications on the business units in London as opposed to the Technology ones also increased the friction.

> We've not really had the same presentations the business had. The Praxis team sold them on how they could use it but didn't really do that with us. Because we're Technology they maybe assumed we knew but maybe not (Technology Manager, London).

These presentations to the business units had raised business expectations to high levels.

> Most of the expectation has been created by the Research Group Project Manager going round and selling to the business. There is huge demand from company business to be involved....To say expectations are strong would be an underestimate. They're all rushing to be on the system (Technology Manager, London).

This meant that the Technology sections had to meet demands which the Edinburgh team did not have the resources to support. London had to resource themselves and initiate their own methods to tackle the demand.

> We are getting asked to do stuff we're not completely geared up to do. For example, the need for interactivity and use of ASP we had to bring in a contractor who knew about this area and we've had him working and passing these skills onto our guys (Technology Manager, London).

These initiatives remained outside Praxis which meant that resources were split often duplicating work. Instead of pooling the resource and learning from each other, a lot of the London activity was not appreciated as evidenced by the Communications Manager stating, "There's no real web activity in London. This (Edinburgh) is the centre for it all" (Communications Manager).

The lack of effective methods to communicate the work being done in different regions may well have been due to the lack of adequate funding for the project. On discussing the budget in departments for the Praxis work, one manager

remarked, "It's not that it's being cut. It's just not there. There isn't a budget to cut!" (Department Manager). When discussing why this was a major issue, another explained:

> To justify my time on this, we have to show what the business is getting out of it and this is a technology initiative. It would be very difficult for me to justify spending too much of my time on this (Department Manager).

6.7 PROGRESSING IMPLEMENTION

Much of the communication and work was reliant on extra-curricular interest and informal channels as previously outlined. These informal communication channels, discussed earlier, are the 'coffee chat' practices linked to geographical location and the 'friends of Praxis' network. These informal methods extended into the process of getting political approval for the project, which was evidenced by the relations among the original Research Group Project Manager, the Executive Assistant to the Technology Director and the Communications Group Head.

The Research Group Project Manager and the Technology Director's Executive Assistant had a good social relationship and had engineered approval for the project. It had seemed logical that the Research Group Project Manager would then become manager of the system. However, when the post with responsibility for the Praxis Intranet was created, it was not seen as desirable by the Research Group Project Manager. A colleague of the Research Group Project Manager explained.

> If the Communications Group Head position had been senior enough, the Research Group Project Manager would have taken it. It wasn't and there was an opportunity to work on the company rollout in corporate communications so she took that. Then they needed someone to run the technology Intranet and they recruited the Communications Group Head to report to the Executive Assistant (Project Manager's Colleague).

The Communications Group Head had limited relevant technology knowledge so constantly had to refer to the original Research Group Project Manager, who, via her relationship with the Technology Director's Executive Assistant held control over the system. Close ties were evident from briefings held between the Research Group Project Manager and Communications Group Head prior to any important meetings or decisions.

6.7.1 Survey Issued

The initial interviews were used to identify the key areas for the survey to contain. These were drafted into a questionnaire. The Market Research department was consulted for advice on how best to carry out the survey. They advised that a 50% response from the target group was very good but usually within the bank it was 30%. This level of response still required incentives usually with a money prize or

store vouchers. It was decided that the Praxis survey would offer a prize of a meal at a restaurant. Also on submission, thank you emails were advised to inform the respondents that their information had been received and explain to them what would happen with the results.

An important consideration was about the best method of delivery for the survey. Whilst paper was the most commonly used format, this was rejected by the Praxis team as they argued it would be more difficult to collect and compile plus there was less likelihood of a response from subjects. Their proposal was for a response via Praxis with a global email advising users of the location of the survey on the site. An issue with this method was raised regarding ease of access to the survey by technology staff. Through the interviews, it was known that some people faced extreme difficulty in accessing the system so the survey being on Praxis meant it was very possible that they would be unable to respond. As a result, those needing to raise issues most would not be heard. This was not considered important enough to change the delivery method. This decision was the first indication of the possibility of a hidden agenda existing around the survey.

The survey was subjected to a number of iterations around the core Praxis team and management. Bearing in mind it was supposed to be an impartial academic survey, a number of alterations were made which would bias the results and affect its validity. The team felt it unnecessary to get background information on each respondent even though this would provide an understanding of the audience and perhaps reasons for certain themes in the results. It was also felt that the questionnaire should have a "friendly, informal wording style" to engender a positive reaction to the system, clearly biasing responses. This was further compounded by the desire that the balance of positive and negative wording used should be considered with the leaning towards the former "to create a good impression". The survey was issued with these changes made to the Technology section.

6.7.2 Survey Results

The results of the survey echoed and supported the themes uncovered during the one-to-one interviews. People were using the sections which required little dynamic interaction such as Human Resources but were keen to see more dynamic interactions. The uses they saw for this were again similar with support for ideas around the phone book and room booking.

The technical issues such as speed and use alongside other applications also appeared repeatedly. The issue around the colour scheme being inconsistent with the standard BigBank presentation theme was also highlighted.

The Praxis team were satisfied with these results as it supported the direction in which they wished to develop the system. The dynamic applications were also projects that were underway at that time. It also provided support for the Intranet to aid the launch of the Corporate Intranet, entitled Orbit. Orbit would feature the standard bank colour scheme. In launching this application to Corporate, the bank would use some of the same team to deliver this, namely the Research Group Project Manager, Communications Group Head, Contract Web Developer and myself. They would want to combine the benefits of the Praxis system with some added functionality around distance learning which forms the subject of the Training and Communications Network case study covered in Chapter 7.

7. TRAINING and COMMUNICATIONS NETWORK

7. TRAINING and COMMUNICATIONS NETWORK

7.1 PROJECT CONCEPTION

Throughout the projects, we see the desire for personal advancement as a key motivation for individuals' interest in innovation. Individuals view a potential development gauging the likelihood of a successful implementation and the benefit to them personally of being associated with its introduction. The ongoing success following implementation means sustained and greater benefit for those involved in the development. The key to ensuring personal advancement, therefore, is to go with the 'smart bets', the initiatives that have been tested and worked well and still have further potential. It is the ability to identify these opportunities that separate the politically astute and successful from the rank and file. This ability was something that the Corporate Communications Executive believed he possessed and caused his colleagues to describe him as "an extremely political animal". His position within the business section of the bank allowed him leverage and his location in Corporate Affairs allowed him to be involved in high profile projects such as the BigBankTV network. While BigBankTV does have limited appeal in terms of subject matter (new mortgage packages and financial regulations), it was an important communications device for the bank. BigBankTV had a high profile with BigBank directors and provided favourable access to their ears.

The Corporate Communications Executive had an interest in new technology because he believed that it could provide eye-catching projects. His interest in this developing area combined with his position within BigBank made him a useful ally for anyone with aspirations within the Technology division. A benefit of new technology came from the access it provided to senior members of the business units allowing valuable exposure and potential support for new initiatives. This was a benefit which the Research Group Project Manager saw as important in gaining exposure for new initiatives in which she was involved within the Technology Department.

Following the success of the Technology Intranet (Praxis), it was decided that this framework and infrastructure would act as a model for a wider Corporate Intranet. The proposed Corporate Intranet would act as an 'umbrella system', enveloping all the isolated Intranets within BigBank (such as the Training and Communications Network (TCN) system) and providing a standard set of guidelines and procedures. While the

Praxis system had provided a useful practical example of the benefits an Intranet could offer within the BigBank framework, a separate business case had to be made for a Corporate Intranet System. This case would need to provide proven financial motivation for proceeding with the project, noting and justifying the benefits it would provide. The ownership of the project and the instigators would be the Corporate Affairs Department responsible for BigBank communications and as such, managers of the existing BigBankTV system. The Corporate Communications Executive, with the Research Group Project Manager's assistance, had recognised the Intranet's success within the smaller arena of Technology Division and felt that it was a sound bet for a larger application. Of course larger applications require more money and the BigBank senior management would need to see evidence that the wider Corporate Intranet justified the investment.

In building a proposal for a Corporate Intranet, the Communications and Technology Departments were faced with a number of problems as a Corporate Systems Research Group project member explained: "Justification for Intranet systems is usually a soft case and this has to be sold to hard-nosed bankers. The cost benefits of the system are often long-term and difficult to quantify".

The principal benefits of Intranets are the existence of a central store of information that saves time when searching for information. Identifying the amount of time saved and expressing that in financial terms or improved productivity are very subjective. This was hardly likely to prove convincing to bankers who relate to hard facts and figures. There was a concern that lack of hard quantifiable justification data would adversely affect the funding of the project and the priority it would receive. Consequently, members of the Corporate Affairs Department, principally the Corporate Communications Executive and the Research Group Project Manager (who had been seconded from Technology) sought to provide additional features which could more easily be translated into more tangible financial benefits.

It was at this point that the Corporate Communications Executive's capability for lateral thinking provided an answer. He had attended a demonstration of the Networked Multimedia project organised by the Technology Research Group and Edinburgh University (described in Chapter 5.7) which had combined Web technology with the broadcasting of BigBankTV programmes over the bank network. The Corporate Communications Executive contacted members of the Research Group and advised them that this system was now 'mission critical' without fully explaining the reasons.

He, along with others at Corporate Affairs, had decided that an Intranet used by Technology had the potential to provide benefits to the wider organisation and would be a system of considerable value. The key issue would be how best to sell it into the corporate organisation which would be primarily focused on hard financial benefits. This was where the combination of the Intranet with Multimedia broadcast provided considerable value. As the Corporate Communications Executive explained:

> Original benefits were removing the cost of printing the phone book, calls to switchboard, directory enquiries calls. With the added combination of training, costs would be saved regarding costs of transport and accommodation incurred sending people for training plus the time lost through them being away [1](Corporate Affairs Executive).

The shape of future banking activities was to be strongly influenced by the effect upon the financial community of European integration and the arrival of the Euro. As a result of these Europe-related activities, BigBank would be required to introduce widespread staff training, another task for Corporate Affairs, which they were keen to make as cost effective as possible. But traditional training programmes are an extremely costly investment given that the company must pay for the instructors, the venues for the training and the transportation and accommodation for the trainee. In addition, BigBank loses the services of that employee for the period of the training course. Corporate Affairs envisioned a way of greatly minimising or in some cases eliminating these costs and at the same time strengthening the case for the Corporate Intranet.

Distance learning was hardly a new concept although its use had not been relatively widely adopted. However, the advent of the multimedia age created new possibilities. As discussed in Chapter 5, these possibilities revolved around the transmission of multimedia training over the network and this research had proved that this implementing such a programme was feasible. The Corporate Communications Executive had seen it combined with web technologies in the trial as well as used interactively with other sites. If this could be done with the Corporate Intranet, they could solve two problems simultaneously.

Originally it was suggested to carry everything over the network but due to the sizable investment that had been made in the BigBankTV network, it was decided to incorporate this into the new system. By doing so, the system became more cost effective as well as more politically palatable to the Board.

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[1] At this point, BigBank was operating under the assumption that the UK would join the Euro in the initial stage.

> When we first looked at TCN we looked at NetShow Theatre as well as NetMeeting. We came back to the business and said if you want it in its current state as it was being demoed at the University then it will probably cost an extra £100,000 with servers and management etc. The business said "No, we would rather maximise our investment in satellite TV". Undoubtedly at some point in the future we'll look at putting it all on the network as satellite time is so expensive (Research Group Project Manager).

With the broad business aims established, a feasibility study of the proposed solution was still required. The feasibility study itself required a budget to enable it to be undertaken but given the desired level of interest in the project, this budget was approved.

7.2 FEASIBILITY STUDY

The feasibility study was initiated to evaluate the system's stated aim which was detailed as follows:

> Corporate Affairs Dept. plan to revolutionise the bank's Training & Communication Strategy through an exciting business vision known as the Training & Communication Network (TCN). The TCN comprises three main elements: -
> - Interactivity with BigBankTV in branches.
> - Access to bank documentation (Intranet) from anywhere.
> - CD-based multimedia training in branches and collation of trainee records.
>
> In branches this service will be delivered via one or more (depending on the size of the branch) PCs. These PCs will be powerful multimedia PCs which run a web browser and have a 'network' connection (yet to be fully defined). The TCN will support Intranet access & interactive training and will provide the hardware, software and network framework for running and managing of (CD-Based) multimedia training & collecting trainee data via the web browser. All these facilities will be accessed and managed via the web browser on the PC (Internal BigBank Report: Business System Overview).

The feasibility study itself had three main deliverables: Estimated project cost, technological and organisational requirements. Once completed, the results would then be presented to the BigBank Board for approval. In order to complete the study, a small team was created.

The Research Group Project Manager recruited a contractor currently employed by the BigBank and myself to form a team to conduct the feasibility study in the Technology Department. The use of student input was prudent as it would not require funding and would also add necessary relevant experience and skills. An added benefit was that I had worked on the Networked Multimedia project (Section 6) from which the ideas for the current project were being taken. This team would work on the Training and Communications Network aspect of the system while work on the Corporate

Intranet remained within Corporate Affairs who had also recruited staff from the Praxis project (Chapter 6).

The Contractor had a number of years of commercial experience and had been employed by the bank for another project which required use of an Intranet system for stress management. He would provide the technical expertise and also possessed the personality to act as a team leader when the project was approved.

A major factor accompanying the technical feasibility study was the organisational feasibility. Within an organisation as large as BigBank it was important that communication was organised and actions coordinated.

> There are three components to any project within the bank, the business and technology which has two sections IT Services and System Development. SYS Development people manage the relationship, getting the requirements and designing the system while ITS handle the infrastructure for that technology. In this project there has been a very open dialogue between these sections (Research Group Project Manager).

An open dialogue between the sections was initiated at this early stage. The Research Group Project Manager arranged meetings with the members from the relevant parties and created a network within the company that would support the project. A major selling point to those involved was the opportunity to participate in a potentially high profile project which would advance their individual positions. By securing this early involvement, the Research Group Project Manager sought to circumvent anyone raising problematic issues at a later stage and arguing against the project. This 'buy-in' was crucial. This tactic proved to be successful allowing a community of interest to be created around the initiative, driving it through the stages of approval.

7.2.1 Technical Requirements

The existing technological environment into which the system would be integrated included a number of technological constraints restricting the innovation. These constraints were further underpinned by financial and political considerations. The technological legacy raised two principal areas of consideration for the project leaders. Primarily due to the fundamental importance of the content for the system, in this case the training material itself, it was important to use a medium allowing uncomplicated migration from the previous system presentation materials to the new approach. Trainers, up until that point, had worked in a classroom environment operating lecture style delivery with slides in PowerPoint format. It was possible to use this medium directly within the evolving system but it was not the most effective format.

HTML pages were preferable as they allowed a greater degree of flexibility and an easier load on the network. The team had a better understanding of the possibilities and constraints created by the different formats through the earlier work performed in the NMM project. This gave an understanding of the effect of different frame rates and users' reaction to information delivered in a video format.

Following discussions with the Head Trainer, it was decided that opting for the PowerPoint medium would be the most pragmatic solution at that point. It was reasoned that because the new system would be a large 'culture shock' for the present trainers, it was important to ease their entry into the new system as much as possible. The use of the already familiar PowerPoint system would assist an easier adjustment as well as eliminating a need for immediate retraining which would add to forecast cost. This compromise would also provide the system with immediately usable materials and facilitate the support of the trainers which was vital.

Method of transmission was an area requiring careful consideration. Existing technical research had established that it would be possible to use the BigBank Network to broadcast multimedia loads of the type intended. To pursue this method would, however, "tread on the toes", as one employee put it, of the system used to broadcast BigBankTV. The BigBankTV network used a leased, very expensive, satellite link to broadcast to TV sets in each branch from a studio in the Corporate Headquarters run by Corporate Affairs. The project had been very costly (in the region of £3 million) and was widely regarded within BigBank as an 'ego trip' on the part of the Board as it was technologically short term with no perceivable development advances foreseen. Corporate Affairs realised if they could use this new project to combine with the BigBankTV, it would make the proposal especially appealing to the BigBank Board by making the system appear more cost effective. As a result it was decided that the BigBankTV network and branch TVs would be used as the medium to broadcast the training classes using the studio. As with PowerPoint, this caused restrictions on the TCN system. Originally the team had planned to use the NetShow package to build and broadcast the multimedia loads which would allow the whole system to be conveniently packaged within the PC environment as well as allowing for future technical advances. This proposed solution involving BigBankTV required the incorporation of the TV into the set up causing the writer to have to monitor two outputs and allowing little scope for future development. While the system was made technically weaker by this amendment, the immediate economic justification case for it was conversely made much stronger.

7.2.2 External Parties

The TCN project team would need to deal with parties external to BigBank in addition to relevant parties within the organisation in order for the project to succeed. These external actors, British Telecom and JNM are identified and their roles in the process discussed as follows:

British Telecom (BT)

The BigBank's relations with BT with respect to this specific project provided an excellent opportunity to examine the changing role of the Technology Department and the complicated role it now occupies. BT enjoys a significant relationship with BigBank due to the latter's size and extensive use of facilities including the leasing of the satellite link for BigBankTV. This relationship is, as bank employees explained, "complicated and problematic". The official channel of communication between the organisations is handled via an officially designated 'Relationship Manager' as is common practice within BigBank. This position is internally considered to be a very 'hot' position with 'revolving door' characteristics as a number of people have held the position in recent times only to be dismissed in a short period of time. This is a situation also experienced by the corresponding role within BT itself. According to the bank the principal cause of the relationship problems is the size of BT and the inadequacy of the communication channels within that corporation. As the Research Group Project Manager explains:

> With BT their right hand doesn't know what the left hand is doing, too many people in the account team not speaking to each other. Our Relationship Manager within the bank was very much in their pocket. They didn't take time to see where they could add value (Research Group Project Manager).

The official channels of communication between BigBank and BT are not always observed which in the case of this project led to very serious conflict of interest and competition. During the feasibility study stage of the project, interested parties in BT had become aware of the planned project. The consultancy wing of BT decided it was a project for which they should tender and approached BigBank. In approaching BigBank they went directly to the part of the organisation with the money and the decision making power, by-passing the formal channels and the Technology Department. BT approached the Corporate Affairs Department and requested a meeting with the stipulation that no member of the Technology Department should be present. Adding salt to Technology Department's wound, Corporate Affairs agreed to the

meeting. Certain members of the Technology Department, while angered, understood this to be a shrewd political move stating:

> We've only got the Corporate Communications Executive's word that they didn't want anyone from Technology at that meeting. This gives Corporate Affairs other options and more leverage. He's a very political animal and likes to keep his cards close to his chest (Employee, Technology Division).

By agreeing to the meeting, the Corporate Affairs Department underlined their position of strength reminding the Technology Department that they were not the guaranteed provider and would be required to tender along with the potential external providers. Ironically, Technology Department felt that they were actually disadvantaged in this situation by being part of the same organisation as the Business section had a high level of visibility of their constraints, structure and resources.

> These other companies can come in and claim this, that and the next thing about their skills and resources and no one will be any the wiser. They could say we've got this many developers. We've got experience with this in order to get the contract. Then once they've got it, they go out and recruit the people. They'll probably recruit contractors we have at the bank that we would have used on the project. Corporate Affairs know about our resources and that we don't have those skills so we couldn't bluff in the same way (Research Group Project Manager).

The TCN team also felt the Technology Department's structure and limited research activity disadvantaged them.

> Some of these groups already have developers with them waiting for projects or working on similar areas so they can react faster to the initial order. For me I have to go out draw up a budget, have it approved, get the resources, find suitable contractors and recruit them. It can take me three to six weeks just to get the resources together (Research Group Project Manager).

In order to counteract this perceived disadvantage, the TCN team attempted to play to their strengths and enlist allies. Their strategy consisted of two key tactics. The Research Group Project Manager would attempt to utilise her close relations with the Corporate Communications Executive, contacting him prior to the BT meeting and attempting to second guess their pitch by advising him on what they would say in the hope of discrediting their claims and appear more knowledgeable in the process.

At the same time TCN project team would use their inside knowledge of the project so far and press on with its development in order to make it more time consuming to bring in someone else who would need to retrace the progress made. A key element in this would be enlisting the JNM group whose technology Corporate Affairs were keen to use within the system. While the TCN feasibility team agreed

internally that the system would be more successfully developed in-house without JNM's involvement, it was also acknowledged that to use them might prove beneficial both for the image of the project and politically.

JNM

JNM were one of the key suppliers for the TCN project although their contribution was probably more political than technical. JNM are a small software house based in the south of England. Their principal product was a presentation system that had the capability to register and poll responses followed by an immediate graphical representation of the results. This system had been widely used at various conferences throughout the UK and they were reputedly the leaders in this field. Some Technology Department staff noted that there was no apparent competition in this field and this must reflect on the significance of their claim. It was through their conference work that they had come into contact with representatives from Corporate Affairs who were impressed by the slick graphical representations and interactivity. When Corporate Affairs decided to use the Intranet for training, they identified JNM's offering as an avenue well worth incorporating.

As the team to conduct the feasibility study was assembled, a meeting was arranged with representatives from JNM and BigBank to discuss their possible involvement and provide a demonstration of the JNM system. Attending from BigBank were the Corporate Communications Executive, representatives from the TCN project team and the Learning Technologies Manager. The JNM representation consisted of their Technical Director and Managing Director who had recently returned from the United States. The MD advised us that they had prospective sales valuing £4M in the US as the distance learning market was large and growing rapidly. Through this lens, he was keen to demonstrate the scalability of their product. BigBank, he explained, would be an ideal project for them. At this stage of the meeting, it became apparent that JNM were not quite as accomplished as the Technology staff had been led to believe.

JNM began by explaining their company structure and how their system operated. They possessed a small technical team of three people, one of whom was almost wholly responsible for coding the entire system. As the TCN Project Lead Programmer would explain later, this raised immediate concerns. JNM being reliant on that one person to provide effective technical support for the system was a significant risk. If that person were to leave JNM, an extremely likely possibility due to the market for IT contractors and the money involved, BigBank would be left with a system that

they did not know how to operate, leaving the bank without any support for a system in a £3M project.

JNM moved on to discuss the technical operation in which they further displayed naivety over the prevailing technical environments within corporate computing. This was primarily a problem within the operation of the database that managed responses. JNM had constructed this database using Microsoft Access which was adequate in an isolated conference capacity in which it had been used but not within a corporate situation. Oracle databases had long been considered as the standard and BigBank utilised Oracle for corporate solutions as did most other large corporations. An Access database would not suffice for the volume throughput and operational dependability required and thus would need to be reengineered into Oracle. It was questioned whether JNM would have the skills and expertise to successfully complete this redesign.

The Learning Technologies Manager present identified the use of PowerPoint slides to deliver the system information as an advantage as this was the standard format used in the training packages within the bank at present. PowerPoint presentations were consistent with present classroom training where slides delivered the information and questions were posed by the trainer.

The JNM system was reliant upon session attendees' use of specifically designed handsets constructed by JNM. These units would provide the responses for the Access database. Selling these handsets was the key profit source for JNM, a fact which again exposed their naivety of large organisations. The central PowerPoint and Access information display and collation were sold as a loss leader by JNM to entice customers to purchase the system. In order to use the system, JNM believed that the company would then have to purchase a handset for each user and as such these were priced at a premium. BigBank felt this approach was flawed for their organisation. Technologically and financially the widespread adoption of the handset would be an unwise move.

The use of the handset would 'lock them into' the use of JNM technology complicating any future developments as it would be a technological dead-end. In addition, the handsets would require limiting the range of responses of users thus negatively impacting the effectiveness of the training. Financially, it would prove disproportionately expensive to purchase these handsets given the hundreds of sites that would need to be included. This handsets requirement would seriously affect the budget of the project which at that stage was an important consideration as it still needed to gain approval. In addition, BigBank were only really interested in the central system and

the handsets were, therefore, extraneous. The central system would also require adjustment in order to comply with the existing system within BigBank. On balance, the TCN project team believed that developers within the bank could replicate the system being offered by JNM. This internally developed approach would also allow for a better support situation than that offered by JNM.

Yet, technical considerations had to be balanced with the political situation and Corporate Affairs were keen to involve JNM. By involving them, they could present a pre-existing, in-use system that could be visually demonstrated. Relative to suggesting the alternative of building a custom system, the JNM solution would garnish more confidence of project delivery by the decision makers. The TCN project team's reservations to JNM were further reduced as their desire to take the overall project on themselves was increasing. This increasing desire was heightened by BT's threatened involvement in the project as detailed previously causing the TCN team to adjust their strategy. The TCN team took measures to enlist JNM and strengthen their political situation in relation to the project whilst recognising that JNM were actually gaining more from the arrangement. This much was admitted later by the project leader:

> I think we could have done it all ourselves. We did more for them than they did for us. We've changed their whole strategy. They now have a full web strategy which they never would have had without our involvement (TCN Project Leader).

The JNM team did benefit from their involvement with BigBank but their application was reasonably robust to begin with. This was demonstrated during the technical meeting in which the Training Technologies Manager drilled the team with various scenarios and how the system would deal with them. These got progressively harder with the Training Technologies Manager stopping short of how the site would deal with nuclear attack.

While the JNM group gained technically from working with BigBank, the TCN project team gained credibility from working with a group that the corporate body viewed as having domain expertise. By aligning JNM with them, the TCN project team were able to fend off the challenge from BT. Firstly it created a perceptually stronger solution but was also done to demonstrate that greater progress was already underway. While BT was still explaining to the Corporate Communications group what they could do, the TCN project team was working onsite with JNM moving along the project roadmap, a fact the Research Group Project Manager communicated to the Corporate Communications Executive. In light of the enhanced solution and progress made the

TCN project team / JNM coalition was a more attractive option for the Corporate sponsors and BT's offer was declined.

7.2.3 Internal Parties

Learning Technologies Department

The Learning Technologies Department was an anomaly within the bank's organisational structure. At the time that Learning Technologies was established, the Technology Department had neither capability in producing training materials nor in Web technologies. Learning Technologies being chartered with producing Multimedia CDs, was, therefore, a stopgap solution and given the disparate skill sets, grew autonomously from the Technology Department.

Learning Technologies Department's primary purpose was to produce and distribute multimedia training CDs which would be operated on stand-alone client workstations in the branches. At this point, the capability to perform this function did not exist within the Technology Department and a respected individual within the multimedia training industry was brought in to head up the newly formed section. Learning Technologies Department was located within the Human Resources section of the bank but carried out a technology function without any formal links to the Technology Department. Links with Technology were deemed unnecessary since the Technology Department had no dealings or expertise in the area as Web technologies had still not been explored at that stage. This lack of contact did, however, mean that both sections developed along technologically different avenues or as one Technology Division representative explained: "A lot of the stuff they've done is incompatible with our infrastructure. At the time that didn't matter as a lot of what they did was stand-alone which we didn't look after so it worked quite well".

As multimedia technology moved towards networked systems incorporating web technologies capable of interactive training, it was inevitable that the interests of these sections would overlap and conflict. Forewarnings of this situation had occurred during research into Networked Multimedia carried out by the Research Group, results of which had fed into the TCN project. This work, discussed in Chapter 5, indicated the overlap in interests and conflict in standards. As noted by a member of the Technology Division staff:

> Now its gone into enterprise level corporate networked computing and what we've seen is the stuff they've done. The standards they are using are inappropriate plus they've had to

> make the shift from multimedia CD-ROMs to web development which takes away their uniqueness (Technology Department Staff Member).

With technological advancement and the convergence of these hitherto separate media, a situation was created in which a conflict arose between the two sections. This conflict resolution would have a profound effect upon the development of the TCN system which required the collaboration of both Human Resources and Technology Departments. A key factor in the resolution of this situation was the appointment of a new Head of Training within Human Resources. Keen to make his mark in the organisation, the Head of Training saw the TCN project as a fast and effective way of making an impact.

The Corporate Communications Executive and Research Group Project Manager quickly allied themselves with the Head of Training and achieved his 'buy-in' to their ideas for the project. This provided them with the lead role for the development of the project, a point not lost on the key people within Learning Technologies who could foresee the dissolution of their section. The Research Group NMM Project Manager commented "Their head has left and their head techie is leaving so the department will cease to exist with the technical skills catered for by Technology providing standards and framework". This marked the end for the Learning Technologies Department with its functions being relocated to other sections, as the Research Group Project Manager noted: "Learning Technologies has been decimated into near non-existence". This occurred over an 18 month period.

This result surprised no-one as the Learning Technologies Department's 'fiefdom' of knowledge had been usurped. Their members continued to work on the project and provided guidance on the look and feel aspects of the system which remained relevant and were not catered for by the Technology Department.

Trainers

Due to the importance of content within the TCN, the involvement of the Trainers was vital. In organisational terms, the Trainers were located within the Human Resource section as was the Learning Technologies Department. As the project gained approval the Trainers were consulted to provide a more direct input into the system. It was also important to allay their fears on the effect that it would have on their jobs.

> At first they were a bit frightened and didn't understand it. You're moving people who having spent 20 years of their working lives teaching to people in classrooms then throwing

all this technology at them and saying this is how we want you to do it now (Research Group Project Manager).

The TCN project team would need to involve the Learning Technologies Department as they were the owners of the existing training content and had expertise in designing learning systems in other technologies. In order to enlist the Learning Technologies Department full support, the TCN project team sought to involve them in the process and design but also needed to moderate this process. In order to achieve this they created close working ties with a Senior Trainer who acted as the chief point of contact and managed communication between the two groups.

> Some of them were a bit scared at first but we had the Senior Trainer who was the Queen Bee. She would get suggestions from the other trainers then discuss them with us. Then she would go back, let them know what was feasible and the possibilities and so on. It worked very well (Research Group Project Manager).

This approach was used for the essential functionality of the system and the TCN project team viewed this as effective.

The other important aspect of the system was the Graphic User Interface which did not require the same degree of technological rigour to design. The Research Group Project Manager decided that a number of benefits would be gained from distributing this work to other sections of BigBank, principally Human Resource Trainers and Learning Technologies Department. Doing so would ease the burden on her limited resources as well as increasing others' involvement especially in an area heavily influenced by the views of these groups. It also shifted responsibility for the visual interface which is often the first feature people notice.

> We said "Look we're just technologists. We can make it work and you just design the screens. Tell us what you want it to look like. Paint the picture and we can do it". We backed off doing any 'look and feel' we're not the experts in that (Research Group Project Manager).

This appealed to the Trainers and especially Learning Technologies who had been very threatened by the project as discussed previously. The Learning Technologies Chief Technical Expert carried out the work.

> The Learning Technologies Chief Technical Expert did the screen designs based on what the Senior Trainer had advised, who was representing a whole bunch of trainers, and the Chief Technical Expert has a good eye for usability anyway as that's his key skill (Research Group Project Manager).

The high level of co-operation of the trainers for the project was beneficially affected by the appointment of the new Head of Training in a departmental restructuring as the Research Group Project Manager explained:

> There was a big shift around and a Head of UK Training appointed. He brought the whole training function together. It was useful for him to have a big project to get involved with as he entered the bank (Research Group Project Manager).

The alliances formed by the TCN project team with the Training Department also provided 'drivers' for further work.

> When Training became involved, it became clear that they felt that: 'Well this is really, really good but maybe we should have placed this investment into a learning management system instead of the virtual classroom' which is why we have the budget to go away and do a learning management system (Research Group Project Manager).

7.3 PROJECT APPROVAL

Officially gaining project approval involved a feasibility study that would demonstrate the financial viability of the project through quantifiable facts and figures as well as technical feasibility. The formalities of the official approval process were satisfactorily negotiated. However, in achieving this formal or final project approval, other informal communications of information tactics were adopted. As with any organisation, interpersonal relations and politics form a central dynamic for the company. The Technology Department had neglected this aspect in the past when presenting projects, but on this occasion the Research Group Project Manager's relationships with other colleagues in Corporate Affairs, in particular with a Senior Corporate Affairs Executive, would prove a deciding factor:

> I was lucky because I had business customers who are world class spin doctors and PR experts. A Senior Corporate Affairs Executive came to me and said 'You guys in technology you've got some really good ideas and everything but you're really, really shit at presenting them. You get all your facts and figures perfect and you can reel them off. But you can't rely on the facts speaking for themselves because you've really got to get round all these people and go out and sell it' (Research Group Project Manager).

This approach of informal communication of the idea to key people would prove to be the key factor in gaining project approval. The process of 'selling' the idea was to be far more than merely chatting to the executives:

> For instance to sell the idea to the Chief Executive, the Senior Corporate Affairs Executive produced a video and before it went to the Board, he went round them all and spin doctored them so we had no surprises. We knew who would say what and this is the standard way of doing things (Research Group Project Manager).

This approach was also aided by the multimedia nature of the project that the Senior Corporate Affairs Executive was presenting which carried an additional edge.

> Multimedia's sexy. It's like BigBankTV; a lot of people on the board were into BigBankTV because they could be broadcasting and seen on TV in the branches. These guys up there are guys with big egos and this sort of thing appeals to them (Research Group Project Manager).

The visual nature of multimedia combined with its currency within the business community would obviously benefit the project. Utilising these aspects in promotion of the project was something that the Technology Department had neglected. Corporate Affairs realised that it was a headline-grabbing project and presented it accordingly with an approach that appeared to work. Prior to the BigBank Board meeting at which the TCN project was to be submitted for approval, the team was advised by the Chief Executive that the project would be "rubber stamped at the meeting". This assurance was reinforced when the Chief Executive also announced in the Press that the BigBank would create "multimedia virtual classrooms in every branch by 1999". This served to underline the weight of informal political activity behind gaining project approval. As can be seen, the level of that activity had been extensive as the Research Group Project Manager admitted, "The amount of shenanigans that went on to get this project off the ground doesn't bear thinking about."

Despite the importance of the informal activity, the formal process is admittedly the seal of approval and, as had been promised, the project was approved at the BigBank Board meeting with an appropriate budget allocated. Had the official feasibility study not been performed, no amount of politicking would have made this possible. From this approval base, however, the Corporate Affairs Department could create a lot of noise.

> In terms of press and coverage that this project got they handled all that. That's what they do for a living. As a Technology Department we could actually learn a lot from how they do that (Research Group Project Manager).

While this PR and 'noise' about the project was good, it still had to get done which would require resources or a high profile concept could quickly become a high profile failure.

7.4 RESOURCE RECRUITMENT

With the project approved and budgets in place, the next important task at hand was to gather the resources to perform the work. The biggest task that the TCN project team faced was gathering the skill base necessary to perform the work. As a result of the multimedia/web technology nature of the project the BigBank's Technology Department

was not best equipped to provide those skills as this type of work was still relatively virgin territory.

> We're gradually skilling up. These skills are in such demand. There's always the temptation to go to 3rd party providers but I feel morally we have to keep as much of the work in house because if we don't start skilling up our people in these technologies we're going to be stuffed! (Research Group Project Manager).

Admittedly a prime motivation for this 'moral duty' was the Research Group Project Manager's ownership of the project and her desire to establish the section permanently as an 'Intranet Centre of Excellence'. As a result of the lack of these skills within BigBank and the increasing importance of these technologies, this would be a powerful position to hold. At the outset of this project the idea of this department was no more than a pipe dream and the TCN project team had to deal with the reality of the corporate environment which functioned along established channels and routines which for the TCN project team didn't exist. As a result of this they had to create new channels and sometimes cross-over existing conventions.

> We've ridden roughshod over the organisational side where we think its right. We've ridden roughshod over what you are supposed to do when kicking off the TCN project. It was all out of approved budget, similarly for the learning management system. Somebody had some money but it wasn't part of the approved Technology budget so we rode roughshod over that with the blessing of the accountants it has to be said. We've talked to people that we're not supposed to because you know we're meant to develop in these stovepipes and not talk to each other or share information. We've just gone out and talked to people and done things that have never been done before. Having said that we've done a lot of the stuff by the book. Within the Technology Department a lot of the System Development managers have a very awkward relationship with IT Services. They just concentrate on getting the project done then leave IT services to clean up the mess. That is why Systems Development gets a bad reputation and relationships become really strained. We did the opposite, we got the IT Services guys in right at the beginning and asked 'what do you need?' So in some ways we've done things by the book and in others we've ridden roughshod over it and we've just followed our instincts on that. If we'd done everything by the book without any innovation we'd never have got it done and we'd never have got ourselves established as a department (Research Group Project Manager).

This view illustrates the conflicts between maintaining an organised structure and facilitating innovation and change. As is evident, innovators within the company feel that the formal organisation prevents innovation and in order to create change and deliver new technologies, the informal structure and social networks must be created and utilised.

> We've had no choice but to operate the work we've done on a very tight shoestring because we have to prove the case that web development is cheap so we can't say 'oh we need 30 developers'. It has been quite painful but we've done it. We've also proved that unless you have a wider resource pool, you can't be as responsive as a 3rd party supplier like Sidalien

where you can go to them with a bit of work and they do it for next week. I can't do that and have to say 'Give me the budget'. That means I can go out and recruit someone and I'll have them in four to six weeks which is crap but it's part of establishing a new department and we felt the pain of that this year (Research Group Project Manager).

7.5 PROJECT DEVELOPMENT

With the project approved, the Research Group Project Manager and the Corporate Communications Executive had to procure the resources necessary to carry out the work, obtain equipment and co-ordinate the system development with other relevant departments. This process would be complicated by the fact that it required a new section which did not possess defined methods of operation, communication or relations to the other departments whose responsibilities would overlap with those of the new section. This new section had to manage the often unpredictable process of innovation of a system which was unproven while coordinating with the other departments who had concerns with fixing time windows.

7.5.1 Technical Issues

As with the development and implementation of any technical project, there are inevitably difficulties. The principal difficulty for this project was the proprietary product families of computer technology. Products tend to be isolated and are often unwilling or unable to communicate with other applications. Microsoft applications are designed to speak to other Microsoft applications as with Java or C++ applications. This makes the introduction of new ideas difficult and means decisions are often based on what is technically easiest to implement not what is the best solution. This is a judgment made by the technical experts who understand how compatible each package is with others. With the TCN system, these compatibility considerations existed at almost every level. Firstly the development of the product itself consists of the integration of divergent technologies with the Intranet, TV, network, etc. This product must then communicate with the other company systems. The principal need to communicate with other systems was the need to receive and send information ranging over different databases.

The two key data sources contrasted markedly from the modern system of Peoplesoft to the archaic banking mainframe systems. Peoplesoft was the new database system employed by the Human Resources Department which catalogued employee details including salary, skills, employment history, etc. The Human Resources

Department wanted the TCN project team to integrate with this system to allow them to keep track of and update the courses that the employees were taking on the system.

The involvement of JNM in the development introduced an additional database due the fact that the system was based on an Access database. Access is only capable of handling small databases and is not scaleable upwards for larger enterprises. For this reason it is not used in large companies like BigBank where Oracle is the accepted standard. To further complicate matters, the Access database structure and language is incompatible with that of Oracle thus requiring extensive re-engineering to adapt.

BigBank was also concerned about using a company with JNM's limited resources. Their engineering team consisted of three people. Being a small company these developers would undoubtedly be on limited wages. With the vibrancy in the IT employment market it was possible that these developers would get poached leaving JNM, and BigBank, without the people who had developed the system. Even if they remained, it would be impossible for them to provide the standard 24 hours-7 day level of support that BigBank would expect.

Even if the technologies within the system fitted together and lines of communication could be established with other bank systems, BigBank had to be sure that these conversions would not be detrimental to the existing BigBank technologies. In order to avoid the introduction of any detrimental changes, a number of testing procedures had been put in place. The chief test was the Product Acceptance for Web Applications by Web Services. This testing was designed to ensure that a new web system would not adversely affect existing bank technological infrastructure. Acceptance could prove to be a lengthy process: time would need to be figured into the project plan otherwise the whole schedule of the project could potentially be unexpectedly elongated. The other important test was the contemporary bogey monster of the IT world 'The Y2K bug'. All technology within BigBank, old or new, had to be tested for Y2K compliance and this testing would also need to be applied to 3rd party components used such as JNM's system.

Security considerations, not surprisingly, are an all permeating concern within BigBank and were naturally an issue for the TCN network. The nature of the information to be held within the system related to employees so the Human Resources team was keen to make sure this was only available to authorised parties. As a result of the internal nature of the network, the system would benefit from the firewalls and external protection procedures which the overall network offered. The TCN project

team first needed to establish what information was to be regarded as sensitive and what could be openly available to all bank employees. This information would be organised into secured and unsecured access areas. The regulations applicable also needed to take into account the location of the client. In this case the access privileges for a client based in Head Office would be different from one located in a branch.

The TCN project team agreed that NT authentication would be the best way to maintain security through linked authentication to the server which was accepted as best practice within the industry. In order to prevent system problems being caused by the users it was decided that the browser should be 'dumbed down'. This required certain functionality being removed that could possibly cause problems if the user altered the data accidentally or intentionally. It also removed functions which where extraneous to the operation of the TCN. This 'dumbing down' and functional alteration was also necessary for Microsoft NetMeeting as it was only to be used 'nested within' the browser window, therefore, limited interaction was necessary.

To amend this functionality, a contractor was brought in from one of the BigBank recognised Microsoft Solution providers[2]. While the contractor was able to amend the Internet Explorer version4 browser, the functionality of NetMeeting affected the whole system impinging on all the development work. As a result the TCN project team, ideally, required assistance from the Microsoft software providers and a dialogue with their designers. With most software developers, this model would be appropriate for the relationship with the provider allowing mentoring for the client regarding any product alterations and amendments. The BigBank relationship with Microsoft followed a different model.

> Microsoft has a very different relationship model from other technology suppliers. The likes of Digital, IBM or BT have massive account teams that support us and they'll be people in selling to us, showing us things and we spend millions and millions with them. We only spend a couple of million with Microsoft but it is very, very different in that they don't have a massive account team. They sell us software and the nature of the relationship with the organisation tends to be based on support. I suppose they pile it high and sell it cheap and you pay for all the extras with IBM. It is all included in the bill at the end of the year. So Microsoft had very little direct dialogue with us and they only started getting involved when we started putting support calls in because some bits of Microsoft product weren't working (Research Group NMM Project Manager).

This quote indicates that the relationship with Microsoft was constructed around fault handling in that when something broke they were asked how to fix it. This

[2] This represented companies whose consultants met a required level of capability in using Microsoft applications.

relationship was handled by a central department which handled their support issues. The communication was prioritised according to the severity of the problem. This relationship was completely inappropriate to that required by the TCN project team as they were involved in development issues which centred, not so much around the product not working but about how to re-engineer the system to work in a different way. In addition, their problems did not directly affect BigBank operations and as a consequence had a low priority within the Technology Department's software support group's framework.

The TCN team decided to use their relation with the Microsoft Solution Provider (MSP) from whom the contractor had come. Via the MSP they would refer issues to Microsoft although they did relate any contact to DIM in order to 'Keep DIM in the loop'.

7.5.2 Organisational Issues

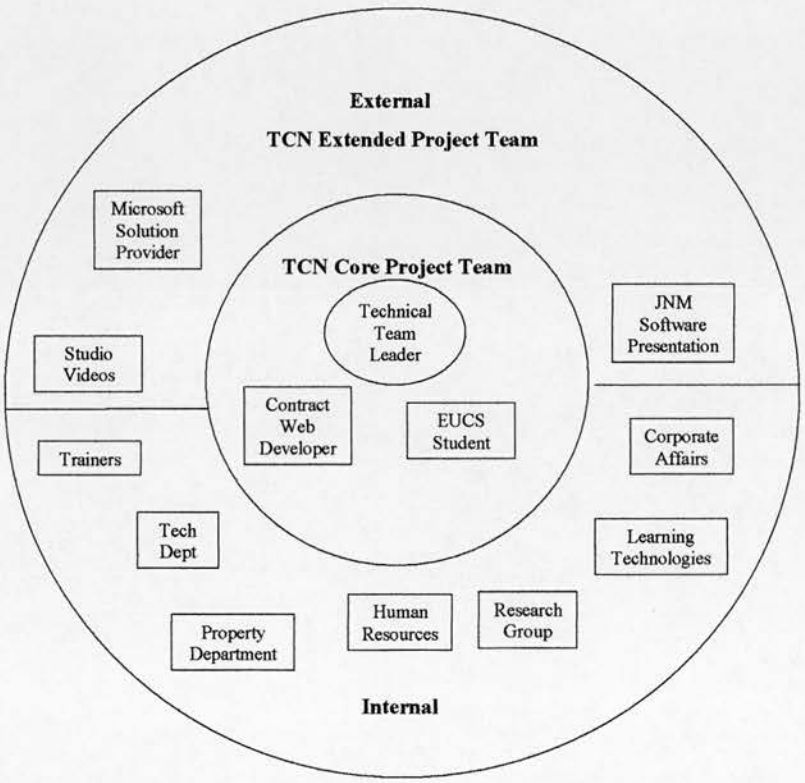

Diagram 7.1: TCN Project Organisation Overview

Within a highly structured corporate bureaucracy such as BigBank, it can be difficult to operate ad hoc project teams as they do not possess established lines of communication and resource. However, this less structured circumstance is often what enables these teams to work at a faster rate as their relations to other sections have not had the time to fossilise into red tape. It was this free rein that the Research Group Project Manager thrived on as she was used to operating in that way and had survived within the corporate jungle by exploiting this types of situation. Unfortunately, when this balancing act fails there is often no structural safety net support.

The Research Group Project Manager had an inkling of this and her organisationally nomadic existence was in part due to her aim to establish an organisational home that she felt fitted her aims. The TCN project was supposed to be the genesis for such a position. Early on during the project, the Research Group Project Manager began to move to evolve this project team into a department which would serve as an 'Intranet Centre of Excellence'. This was not a surprising move by someone who had acted as a technology champion for a number of innovations that had served as a useful vehicle to enhance her role within the organisation. With the Intranet expansion to a corporate wide level, this department would possess extensive influence that would allow the Research Group Project Manager to broaden her scope beyond the Technology Division.

Despite this longer-term ambition, the TCN project team still had to contend with the difficulty of operating to tight time scales while relating to other departments without the existence of formal lines of communication. This caused difficulty in obtaining resources and also integrating developments into the technological architecture via testing.

As with the integration of the technology into the organisation, the responsibilities of the section had to be integrated as well. This at times meant a degree of territorial competition with existing sections that handled areas affected by the TCN project. This was evident at the inception of the project development when the team was drawing existing resources away from departments that they were attached to at the time. An example of this was the enlistment of one of the ASP (Active Server Pages, a programming language) experts to the project who had been attached to the Praxis Intranet team and was, in fact, still required by that team.

While attending to the problems with internal competitors, the team also had to establish and maintain relationships with internal customers as well. These internal

customers would be the Retail Banking division as well as Human Resources who were responsible for overall training requirements.

Some of the work within the project was beyond the scope of the TCN project team so they had to contract to external suppliers, such as JNM. In dealing with these external parties, the TCN project had to consider a number of issues. The primary difficulty was in defining the exact requirements to the suppliers as these had not only to include the actual technicalities of the system but also the need to integrate with the developments of other sections. If this was not accurately scoped and alterations in the technical design were required at a later stage then this would cause the contract to be renegotiated. If the external party supplied their work according to revised requirements without contract alterations, they would be technically in breach of contract. Of course, this presented another problem because the supplier could choose not to renegotiate and simply work to the initial contract, delivering to the original specification and providing a useless item but still requesting payment.

Relations with other suppliers were further complicated by the potential threat the project posed to their business. This was the case with Studio Videos. Studio Videos supplied the studio that was used for the broadcast of BigBankTV and would have to be utilised for the work on the TCN. The studio, as a result, would need to be altered considerably to allow the technology used for the network. This alteration threatened Studio Videos' existing business so in order to ensure their successful co-operation, the TCN project team would require considerable diplomacy and political acumen. Of particular benefit was the Research Group Project Manager's links with the Corporate Affairs Department who were Studio Videos' sponsors within the bank. Corporate Affairs Department's support for the TCN project provided considerable leverage to obtain Studio Videos' assistance. One complication was that Studio Videos were not actually very good at their job as had become apparent during the NMM project. When tapes of their broadcasts had been analysed, it was apparent that there were technical weaknesses in their production techniques. The TCN project team would have to work round these deficiencies while retaining Studio Videos' support.

7.5.3 Internal Suppliers / Contributors

Issues of physical location and logistics had to be addressed in addition to the technological requirements. The TCN project team had to liaise with the Property Department in order to deal with these aspects. One of the Property Department's

principal tasks would be locating the TVs and PCs within the branches and this proved to be a considerable stumbling block. The original placement of the TVs within the branches had filled an entirely different role. The TV was located to allow the whole of the staff to view broadcasts on BigBankTV whereas the TCN learning purpose required a more isolated setting in order to aid the learning process. This would mean moving the TV with fittings and connections to a position that facilitated this wider viewing but, also, had space suitable for the PC to be located. The property section surveyed the locations and established that this would first be very costly and secondly, physically impossible in some locations.

This is a good example of the physical factors affecting innovation. The TCN project team realised as a consequence of this situation that they would have to explore alternative solutions to placing a TV and PC together. The Property Department had been able to locate positions for the PCs so the TCN team returned to the aim of incorporating the TV image within the PC. A number of routes to achieve this were identified:

- TV tuner card: This would feed the signal into the PC to be displayed on the terminal.
- BT system delivering images via networks using new technology by Future Software. This was unproven.
- Fantastic Corp. identified by the Research Group, operated on the European continent and had previously performed this type of function although they were unknown in the UK. Their system involved the same concept as the BT system solution by broadcasting the images via the network.

The latter two suggestions were rejected. The BT system was deemed unsuitable because it was based on a system which was unproven and the TCN project team did not wish to take a risk on unproven technology at that stage during the development cycle.

While Fantastic Corp. had proven their concept on the continent they were still new to the UK. BigBank was, therefore, unsure as to the level of support that they would receive from the organisation. In addition, some internal politics were motivating this decision. The suggestion of using Fantastic Corporation had been put forward by the Research Group after the Research Group Project Manager had left in order to pursue her own projects. There was some animosity between the former Research Group Project Manager and the members remaining within the section so she was not keen to rely on them in any way for this project.

This left the first option of using the TV tuner card that relied on technology which was not as forward looking as the other options on the table. It was, however, proven and did not require direct integration with the system. The card could also be installed by the BigBank's IT section without having to rely upon 3rd party expertise.

As discussed previously, the TCN project team faced a number of problems getting the necessary resources and personnel. A number of the team members had been drawn from other projects which were still running concurrently to the TCN project. These projects still required the input of the scarce resources from the TCN project and this impacted upon their time spent on this project. This caused complications in planning of the project. A major complication arose due to the Technical Team Leader leaving to get married followed by a six-month honeymoon. The Technical Team Leader had proved central to the project, having been involved from the inception, during the feasibility study and then taking a role within the project planning and guiding the other developers through the project. The date of his wedding and the proposed honeymoon had been planned prior to his involvement in the project and as the Technical Team Leader put it, "I'm disappointed that just as the project is beginning to get interesting I have to leave but, of course, I am delighted to go travelling and get married".

This factor of losing a key person with scarce skills had not been effectively built into the project. Although there was an Assistant Project Manager, he did not possess enough expertise to allow smooth development.

The Contract Web Developer who had been drawn from the Intranet team was viewed as the 'guru' within the bank regarding ASP which was an important element of the Intranet. He was still involved in the development of a room-booking system for the Technology Intranet. The Research Group Project Manager had to exert some political influence to draw the Contract Web Developer into the project and had therefore needed to provide assurances that his role in the previous project would be completed. Unfortunately, the milestones of the Praxis project (Chapter 6) often clashed with those of the TCN project causing conflicts. The Contract Web Developer was the key developer in the room-booking project and was also essential within the TCN Project Team. This created a number of issues between the two teams regarding the allocation of his time to each project.

A number of the other developers operated on a contract basis and this caused a number of problems. Contract workers tend to have less loyalty to the end result of the project as they will shift onto another project upon assignment completion and will not

be responsible for the ongoing support. As a result, the quality of documentation was not strictly maintained. Within the TCN project this was certainly the case. Another difficulty was that the contract periods for the contractors were not extended for budgetary considerations. Subsequently they would leave for new projects before the culmination of the project so when problems occurred, the person who had worked on the section was no longer available and there was little documentation to explain how the work had been performed.

The development of the system was obviously crucial but it would be of little use if the equipment was not in place within the branches. In order to ensure the correct implementation of the infrastructure, the system rollout had to be handled well. This area thankfully held little mystery to the BigBank Technology Section as they had a Rollout team that performed this function on a regular basis. The TCN project team would be able to hand that function straight over to this team thus 'giving them one less thing to think about'. The Rollout team had to concern themselves with organising the branch implementations around other upgrades or rollouts and this was achieved through scheduling which prevented clashes and minimal disruption to branch operations. The ITS Manager responsible for this work was brought in at a very early stage to allow the early planning for this event.

It also gave the ITS Manager an understanding of the project enabling him to flag up the need to develop instructions regarding the installation of the system. These instructions would be needed by the engineers to perform the work but also training would be needed for the system users.

7.6 IMPLEMENTATION

In order to achieve this training aim, the Research Group Project Manager drew upon her experience in the previous project with the Praxis Intranet. In that project, they had designated an individual from each section to act as a Content Co-ordinator who would educate the members of their individual section about the system. It was decided to use a similar approach by appointing a similar individual within each branch who would be trained in its use and then pass that information on to others within the organisation.

These individuals would also be involved in the initial testing of the system. The initial training on system use would be provided during the testing of the system's robustness and capabilities. This achieved two aims of both testing the system under

realistic conditions as well as providing training for the staff. The project timelines would also benefit from this planned overlap.

The learning experience provided by the TCN project would be affected by the look and feel of the site and this would strongly influence the usability. This had to fit in with the prescribed look and feel for the overall Corporate Intranet known as Orbit. The Orbit system had evolved from the Praxis system with more thought and planning having been given towards corporate image considerations.

> We worked hard to get Corporate Affairs to take overall responsibility for devolved publishing. The infrastructure became more productionised. Praxis got revised and re-revised. Everyone worked hard to make things better. We got more standards applied and developed on the back of TCN because we got some money for Intranet applications and for really pulling together a Corporate Intranet. On the back of the TCN project we launched Orbit. I think it is a classic evolution of an Intranet. The difference is we've always done ours within a shared infrastructure. I think a lot of Intranets evolve as servers under people's desks and in various rooms and are then linked together in a web cell. Whereas we've always had it as an ever growing web farm (Research Group Project Manager).

7.6.1 Testing

First impressions are always a key factor in users' assessment of a new system. Accordingly, the testing for the TCN system graduated through a number of different venues in order to minimise operational difficulties in implementation. Firstly the testing was performed on a test set-up within the Technology division. This simulation was then exported to the test branch that was located in another area of the city. This was a model of a fully functional bank branch and was used to test all branch additions prior to rollout. The rollout would then take place in six selected branches prior to the final rollout to all branches. 'Piggybacking' on the experience of another rollout for the 'new branch' benefited this rollout as the Research Group Project Manager commented "New Branch innovated that and we just bolted onto that because there was a lot we could learn from them".

The new branch team handled the main work within the rollout and as the Research Group Project Manager admitted "They did our rollout for us". As with any testing phase a number of bugs were uncovered.

> There were a lot of stability problems in the early part of the pilot with the audio. It was a real baptism of fire but we managed to get two weeks from somewhere without losing too much face which allowed us to do about 20 enhancements to the software (Research Group Project Manager).

It was important to fix these problems and develop high availability for the system.

> We've established all the business procedures and the technical recovery procedures. If anything falls over we can recover very quickly and invisibly to the user. At the moment someone is monitoring each broadcast and logging what happens and how to recover from any problems (Research Group Project Manager).

7.6.2 Rollout

With the stability, recovery and monitoring refinements just discussed in place, it was possible to roll the solution out over the entire branch network. One of the difficulties with any project is deciding when it is complete. Uncontrolled testing phases can give rise to new suggestions and pieces of work that go beyond the intended scope of the project. The Research Group Project Manager was well aware of this potential problem and commented

> The problem with updating is that you end up in this dynamic updating cycle that is ok for maintenance which can be done as you go along. We need to bundle a number of key enhancements and turn that into a project so we can formally agree a scope, requirements and deadline, but that applies to any technology (Research Group Project Manager).

With this possibility recognised, some situations also required that some problematic sections of the original scope be eliminated in order for the system to go live. These areas included the proposed link to the PeopleSoft Human Resources application. This PeopleSoft link would have allowed TCN to update employee files with the details of the courses that had been taken, allowing their profile to be held in a central record. Integrating systems is difficult enough to perform when both are stable entities but near impossible when one is still in development. It was decided that it was important to first of all get the TCN system operational and then create the links.

Once sufficient satisfactory testing had been conducted on those parts of the project to be implemented for initial live operation, the testing phase was deemed completed and the system was rolled out in 1999.

The project demonstrated the pragmatic cost orientation of the central corporate body in comparison with the more experimental atmosphere within technology where the two components of the system had evolved. As the Research Group Project Manager reflected:

> The business say they want this, this and this so we work out how much it costs and they usually make fairly pragmatic decisions based on upfront cost and cost of ownership (Research Group Project Manager).

In order for the project to be realised it required some of the more freewheeling attitude of the technology team.

> They're blinkered. They're just very focused on what is on their change plan and don't look outside the box. We just cajole, persuade, ride roughshod over their political shenanigans. Part of the time the project was managed on the business side by Retail Bank change management. We got a lot of benefit from that in terms of the model office and their managing the rollout. We were part of them when it suited us (Research Group Project Manager).

This exemplifies the spirit shown by the project teams throughout the case studies. Their focus was always on the end goal both individually and organisationally as opposed to the prescribed process. This approach invariably produced innovative results.

8. ANALYSIS

8. ANALYSIS

8.1 INTRODUCTION

Throughout literature, we see a variety of approaches to tackle the same issue. How do we understand and plan innovation effectively? The sheer volume and variety of perspectives support the consistent belief that this process is complex. Across the theories a progressive appreciation of a wider range of factors is evident. Foremost of these is the need to understand the innovation environment and most specifically the user. No model has emerged that provides a comprehensive method of providing this understanding. While broad, high level theory has been offered, it has failed to move from generalisation to practice and studies made have frequently focused on isolated scenarios. This offers a number of areas to consider during our investigation. Principally, do interactive models of innovation operate in practice? If this is the case how do they network and what factors affect them and thereby the technology trajectory? It is also important to consider how the organisation manages this process over time in terms of resource and expertise, aspects which may be accommodated via formal methodologies and social learning. Analysis of these areas should assist in identifying a model of innovation, or at least consistent themes, and guiding principles to allow some reduction of uncertainty.

Multimedia innovations are driven by new technologies providing opportunity for advancement of actors' agendas. Innovation is driven by the twin forces of project champions and new technology. Project champions develop a community of interest around the proposed innovation. The final design of the technology is shaped by the alignment of actors enrolled within the community evidencing social shaping. New technology generates interest within the organisation as it offers a potential power resource creating readjustments in the existing power relations. The agendas are aggregated across networks or communities of interest aligned to support the innovation.

Multimedia technologies are configurational technologies created from various components. In each case, BigBank was required to configure the solution to the setting. This necessitated considering both technical and social elements and the interactive cycle of influence between the factors. Considerations include infrastructure (network, computers), content (sourcing and conversion) and expertise (managing and delivery). These aspects must be woven into the network to facilitate the delivery and ongoing maintenance of the innovation. As a result of the emergent nature of multimedia within the market overall and BigBank specifically, resources

offering these capabilities are in limited supply. This creates twin concerns, finding or creating these resources and then, the ability to assess and judge their value.

The process to find, align, combine and deliver the complexity of factors requires management of relations among a network of end-users, technology suppliers and project sponsors. The project champions manage the network to identify, appreciate and appease the issues and agendas of the various actors. This has created a shift in the operations of the Technology Department. Formalisation of this process presents significant problems for the organisation but in order to make sure the innovation is beneficial to BigBank, it must provide business benefit in order to gain formal approval. Surprisingly, business benefits were not the initial motivation behind any of the initiatives. While the need to meet user requirements is frequently expressed, in practice this is used only to validate opinions of project sponsors and influencers. This requires political tactics to be applied to align differing agendas and perceptions around a common objective.

Through the case studies, we gain insight into the innovative drivers behind multimedia in this organisation. The opportunity of multimedia technology is embraced by actors within the organisation as an opportunity for advancement. Advancement includes control over resources and establishing expertise.

The implementation of multimedia creates both technical impacts in terms of infrastructure and social impacts in terms of content sourcing and system use. In order to accommodate the joint consideration of both social and technical factors a complex navigation of the innovation process occurs.

Within this section, we shall try to draw together the themes which have occurred through the three case studies. This will be done by viewing the cases as a whole as opposed to individual pieces, allowing a view of the commonalities that exist among them. We shall examine why changes occurred, what those changes were and the process which allowed these changes to take place.

8.2 MULTIMEDIA INNOVATION PROVIDES VEHICLE FOR ACTORS TO ADVANCE AGENDAS

Through the course of the three case studies within this thesis, we have seen changes in aspects of the operations of BigBank. Innovations have occurred where actors have perceived an opportunity to advance their agendas through multimedia technology. While a number of actors may perceive the opportunity, a central actor, the project leader, drives it. Project leaders act to align resources and actors within a community of interest that can deliver the innovation.

Within the cases, we witness an informal structure, conforming to Burns and Stalker's (1961) view, driven by internal politics. Actors engage in political activity in order to advance their position and influence within the organisation.

Innovation activities were born out of the desire for advancement by an individual and/or group. These personal motivations acting as drivers for innovation provide an alternative perspective to traditional supply push, demand pull theories which present rational business motivations. What was defined as 'advancement' varied between actors, varying from hierarchical advancement to expertise acquisition.

The NMM project presented a variety of advancement opportunities for a number of actors. The Change Planning Executive views the project as a way to understand and advance Microsoft's NetShow application, advancing his reputation for discovering and implementing technologies. The Research Group view it as an opportunity to establish their multimedia capabilities and reinforce their relationship with an influential internal customer. Technical Strategy, responsible for the technical direction of the bank, is enticed by the opportunity to test best practice for the BigBank network to deliver multimedia services. EUCS seek to advance by acquiring knowledge of a technology relevant to their distance learning operations. Learning Technology and Corporate Communications perceive an opportunity to influence the next area of technology development.

Praxis offered actors the ability to acquire valuable web expertise. The new Communications Department Head, and Content Co-ordinators seek to advance by gaining a 'very sellable skill'. The Research Group Project Manager desires hierarchical advancement while the Technology Director desires to keep pace with competitors.

For the TCN project, the Board view it as a good Public Relations project which will be perceived as putting them ahead of market competition. They also view it as being a cost-effective measure allowing them greater return on investment from outlay on their satellite link by saving money on training costs. The new Head of Training from the Human Resources section views it as a high profile project which will immediately benefit him as does the Research Group Project Manager who aims to use it to establish a departmental role.

Agenda advancement acts as both as catalyst and shaper for technology innovation. The desire for advancement causes frictions to occur between factions as each drives to position their own agenda, such as conflict between the Technology Department and Learning Technologies. Within these conflicts, technology acts in a political manner (Winner, 1977), both shaping and being shaped by the struggle.

Innovation was not only a struggle to solve technical problems (Hard, 1993) but also, social problems arising from conflicts and issues between actors.

Observation of linked projects provides details of the progression of project champions across projects. (See Diagram 8.1 below). During this entire process, they continually campaign to advance their agendas in the pursuit of power legitimisation.

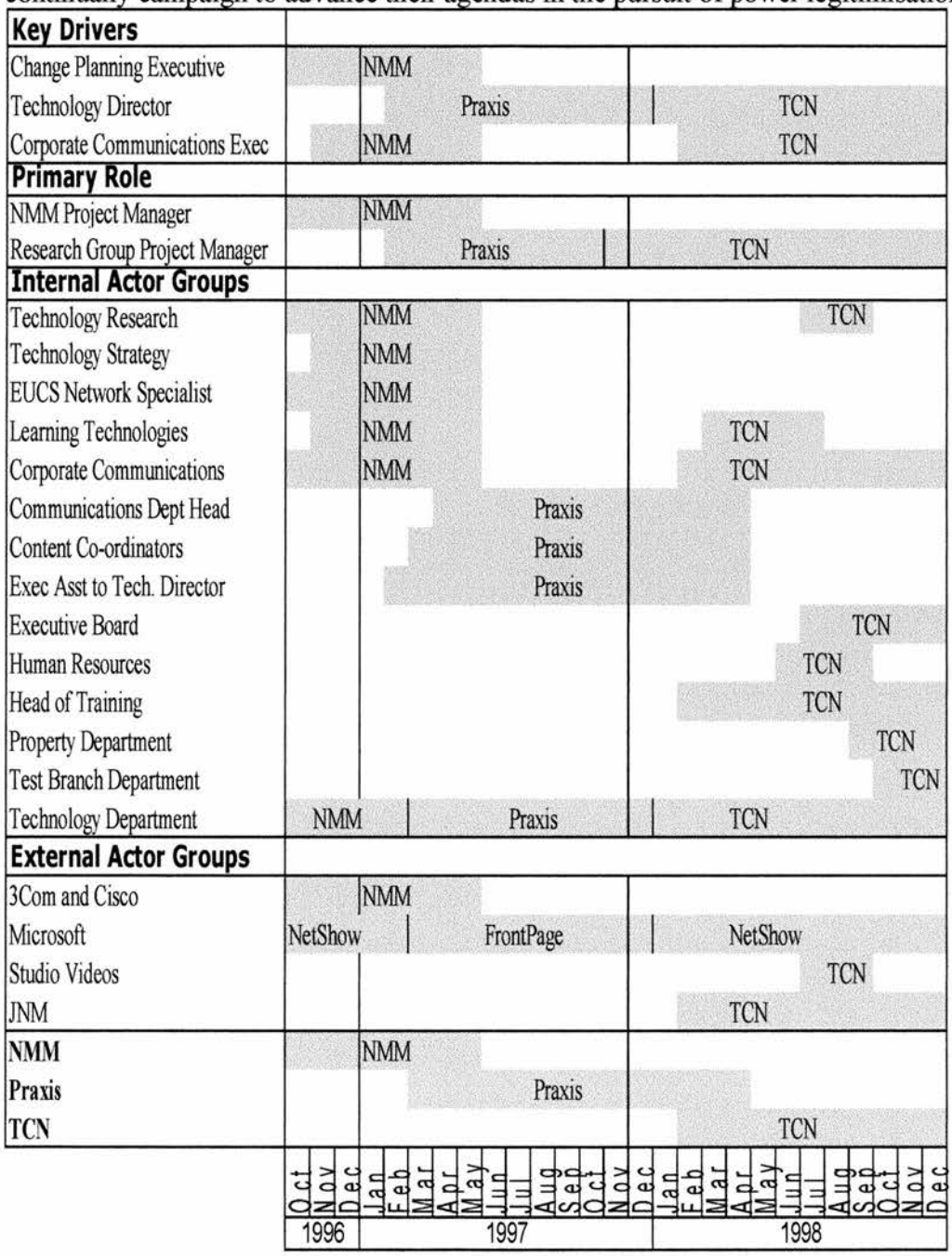

Diagram 8.1 Resources' Involvement Periods

The Research Group Project Manager evolves from presentation of knowledge claims concerning intranet expertise, to a more prominent position against departmental colleagues. This positioning provides the opportunity to lead the Praxis initiative offering advancement from the Research Group. The role of the Communications Manager offered through this move does not, however, fulfil the Research Group Project Manager's agenda. Leveraging acquired expertise in web technologies, the Research Group Project Manager campaigns for other advancement through the TCN which provides additional opportunities outwith the technology department.

Evolutionary agenda advancement occurs for groups as well as individuals. We see Edinburgh Technology section advancing its position against London Technology for servicing web technology. This service facility had previously been provided by London, but the legitimisation of knowledge claims through NMM and Praxis projects altered this perception of expertise.

On a wider scale, we also see the Technology Department advancing its position within Multimedia work against the Learning Technologies group. This advancement eventually sees this latter section being eliminated with their work being transferred to Technology Department as their role is marginalised.

The political evolution of technical experts and groups across linked projects has not been possible through isolated case studies. Examination of a series of linked cases provided an appreciation of agenda advancement over time and the shaping of agendas based on previous activity.

Actors drew together to create a network of shared interest, or 'community of interest' to all for a mutually beneficial advancement of agendas. Within each project, one actor fulfilled a primary role creating the reason for initiation then driving delivery. Within the Networked Multimedia project, the NMM Project Manager from the Research Group serves this role. In the Praxis and TCN projects, the Research Group Project Manager performs this capacity although in the TCN project, she is not the key driver. The Corporate Communications Executive occupies this role.

While a central actor fulfils the role of Project Champion, other actors within the community assist in aligning resources. Within the NMM project, we see the EUCS Network Specialist being recruited by the Research Group and then acting to align resources within his area of influence, the University, for the needs of the project such as the Multimedia lab facilities. This is also true of the Research Group Project Manager recruiting the Corporate Communications Executive who then acts to champion the project within the Retail Bank.

8.2.1 Technology Statespeople

In each case, the communities of interest formed around innovations are created and orchestrated by a central actor. Studies of technology innovation have consistently identified actors within cases who draw together the elements of the project and act to drive it forward. Actors in this role have been variously termed as 'system builders' (Hughes, 1983), 'project champions' (Bessant, 1985), 'project leaders' (Tidd et al., 1997) and 'heterogeneous engineers' (Law, 1997). Shared characteristics focus on the demonstration of both social and technical capability, enabling navigation of the complex of considerations required for successful innovation.

Application of their hybrid expertise has been frequently documented but the process of their creation and evolution has been obscured. The use of isolated case studies has made it problematic to view actors migrating from innovation to innovation. Within our study, we were able to a gain insight into both of these aspects. This insight allowed us to appreciate the motivations and social construction of these actors. In contrast with Bessant's (1985) belief that these actors are formal appointments, we instead witness project champions emerging patterned by the constitution of their organisational environment.

While these terms capture the richness of these actors and their application of hybrid expertise to technical innovation, it does not assist the identification of factors that contribute to making these individuals successful over time and therefore assist in their selection and appointment at the outset of projects. Instead consideration is focused upon their actions during an isolated project and what problems were caused.

Identification of the various actor roles within projects is useful, allowing differentiation between the important roles of the technology sponsor, project leader, etc. (Tidd et al., 1997). It assists in understanding the activities performed by these roles, but fails to add value in considering which individuals should occupy these positions to minimise project risk. Indeed the use of 'system' and 'project' within the description of these actors is as limited as the isolated case studies that identify them. These actors migrate from project to project with the consistent aim of advancing their own personal agenda and gaining legitimisation of greater power, a process more akin to politicians than scientists or businesspeople. Precise roles within projects may alter, sponsor in some, leader in others but common traits most likely exist driving them to those roles. Identification and assessment of these traits should assist in the construction of teams with innovation activity.

Each innovation is merely a different manifesto to gain 'election' to legitimate influence. We witness these actors 'lobbying' other actors to create a

community of interest around a central agenda or manifesto of innovation in the belief it will offer advancement of their agenda. In order to reflect this apparently ongoing pursuit of power beyond individual initiatives, I have set aside the terms of Bessant and Hughes, project and system. Instead, I will refer to these actors as 'Technology Statespeople'. This term is aimed to reflect the broadly political agenda aimed at legitimising power through appointment to a desired role. The inclusion of 'technology' is equally as important as their ambitions are grounded in the real world implications of the innovation they are linked with. Their opportunities are not 'blindly political' with their ambition 'bounded' by the actual and perceived technical possibilities. In order for the 'Technology Statespeople' to legitimise knowledge claims to achieve and retain power, innovations they champion must deliver value to stakeholders. Technology Statesperson must focus their efforts against 'doable problems' (Vergragt, 1988) in order to satisfy allies and build status. Classification in this manner is also reflective of the long considered political nature of technology (Winner, 1977), a role supported by Burns and Stalker's (1961) discussion of technology's role as a power resource in the factional struggles within informal structures. Acquisition of ownership of such a resource offers a lever to legitimise power, a pursuit evident within our cases. Indeed, we witness actors migrating between innovations in search of one that will provide suitable legitimisation. Technology Statespeople also seek the sponsorship of those who have achieved this legitimisation, the Change Planning Executive, Technology Director, and the Board, enrolling them to assisting in guiding this process.

Sponsors each possess their own agendas, advancement of which provided the core of the innovative activity. The NMM agenda was driven by the Change Planning Executive's friendship with Microsoft and his interest in their offerings. Praxis arose from the Technology Director's interest in intranets, while TCN is motivated by advancement possibilities for the Corporate Communications Executive and Corporate Communications Department who in turn enrol the Board to become sponsors for the TCN project. Sponsors utilize their hierarchical power to assist the Technology Statespeople in creating and aligning the community of interest and achieving formal approval.

Technology Statespeople emerge through a largely social process contrary to the view that project leaders, champions, etc. are organisational constructs (Bessant, 1985). Participant observation of the pre-project environment and the forces therein uncovers social aspects that create Technology Statespeople, similar to Intermediaries.

Technology Statespeople and Intermediaries (Williams, Slack and Stewart,

2000) are fundamentally different roles driven by contrasting motivations. Intermediaries exist primarily to assist social learning, whereas Technology Statespeople exist to advance their agendas through technology. This is not to say that a single actor cannot act as both. For example, serving as an expert intermediary may assist social learning, aid knowledge claims and advance personal agendas thereby fulfilling both motivations.

An informal, politically driven structure acts to affect the formal within the BigBank pre-project environments. Political tactics were used to create factions and groups as part of this informal organisation allowing people to act out within their formal role to advance their position.

This is seen in Praxis with the Technology Director's Executive Assistant assisting the Research Group Project Manager in positioning herself for the Intranet project. In turn, the Research Group Project Manager encroaches on the area of expertise of her colleague who had been doing work within that area. Technology Statespeople exhibit the characteristics of 'project leaders' (Tidd et al., 1997), 'system builders' (Hughes, 1983) and 'project champions' (Bessant, 1985) as they form 'communities of interest' around an innovation agenda.

Communities of interest are collections of actors and resources mobilised to deliver a particular innovation akin to 'actor networks' (Latour, 1986; Callon, 1994), 'socio-technical constituencies' (Molina, 1997), 'socio-technical constellations' (Williams, Slack and Stewart, 2000) and 'socio-technical systems' (Hughes, 1983) where actors are enrolled and aligned around a central agenda with social and technical aspects. They share the common objective of these constructs, creation of a network to deliver innovation. This process is characterised by negotiation to tackle 'doable problems' (Vergragt, 1988) with decisions influenced by economic, political interests and power relationships of the actors involved. Communities of interest present a hybrid between the various socio-technical frameworks, principally due to its existence across both pre-project and formal project stages. Within the pre-project stage, it shares the loose coupling of actors captured by socio-technical constellations. Actor networks and socio-technical constituencies display closer linkages between players. Players typically have direct relationships and commitments to particular facts and artefacts, features evident in communities following formal approval of the project.

Communities of interest were used to enforce a degree of control and ownership around power resources (Burns and Stalker, 1961). Power resources within the studies were represented by artefacts and expertise valuable to the organisation such as the BigBank Network and infrastructure. The relative

importance of these resources is dependent on a number of social factors. As we see across the cases, the importance of multimedia CD-ROM diminishes due to alternative technologies emerging. Technology Statespeople used a number of political ploys to create the informal networks of influence building co-operation between the groups by negotiating a way by which they would all benefit from the endeavour. In addition, the Technology Statesperson will act to marginalise competitors and neutralise threats to the project taking place and succeeding. This was witnessed through the marginalisation of internal threats, such as Learning Technologies and external ones, such as BT. In order to pursue these initiatives they had to align aspects of the organisation to allow this to happen. Before the formal structure aligned, an informal influence network had to be established which could then affect the formal structure. This allowed the dominant informal factions to marginalise other groups, including their allies and excluding opposition via this boundary. The aim was to legitimise power formally within the bank, by creating and owning the innovation they would place themselves as the obligatory point of passage between the resources and other bodies creating legitimate power.

8.2.2 New Technology: Multimedia Technology advancement opportunities

Emerging multimedia technology offered exciting new possibilities to alter existing power relations and provide actors an opportunity to advance their agendas. The innovations developed in each of the cases supported theories concerning the characteristics of multimedia technologies. The array of systems conforms to the perception of multimedia as a 'cluster of innovation' (Williams, 1997) under a common banner and sharing common features. Each system allowed for expansion and co-ordination of the media by which information could be provided and shared. The facility for interactivity with the information was consistent, but convergence of media evolved across projects. Within NMM, the system provided a new medium to view a number of formats, with control over type, viewing time, and so on. The Praxis Intranet system did not expand media as such but created new access options for data plus increased facility to maintain and improve the content. This differed from the previous repository for data which was a hard disk drive that only allowed file names to be viewed after the file was accessed with a confusing navigation system. The Intranet would provide the information on the file as soon as the user accessed a link and was structured in a more logical manner to the users. Within the TCN project, the systems of Praxis and NMM are combined to create a corporate wide, networked training system providing wider options for content, times and

location.

While each application provides the capacity for technical convergence, the demands on content creation and delivery placed considerable demands upon BigBank. These demands were met incrementally across the projects: functionality was deployed and extended once successful. The TCN system was made possible by the success of the NMM and Praxis systems, supporting Gilb's (1988) belief that big systems develop from successful smaller systems.

The complications experienced in sourcing multi-channel content lend credence to Fransman's (1995) scepticism regarding the actual level of convergence. While Fransman's concerns are directed at the macro market, by implication they question micro organisational aspects.

Each system was created from configurations of component technologies. While some of the components were used across projects, e.g. HTML, no stabilised design emerged.

Project	Component Technologies
NMM	Network equipment, Microsoft NetShow, HTML, Microsoft PowerPoint, Silicon Graphics content editors, VHS and audiotapes.
Praxis	HTML, ASP and Microsoft FrontPage.
TCN	Microsoft NetShow, NetMeeting, HTML, TV streaming, Internet Explorer browser, C++, ASP and JNM Company's application.

Final integrated system designs varied but were constructed from standardised component offerings. These technologies marked a departure from the discrete multimedia applications BigBank had used previously. The emergence of integrated systems was assisted by the realisation that the BigBank network could support multimedia applications. Programs previously run on individual client machines could be distributed more effectively across the network.

In the first case study, the Technology Department believed that the network would be unable to handle the loads required without readjustment. With this perception reassured they became comfortable in supporting this expansion.

The possibility for distribution meant that new mediums could be created which would provide content in a more timely and user-friendly manner. The content already existed but was not always in formats that were uniformly acceptable. With this distribution potential, a wide number of possibilities now existed. However, an organising mechanism to share this content remained a major challenge. This organisation required not only technological consideration but also the structure for content governance and management.

The potential value of multimedia innovations for BigBank positioned them as an attractive opportunity for advancement. Multimedia's emergent state presented a 'greenfield' ownership situation for actors to claim. Societal attention around the multimedia revolution, both within consumer and corporate spheres, was coupled with attention from senior figures within the bank.

Before any project could occur it required formal approval.

Every project required a business case in order to gain approval. Business cases needed to present a solution to an existing BigBank issue. This requirement allowed the BigBank's formal structure to ensure that the organisation's objectives were not neglected by employees pursuing personal agendas. Conventional business theory believes that business needs act as the driver for organisational activity. Our study presents contrary findings with business needs retrofitted on to each project all of which are initiated to serve as vehicles for the advancement of actor's personal agendas.

The official objective for NMM was network testing to assess multimedia capability, although the initial motivation was curiosity around Microsoft NetShow. The BigBank Technology Director's motivation to have an intranet because other companies had them became transformed into a business case on the best way to share data offering the capability of providing the 'one true word' thus replacing the archaic J-drive system. TCN's benefit as a cost saving system, built on expanding use of the Board's satellite TV investment, emerges from a high profile project for its champions.

8.3 WHAT CHANGED?

8.3.1 Introduction

The innovations viewed within the cases studied created a number of social and technical impacts for BigBank. BigBank moved from using discrete multimedia technologies to integrated solutions. This was combined with an increase in scale and importance of these systems as they moved from experimental tests to corporate wide applications.

A number of areas were required to be involved in order to allow sourcing, configuration and delivery of these systems to BigBank, impacting the role and requirements of the Technology Department. The realisation of the network's capability to support multimedia applications was a key stage in the emergence of integrated offerings within BigBank. This allowed migration from the stand-alone CD-ROM delivered applications to TCO/IP delivered applications.

The migration of multimedia applications to the network altered the possibilities for information delivery. Delivery over the network allowed information to be delivered in a more interactive and timely manner. This in turn required revised sourcing options for content. New options required content to be sourced in timely manner from a range of sources. Content sourced also required technical compatibility in order to be inputted into the system. The complexity of this process was consistently under-appreciated. Developing and delivering these innovations placed new requirements on the expertise of the technology requirement through the necessary dual appreciation of both technical and business issues.

8.3.2 Network Use Changes

Revised understanding of the network's capability to handle multimedia applications offered the possibility of corporate wide, integrated multimedia systems. From being viewed as a support system for current bank operations which would require considerable change to support multimedia traffic, the results from the NMM tests change its perception to that of an enabler for multimedia traffic. This opened up a number of attractive options for integrated applications thus increasing its value as a power resource.

Shift in perception was a result of both technical and social factors. In the NMM case, the group was involved in the tests to examine the possibilities of sending multimedia content over the network. The Technology Department believed that they would need to make changes to the network in order to make it capable of handling this task. This existing capability did, however, prove to be sufficient. It was not only sufficient but offered a number of advantages which consequently enhanced the perception of the network.

Transmission of multimedia content via the BigBank network offered economic benefits compared with broadcasting over the existing satellite link. Additionally, faster data updates were possible than with CD-ROM. Alterations to multimedia CD-ROMs required them to be remade. Material shared over the network merely required updating on the server to be available.

The BigBank Network was already a considerable power resource within the organisation with its support for key bank operations. It was the power resource around which the Technology Department positioned itself as the obligatory point of passage with any operation to be performed on it having to be qualified by them before it could be added to the network.

Due to the importance of this resource for them and their responsibility for its operation, they needed to be very conscious of any threats to this situation. For this

reason when systems were to be deployed in the live system, they had to be tested and approved as the technologies used within the projects did not exist in isolation and their operation impacted on the overall network performance. The results of these tests meant that they could not only feel confident of the effective operation but also expanded the scope of the Network as a power resource.

Providing training over the network placed it under the Technology Department's jurisdiction and ownership, raising potential conflict with an existing specialist group Learning Technologies. The logic of networked delivery was implicitly supported by Learning Technologies, external suppliers of training CD-ROMs, directing R&D activity in this area. In order for the department to feel comfortable using the network for this type of work, it needed to believe that the system could provide both stability and acceptable speed which could only be answered by a network assessment. This was set as a business reason for the NMM project.

The network needed to remain stable withstanding the additional loads placed on it. We see this as a requirement in each project. The transmission of various multimedia loads in NMM set a benchmark of BigBank network's capability. The tests carried out during the NMM project supported the network's ability to handle the web pages of Praxis and rich training broadcasts of TCN.

The Technical Department was wary of the impact of additional loads. As a result, the business reason for NMM was concerned with finding how far the system could be pushed. By discovering that the system was sufficiently robust to accommodate additional multimedia loads, the department had the comfort to engage in the TCN project. As noted, this original vision would enable the loads to be transmitted via the network instead of the satellite link which was eventually used for other financial reasons discussed later.

Usability requirements dictated that speed of transmission was an important aspect of performance. As previously discussed in reasons for change, a major attraction of multimedia technologies was the possibilities that they provided for interacting with information. These possibilities were limited if the system took an excessive amount of time to provide the information required. This requirement was due to the social factors of actors' impatience.

Within the TCN system, if the responses took too long to be received, the flow of the lesson would be disrupted while in Praxis if the pages took too long, the user may give up. The demonstrations of the work on the NMM project made the Technology Department and stakeholders confident that sufficient performance

could be achieved. The proven ability of the network to handle rich loads at a satisfactory transfer and quality level shifted perceptions and raised new possibilities.

This change was not due to any individual technological change. The network had been set up to allow BigBank to perform a number of other operations. Its ability to support these multimedia initiatives/technologies was a fortunate by-product. The technical reality of the network did not change, only the perception changed. This perception changed within the minds of a number of relevant individuals creating shared interest.

This shared interest opened up other possibilities for the network use for multimedia technologies offering new technologies and power resources that the Technology Department could affect and own. The actors associated with the network and testing gained reputational expertise and social learning concerning the implementation of multimedia systems on the BigBank network. This knowledge encompassed technical issues as well as adherence to organisational standards which could potentially exclude certain innovations. For example, the technological direction of Learning Technologies CD-ROM technology excluded them from network inclusion.

The above evidence goes against the linear model of innovation and determinism where the direction of technology development is considered inevitable. The innovative possibilities for the network are opened by the NMM project, which was only engaged due to the interest of the Change Planning Executive in Microsoft NetShow and the Research Group's efforts to justify this request.

As can be seen, revised perception was an important shift for the network. While it did not affect the technical content of the network, the resulting projects it encouraged would have implications that required alterations in other areas of BigBank's technology infrastructure. One of these areas impinged upon was the equipment required for these projects.

8.3.3 Required Equipment

Migration of multimedia systems onto the BigBank network required enhanced equipment to input and access multimedia content. Revised requirements necessitated improvements in operating systems and machine specifications. Within the NMM project, equipment of a particular specification was required for capturing and converting the material, whereas in Praxis the machines required to run Windows NT, instead of 3.1, and had to be upgraded in order to perform at the desired level. In some situations, the required standard could be met. Where this was not possible, trade-offs occurred around system capability and direction. These

restrictions were due to political, economic and social reasons demonstrating social shaping of the technical trajectory.

PC operating systems offered opportunities and restrictions on content creation and processing possibilities. Parallel to our study BigBank was migrating their standard operating system from the antiquated Windows 3.1 to the more advanced Windows NT. As a result of the size of BigBank and the number of PCs, this process took considerable time so for an extended period BigBank had different sections operating on different systems.

The implications of dual systems were particularly evident within Praxis but affected each case. For content to be developed for the Intranet, developers required access to an NT machine as the FrontPage application would not run on Windows 3.1. It was then necessary that a development infrastructure be in place, which allowed content authors priority access to machines that were on the network. This priority need had to be communicated to the NT Supply Team by the TCN project team for early accessibility.

The requirement for NT machines for development was also true for the TCN project but at this point the company rollout was further along and they were more prevalent. Whereas the Praxis project could have users access the Intranet from Windows 3.1 machines, although not very well, the TCN system required that users must have NT machines. This was due the higher requirements of the application. In addition, the PCs had to have video cards installed when it was decided that the TV pictures would go via them as opposed to the existing TV sets.

Due to the importance of the operating system both in terms of development and access, the machines were seen as a power resource with those actors who determined the priorities for allocation holding a strong position. The teams in both cases managed to gain an influence on this allocation process. For Praxis the sponsor was the Technology Director so the project team was able to trade on his position in the formal organisation. The Intranet team then used this as an enlistment tactic with the Content Co-ordinators. In return for providing their time on the project they would receive priority for machine allocation. For the TCN project, a smaller number of machines were affected and with Board approval it was a straightforward task to influence this process.

The inclusion of the required equipment to allow the content to be captured, created, shared and managed successfully was an important piece of the infrastructure required in each project. As detailed above, both Praxis and TCN required this but for the NMM project higher specification machines were important. Because it was an isolated project setting up a couple of boxes was not as great an

issue compared with the TCN and Praxis projects which required rollouts across multiple business units. Without these machines and the appropriate software and operating systems, none of the development for that project could have been carried out either, so equipment was a constraint factor that had to be managed. For NMM this equipment was donated to the project from the IT Services for involvement in the project that would allow them to understand the implications for the network, their key area of responsibility.

Until these pieces of equipment were in place, trade-offs had to be made regarding the functionality of the system. With Windows 3.1, the colour palette was limited to 16 colours constricting design. Also performance was worse than on Windows NT so more interactive and richer content could not be used. Thus we see these socio-economic factors influencing the direction of the innovation as everything had to be developed to the lowest common denominator, Windows 3.1 until the whole bank had Windows NT in place. Also the lower machines' specifications meant that while the network could supply content at the required speeds, the client machines could not handle it. The project innovation had to be engineered to account for this.

8.3.4 Content required important consideration

Multimedia technology's purpose of providing new ways to access and handle information makes it critically dependent upon content. Users expected benefits when accessing and handling information. Functional benefits were secondary to the value of the information contained in the system. If the information was valueless, users would not waste their time accessing the system no matter how pretty it looked. The integrated, networked multimedia offerings studied offered new possibilities to increase functionality and value of information delivered compared with previous methods. Possibilities existed in many ways including format, relevance, production, accessibility and sourcing.

The possibilities of integrated, multimedia technologies differed from the previous discrete CD-ROM and video conferencing applications used by BigBank. While both offered interactive media-rich experiences, they were restricted by freshness of data and audience accessibility, respectively. Information on CD-ROMs was only as recent as the date of its creation, whereas video conferences had a limited number of participants before they became impractical. Networked multimedia applications allowed the widespread dissemination of information utilising a variety of media that could be updated as regularly as necessary.

These possibilities had extensive organizational and technical ramifications

for the process used to access and update the system. Throughout the case studies, the value to the system of the information contained within it and the complexity of providing this information was evident.

Use of existing content was important in order to ensure the NMM tests were relevant to BigBank operations. Within the Praxis case, this status was more clearly defined by the team who stated that a core part of the system which it offered was the 'one true word', content that was relevant and reliable. Within interviews, users stated that their use of the system was largely dependent on the relevance of the information held on it to their work. For the TCN, again the system value was based on the information on it. The network was only of use during broadcasts of training deemed valuable by employees.

Appreciation of the value of information offered a valuable insight as most studies of multimedia have focused on the functions offered, and technical infrastructure required, rather than the importance of the information provided. From these cases, the success of the system is critically dependent on content.

Content sourcing required inclusion of previously disparate groups

In order to provide up to date content, the system would need to ensure that it was able to source required information from relevant owners within the organisation. This presented another possibility for conflict with existing specialist groups.

In order to fulfil this process project members require appreciation of the business value of the content and the technical issues when entering into the system. This required hybrid skill to understand how to present and how to get it there. In order for this new channel of delivery to function in each project, the above factors had to align to create an appropriate infrastructure. As with content, this infrastructure was both technical and organisational covering the physical network, skilled resources and equipment along with structure to support it. This required previously disparate groups to work together as a community of interest.

In conjunction with considering the technical needs for content population and skill mismatches, the project teams were also faced with the issue of creating channels within the organisation for that content to be sourced and submitted.

A process for sourcing content is present in each project. The sourcing process develops increasing sophistication through the projects: from the ad hoc sourcing from siloed sections of historic content in NMM, through the Content Co-ordinator network in Praxis which collects current data, to the up to date visual and dynamic training information of TCN.

Within the NMM project, content was collected in an ad hoc manner with the development team concerned with older content that had been used by the bank. This was because the tests had to operate in isolation and not provide the base for an ongoing system. Praxis and TCN both differed fundamentally in that respect as they were both part of ongoing initiatives and currency of information was of greater importance. As a result, they required not only the information to establish the system, but also the creation of a governance structure to support ongoing, timely submission of content. In Praxis, the Content Co-ordinators who source, channel and vet the content for their areas of responsibility facilitate this content submission. This would be an unfunded role so in order to enlist these parties they were provided with training in web technology, priority in distribution of new equipment and involvement in an area which would benefit their advancement. This is also apparent in TCN but the existing trainer group fills the role of providing the new content. This also provided them with access to a new and valuable skill.

A key reason for the need for organisational structures is to manage ownership of content. In NMM the development team needed to identify and source from the existing content owners. Praxis does this but takes this a step further as, by creating an ongoing route, it demands a shift in the existing organisational structure which the Technology Statespeople need to find a way to make palatable to each section.

This navigation of the ownership of data, which acted as power resources, is critical in order to move from informal organisation to formal organisation. First the Technology Statespeople had to gain agreement for access from the existing content owners.

One way of dealing with the shift in organisation is where the power relationships of content owners are not adversely disrupted. In NMM, this was the case as it was a one-off which provided new avenues for the content owners to share their information. The information was also historic so of lesser value. The content owners in return received inclusion in the reputational network about the use of networked multimedia technology.

In Praxis, the development team sought to maintain the ownership by planning decentralised publishing. This would allow the existing owners, once they had the required skills and knowledge, to manage the publishing of their own content in the new system. By recruiting a member of each of the sections to act as Content Co-ordinator they gained an advocate within the section to assist in the running of the system but also raised visibility of the entire project. The sections were also coerced into joining by this reputational network with the 'published or be damned'

manifesto. When a critical mass of sections had joined, the others were obligated to participate themselves. It was also a useful medium to publicise their department activities.

In TCN, the ownership remained with the training group and was not threatened as the trainers were brought in at an early stage to aid system design for their needs. The group excluded was the Learning Technologies group who had previously provided the medium of communication via CD-ROMs. Responsibility for the training content remained with the trainers and they were provided with another outlet.

Throughout the projects, the key was enlisting an agreement from the content owners to access the personnel who would own the new delivery channel for content. With permission thus established and content owner participation, it was then important to define a procedure for smoothly transferring the content technically onto the system.

8.3.5 Technical Complexities of content creation were underestimated

The technical complexity of capturing, converting and delivering content was underestimated in every project. No consistent method of content creation emerged across projects. Differences were evident in the sourcing and conversion of content for transmission in NMM, the production of information on web pages for Praxis and the application of training materials in TCN.

Difficulties were driven by two key factors: lack of an agreed technical format and limited facilities to develop content. As a result of the newness of the technology generally in society and specifically within BigBank, IT facilities to perform content creation were limited. In order to determine what facilities were required it was first important to know what type of content was acceptable.

Format Technical Capture and Transmission

In order for the system to be technically viable, each project had to have the technical means to populate and share the relevant content in a manner easily accessible and manageable by the users. In each of the projects, we see that the formats which the system uses can pose a barrier to information being transferred to the system. This is due to technical barriers against converting between different formats. In some cases, this was merely very difficult, in others impossible. In order for the content to be provided and shared in this manner, it needed to be available in a format technically compatible with the delivery system.

Different formats were required throughout the projects: for the NMM case, the Microsoft proprietary .asf format for Microsoft NetShow, the HTML format for

Praxis and also a mix of PowerPoint and HTML for the TCN plus video broadcast. The ability to meet these requirements, would serve as an inclusion or exclusion factor for the systems.

As we have seen, each case was faced with the issue of formats and standards. Moreover they had to deal with a number of issues in determining how to tackle it. They needed to identify the current format of the content, if and how it could be converted and the facilities required for performing this conversion.

Invariably, the format of the existing content was not of the type required for the new multimedia systems — from the Microsoft Word documents for Praxis information to the VHS tapes on NMM. For many of these, upgrade / conversion paths were possible. The exception was the training CD-ROMs provided by Learning Technologies in the NMM case.

The CD-ROMs were designed for a stand-alone proprietary interactive training exercise, representing the previous era of multimedia with discrete, broadly standardised offerings. In order to convert the information in these CD-ROMs, all the content needed to be stripped out and rebuilt in the NMM system as would happen later in TCN through the trainers' involvement. In the TCN project the use of the trainers and their PowerPoint materials in a live broadcast delivered the content of the training. This was the content that was buried in the CD-ROMs in an incompatible format. By using the trainers directly, the technical barrier was lifted. Conversion was too large an undertaking and was therefore left out of the NMM project. This technical isolation is indicative of the Learning Technology section as a whole, as will be discussed later. This situation demonstrated the ability of BigBank to reverse the technology choice of multimedia delivery through CD-ROM in favour of network delivery as well as the costly obsolescence of technologies developed against the standards for un-networked multimedia technologies.

Content conversion facilities were scarce

For other formats such as the aforementioned Microsoft Word documents and VHS cassettes, while the conversion paths were more amenable, they still required appropriate facilities for the conversion. Locating and accessing conversion facilities presented a constant problem.

In the NMM case, the problem was at its most severe in locating equipment that could capture and convert the video loads and transfer the large files to the test environment. Robust network facilities were sourced from EUCS alongside the laboratory network testing facilities and knowledge resource for inclusion in the project and access to data.

In the Praxis project, while the network could support the transfer, the applications required to perform the creation could only operate on Windows NT which was in scarce supply. The software acquisition was discussed in the equipment section.

A specialised studio was required for TCN, demonstrating the investment required to ensure content was of the appropriate technical format. This was gained by involving Studio Videos who already provided BigBankTV working for Corporate Communications sponsors of the TCN project. In addition, the Board backing and budget secured these facilities.

Sourcing issues required the Technology Statespeople to align the required resources through negotiation with resource owners. The EUCS resources were made available to the NMM team through the negotiations of the NMM Project Manager with Technology Strategy who had paid for the resource for some of their existing projects. The EUCS contractor then provided additional time due to his own interests in the Multimedia area. So we see the incremental development of the social network which is supplemented as the Technology Statespeople trade access to their power resources in return for required resources. This is where we see the importance of the informal organisations which work to align resources which the formal organisation could not given the level of justification which would have been required but not obtainable at that point.

When the content could be transferred into the appropriate format, the development teams still had to consider the design characteristics particular to the new format. Multimedia technologies provided new presentation channels for content, each with technical constraints and resultant design limitations.

Technical aspects imposed visual design considerations

In the NMM case, the design limitations were only apparent after the content had been created. The key problem was that a lot of movement within the videos exposed the low frame rate. Because the frame rate was less than for TV, people would respond adversely to the video. The best way to minimize this was to shoot the video with 'head and shoulder' camera shots. Unfortunately, when this was discovered it was too late and costly to re-shoot the videos in this manner. In an effort to minimize this visual weakness, the videos were shown on smaller screens where the deficiencies where less apparent.

For the Praxis case study, the medium of web pages was a better understood quantity but migrating the information from Word documents required consideration and pre-planning. The layout of the content would be altered to allow for the new

hyperlink navigation options and the data size of the file would need to be considered. The size of the file affected how long it would take to transfer it over the network and ultimately display it. This related to the importance of speed in the network as noted previously.

Within the TCN project, considerations had to be made about how the training content could be delivered over the network in a way which was useful to the trainers who were used to a traditional classroom situation. For the trainer and student, the interfaces to the content had to accommodate the new situation without losing the training benefit.

Each of these situations was new to the organisation. The previous depository for data was the J-drive, a file server with an extremely limited graphical interface compared to Praxis and without the multimedia capability of NMM or TCN. The CD-ROMs and classrooms used for the training previously did not offer the combinations and possibilities of the TCN system.

The complex consideration necessary for multimedia content supported the increasingly multi-disciplinary nature of innovation with an expanding range of interest groups and knowledge required for successful innovation, implementation and utilization (Burns and Stalker, 1961).

Through the case studies, we have seen changes in how the organisation aligns itself to deliver this type of project effectively. To support this requirement, the skill base for the organisation needed to be altered to meet this need.

8.3.6 Required Skill Base

Expanding knowledge, interest groups and complexity within multimedia innovation exposed gaps within BigBank's expert resources, which the Technology Department attempted to fill. Expertise gaps occurred around web skills and broad delivery expertise for multimedia technologies. The Technology Department lacked actual hands-on development skills and, as evident in the Praxis user interviews, a general lack of awareness of multimedia and web technologies existed.

Within the NMM project, the team required the ability to understand the presentation, message, development requirements and system issues, for technology unfamiliar to the Technology Department. Praxis needed web skills and understanding of requirements of different business units. For the TCN project, BigBank had no resource with experience in developing systems of this type but needed to combine previous project experience.

BigBank users with awareness and experience of multimedia technologies tended to be younger, junior employees who had experienced its use at college or

university. This meant that the more junior employees often had a more advanced understanding of the technology than their seniors. In interviews for Praxis, this factor contributed to a feeling of frustration amongst the junior employees about the perceived lack of progress within web technologies in comparison with systems they had used previously.

Employees did not have access at work to the Internet due to security issues surrounding outside access to systems. While in their home environment, they wanted a break from the technology they worked with all day. This sentiment was expressed by a number of Technology Department employees during the survey interviews.

Project teams required not only awareness but the capability to understand, technical, business, design and process aspects to deliver. This was a gap within the organisation and required hybrid expertise combining technical knowledge with business understanding. This is a common feature for organisations tackling emergent technologies (Fincham et al., 1995; Williams and Proctor, 1996). In order to cater to this requirement, the project teams had to provide the solutions through a collaborative network with actors from within and outwith the organization. These groups were similar to the types viewed by Williams and Proctor (1996).

The Technology Statesperson had to operate as a generalist specialist (Fincham et al., 1995) who co-ordinated all the parties involved in the development of new configurations in order to align and operate these groups. These groups acted as a conciliatory force for the firm's knowledge and expertise base. This meant that the Technology Statesperson needed to have social skills to build these groups as well as the technical skills to execute them. Each project studied possessed a requirement for hybrid expertise as outlined above but each varied in how these were mobilised.

Project resourcing was a relatively pragmatic process but suffered great complexity. The procedure was complex because expertise was evolving and hybrid so people did not necessarily exist who possessed the requisite skill set. In addition, people within the organisation did not have the experience to define what that skill set should be. As a result, use of reputational networks to ascertain ability was necessary.

During the course of my study, the organisation developed increasing capability to accommodate the required expertise for multimedia innovation. Aspects of Pettigrew's (1975) belief that specialisations develop through an evolutionary process are evident although no formal grouping emerges.

Within the NMM project, all the development staff came from external

organisations in the shape of EUCS. With the Technical Strategy, IT Services and Learning Technologies being brought in as necessary by the Research Group to provide their particular domain expertise. As a result, no special organisational changes were required. During the Praxis case study, we see the web development capability formalised and placed within the Communications team, altering their remit from largely offline print work to online Intranet activity as well. This group is only responsible for the Intranet for the Technology Department. In order to accommodate the need for deeper development knowledge of web technologies such as ASP (Active Server Pages) and to add dynamism to the Intranet, the firm recruits labour. This labour comes in the form of contractors who end up forming the majority of the skilled resource required. For Praxis, the Lead Web Developer and part-time Developer are both contractors as is the ASP developer who was hired.

The more sophisticated multimedia applications developed within TCN required extended skill sets to be accommodated. During the case, we see the Research Group Project Manager using a number of strategies to create a formal department as an 'Intranet Centre of Excellence' which will hold the 'power resource' of the multimedia capability formalizing the Research Group Project Manager's role. In the TCN case, only the Project Manager was a BigBank employee. The problem this strategy creates is that maintenance of a key technology is subsequently reliant on resources BigBank does not 'own'. The issues this can cause are evident when the Technical Lead for the TCN project leaves for six months to get married and go on honeymoon. A full time employee's holiday allowance would not allow for this length of absence, thereby guarding against the problems it can create.

Through the projects, we see the new skills become more entrenched and formalised within the organisation. Reputational networks (Whitley, 1988) form, combining expertise to deliver projects. Members of these networks are enrolled repeatedly across processes as their knowledge claims become entrenched through perceived success. The social learning gained by actors through these successes gain increasing importance as multimedia adoption grows, generating increased need for BigBank to provide expert support. Innovations driven by the informal structure thereby impact the formal structure. As the formal structure begins to use and see value in these innovations, they must protect their investment and reliance with organisational support. The creation of formal expertise capability relies upon qualitative judgements referencing intangible metrics such as reputation. The evolution of web capabilities across projects from NMM ad hoc team structure to the proposed formalisation of an 'intranet centre of excellence' in TCN supports the

evolutionary development of specialisation (Pettigrew, 1975) through a socio-political process (Wood and Kelly, 1982; Cockburn, 1985; Burns and Stalker, 1961). Consideration of the development of expertise and ownership of knowledge across projects shows this broader social process.

For the NMM project, ongoing ownership was not an issue as it was an exploratory investigation. While a temporary team was established to conduct the project, ownership within the organisation rested with the Research Group who then organised the sharing of the project discoveries with the relevant parties. The demonstrations and results of this work were used to enhance the Research Group's perceived capability to perform multimedia work. Research Group's revised multimedia knowledge claims were reinforced when the development resource they used for this work was brought into the TCN project. This provided benefits to the TCN on two levels, primarily the improved perception through use of expert resources but also the transfer of social learning from another multimedia innovation.

During the early stages of the Praxis project, ownership was held by the temporary team headed by the Research Group Project Manager. The ownership was then formalised and placed with the Communications Group causing a large expansion of their areas of responsibility. This in turn caused the addition of new positions in their team, e.g. Web Developer, and placed them at the centre of the Content Co-ordination network. Associated training courses in web skills represented a formal investment in this technical capability. This was typical of the firm as it found formalising ownership of artefacts easier than establishing expert groups. By setting ownership of the system, expertise was focused on the owner group. The Research Group Project Manager did not accept the formal managerial role as the level of seniority did not fit the personal agenda.

For the TCN project, a new section was established to own the project. Challenges emerged as they worked to set up and develop interdependencies to other sections in order to fulfil their role. This led to attempts at establishing an Intranet Centre of Excellence. The Research Group Project Manager worked to position herself as the head of that section. She aligned herself with other actors and created a reputational network to legitimise her capability to run such a section and to justify the need for it. As this was a new area, she avoided accusations of encroachment common with the development of new specialisations.

Internal actors were reliant upon reputation built upon previous history and validation from other actors. This supports the role of reputational networks (Whitley, 1988) to support knowledge claims and therefore perceptions of technology value. Knowledge acquisition and capturing social learning during the

process of expertise development are only valuable if they can be presented and gain legitimisation with a wider audience. NMM demonstrations and 'word-of-mouth' publicity from community members were essential for those involved to establish knowledge claims. Similarly, the value of capability of the Praxis team is disseminated and established by Content Co-ordinators and 'Friends of Praxis' communicating to the user base. The Research Group Project Manager conducts presentations within the firm raising profile and perception with influential actors. For TCN, perceptions and exposure are critical to success. The 'spin' tactics and presentations of the Senior Corporate Affairs Executive and the Corporate Communications Executive legitimise claims with the BigBank Board.

These tactics allow both individuals and groups to establish and legitimise their reputations. This is important because when they are viewed as having valuable knowledge or expertise, their ability to advance their influence in the organisation is enhanced.

The very nature of multimedia as a communications tool lends itself to the creation of expert reputation as the system owners can use it to promote their role and can be contacted through it. Its use is very visible and this allows its owners to raise and promote their involvement.

The fact that the Communications Group is viewed as the hub for Intranet activity in technology with the Research Group Project Manager involved in the corporate rollout, attests to the legitimisation of their knowledge via this method. This supports Pettigrew's (1975) assertion that knowledge claims are legitimised by gaining recognition of knowledge claims, allowing them to act as owners and traders of that knowledge.

8.3.7 Formalised accommodation of technical resources: responsibilities of support

In order for multimedia applications to retain an ongoing role within the organisation, the formal organisation must make accommodation for them. Reorganisation was required in order to accommodate this inclusion. The most obvious formal change that happened with the decision to introduce new technology, was the acknowledgement that the organisation would support it. This required compatibility with existing organisational standards, and, where necessary, the creation of new standards. Organisational standards are designed to ensure cohesion with existing technology and ensure appropriate support resource is available. Recommended principles for standards are consensus, usability, feasibility and harmonisation (Ruggles, 1990). The bank's adherence to these principles was ad hoc

and subjective. While some principles were followed to varying degrees, socio-political drivers were apparent behind some of the standards.

Standard compliance was most rigorous concerning the inclusion of multimedia technologies on the bank Network. The support for this was the responsibility of the IT Services group within the Technology Department. This is why this section is included in each project.

Through the projects, we also witness shifts in the formal organisation to support the innovations and resulting systems through the creation of standards and guidelines concerning the initiatives. IT Services helped setting up the test bed for NMM to give an accurate indication of the issues they would face with multimedia content. For Praxis, the IT Services team approved the system and had maintenance handed over to their Web technology team. For TCN, the IT Services team was brought in at the inception so the development team could understand what they required to ensure a smooth transition onto the network.

Standards for multimedia evolved through the projects as the Technology Department gained knowledge and understanding of the technology. Tests performed in the initial NMM case confirmed conformance to previously existing standards and established a benchmark. Key deliverables from NMM were the technical quantification of the broadcast options and guidelines/lessons learned on how to achieve the best results when sending loads of this type. The social learning gained during this project were distributed within the Technology Department through the use of expert resources in subsequent projects. Difficulties experienced during content conversion supported the need for the harmonisation within standards. In order for the information to be shared effectively, it needs to have been made available in the correct, agreed format.

The Praxis project established content sharing standards and via the Content Co-ordinator network, a method of diffusing and governing these standards. Unwittingly, this also served as a channel for actors to share social learning across the group. Training courses also supported standard adoption. Acceptance of Praxis standards was a key stage to allow decentralised publishing.

8.3.8 Formalisation and Evolution of Standards

The creation and enforcement of standards can also exclude and marginalise actors and groups. A number of intranets that pre-dated the Praxis system were eliminated or absorbed as a result of the standards propagated by the Praxis team. Praxis was established as the premier intranet through senior approval and faster user growth. Previous intranets generally covered a single section preventing them from

building a critical mass of users, an important stage in establishing standards (OECD, 1991). Control over standards provided the Praxis team with governance of intranet style, publishing and management so their power was legitimised.

The ascendance of networked delivery of multimedia and associated standards drove the CD-ROM based role of Learning Technologies into obsolescence. At the outset of our study, Learning Technologies, a department in Human Resources, was responsible for multimedia training delivered via CD-ROM. CD-ROM was the sole medium accessed via stand-alone PCs. The department's combined technology and training function had evolved due to initiatives in the Human Resources section that could not be satisfied, at the time, by the Technology Department due to lack of expertise. Because the technology did not impact on the other technology operations, their existence outside the Technology Department was accepted. The new possibilities for networked delivery changed this amicable situation.

Incompatibilities between the standards for stand-alone clients and networked delivery emerged immediately. The stand-alone applications were rendered obsolete by the new networked direction supported by influential actors, thus reversing this earlier selection. The ability of the TCN system to provide a superior training experience combined with the Intranet was a compelling argument. It was no longer technically realistic for the section providing this to exist outside the Technology Department. The area of ownership held by Learning Technologies was being undermined by shifts in technology and organisational logic and requirements. As a result, the section was disbanded having been usurped by technology and the responsibilities it held split between the Training function of Human Resources and Technology Department. As a by-product, social learning was retained and shared within the employees' new roles.

The evolution of multimedia standards occurred through a process of consensus shaped by environmental factors. Consensus building was linked to communities of interest created by Technology Statespeople. Acceptance involved negotiation and acceptance of a mutually beneficial option which was not necessarily rigorously considered. Consensus was rarely aligned along other logical principles of standards which seemed secondary to political acceptance. This demonstrates social shaping within the creation of standards and the influence of informal structures on formal. The reason there is so much interest in influencing the creation of standards is that they are strong tools for implementing power maintenance strategies, allowing the inclusion or exclusion of certain areas.

The requirement for this adherence to these standards necessitates some group to enforce them and to enable sanctions on non-compliance. This responsibility for standards provides a great deal of power to the controllers of these standards with regard to excluding or including parties from access to these power resources. By employing the adherence to standards, the organisations and various power holders within it were able to exert a level of control.

Socio-economic elements affected technology standard formation. The Microsoft NetShow development tool was selected due to the project sponsor's interest and low price. Similarly, the development tool for Praxis content, Microsoft FrontPage, was selected due to economic considerations as it was free and the design guidelines were set due to the whim of the lead developer. Selection of a proprietary Microsoft standard endangered future technical options. This goes against Ruggles' principles as well as failing to embrace existing standards. The standard used for the bank CD-ROMs was such that it did not translate into ASF so all the material built up on that medium was rendered obsolete. This was a self-inflicted redundancy as the standards used there had failed to follow the principles outlined and in themselves had inhibited technical innovation by not following any of the general market standards.

In forming new standards, those perceived as having knowledge of these new technologies are called upon to give advice as to what these standards should be, allowing them to use reputational credibility as a means to determine them. So the involvement within a reputational network can benefit the actor's position and power in seeing their views expressed within the formal standards.

While the informal organisation will influence the creation of standards, it is ultimately the role of the formal organisation. This formal power can be used as a tool to ensure that the new innovations will operate in line with existing operations and thereby adhering to previous organisational decisions creating entrenchment along certain avenues of technical development. We saw, however, with the case of Learning Technologies that these decisions can be reversed.

Standards presented an important power maintenance tool and means for the formal organisation to create a cohesive strategy despite the influence of micro actors. The ability to reverse previous decisions was an important aspect allowing recovery from mistaken selection.

8.3.9 Role of Technology Department moves from creator to orchestrator

Through the cases, the role and responsibilities of the Technology

Department changed from creator to orchestrator, a shift observed in a number of studies concerning the organisational application of configurational technologies (Fleck, 1994; Fincham, 1995; Williams and Proctor, 1996). The Technology Department was required to create and align a community containing a number of disparate groups. Communities drew on both external and internal parties from business unit users, to technology suppliers, to technical specialists. Effective development required this group to provide relevant and effective knowledge, whether sourced internally or externally. Within each project, we witness the Technology Statespeople from the BigBank IT group acting as a generalist specialist (Fincham, 1995) through application of hybrid expertise to mediate each community. The ability to match business needs to technology possibilities was a core skill for Technology Statespeople and reflected the revised role of the macro department.

This is representative of the shift in the role of technology with the members of the IT department creating an interface for the organisation and various technical artefact companies and specialists. The Technology Department was able to provide local knowledge of the organisation to configure the systems bringing knowledge required to combine the components into a system that delivers the requirements for BigBank users. This changed the engagement between user and supplier and raised the challenge of defining who the user of the system was.

The change in the role of technology created a three-tiered relationship with the suppliers of the generic systems that were used by the Technology Department to create systems for the BigBank end-users. Within our study, the Technology Department seeks to moderate 'end-user customisation' (Williams and Proctor, 1996). Communities of interest create a composite end-user requirement moderated by BigBank standards. In corporate environments, there are multiple audiences and therefore multiple users. The Technology Department needs to moderate user innovation as complete personalization of systems would be uneconomic and unsupportable.

The Technology Department fulfilled the role of customer/user to technology suppliers. In reality, they are more of a composite 'user' as they drew together requirements from a range of users. In turn they presented technological opportunities to internal business units. While the motivation behind individual projects is actor's advancement, in order for any of its initiatives to be approved, it needs to demonstrate a business need and therefore a user need. As a result of the number of actors affected by the integrated multimedia application in our cases, multiple user types are involved. This complexity is appreciated within literature with various perspectives on user-led innovation, human-computer interaction and

user centred design methodologies. Each argues the importance of the users within the design process. Within our cases, these techniques were used sporadically and primarily to support the views of sponsors and team members. These actors served as 'proxies' for sections of the wider user groups, utilising testing techniques to legitimise their opinions.

Within the NMM project, testing was performed on a sample group drawn from university staff and students who were taken as being able to represent the end-user group, as they represented a similar demographic balance and skill set to bank staff. Test results were favourable and supported the legitimacy of project results but the opinions of influencers within BigBank, such as Learning Technologies and Corporate Communications exerted greater influence in designing the usability of the system.

The Praxis system survey also gathered user views which were used to validate the roadmap for future Intranet developments. Decisions on what initiatives to engage in were effectively agreed before the results were received as the manner in which the questions were asked was slanted to support these decisions. For example, the need for greater interactivity, supported by the survey, was a view the section had received from the Content Co-ordinators and had already been acted upon. The survey merely provided the illusion of involvement within design.

For the TCN case, the involvement of the trainers from Human Resources provided support for the system as well as bringing in the content. The trainers also had a more direct input into system design than users in the other cases as they were given the resources to design the 'look and feel' of the system.

From this evidence across the cases, we see some use of HCI techniques with user testing and surveys but the direct results of these are far less significant than the socio-political direction for actors within the community of interest. In no case do we see test results influencing the development of the technology. In contrast the social shaping aspects are evident and impact in each instance. These aspects are delivered by community actors who act as 'proxies' for the BigBank user group. The Technology Department operated to fulfil user needs in a manner they deemed best, as opposed to obeying the findings of best practice techniques. From their appreciation of the internal user requirements, they had to identify technology options within the market that could fulfil those needs. With Multimedia this required a range of component technologies.

The Technology Department's role in configuring systems is assisted by suppliers offering more-or-less standardised technological components that can be configured together on a pick-and-mix basis to meet user requirements, although as

witnessed with content, standard incompatibilities do exist. This has allowed components to be 'picked and mixed' to meet project objectives (Williams and Proctor, 1996). This allowed project teams to exchange components dependent on political pressures.

The Technical Department serves as a 'middleman' controlling the supply channel to end customer corporate bank. Both parties with whom they interact are reliant on their knowledge. The suppliers need them to identify the business issues their offerings can cater for while the business needs the reverse. The Technology Department essentially acts as a translator and guide for each party. This agrees with other literature which has studied the operation of Technology Departments in similar projects and found that situation to exist.

Whilst this was written at a time when most technology was built in-house before the move to componentised, configurational technology, the principles remain the same. As we have seen in the case studies, this link to external sources of knowledge is still required. The additional insight we receive here is the tactics required to maintain this role and the informal conflict and negotiation that occurs in trying to do this. This is due to the more visual, user friendly aspects of the technology which make it more decipherable by business users. This causes the Technology Department to have to act to reinforce their role as in TCN with JNM and BT.

Communities of interest require Technology Departments to manage a complex assortment of suppliers, users, sponsors and specialists. In this capacity, the Technology Department and its representatives acted as gatekeepers and moderators between the various parties. Managing these relationships offered the Technology Department an influential role. By managing supplier relationships, the Department moderated access to new technology options for the entire organisation.

Friction occurred between development teams and corporate bank relationship managers tasked with managing business units' awareness and adoption of technology. Conflict arose around when and how to communicate technology opportunities to bank business units. In some instances, development teams worked around relationship managers to present opportunities to gain momentum around particular initiatives, particularly Praxis and TCN. This provided the teams with influence over budget owners and suppliers. To business units, they held knowledge of technical opportunities while to suppliers, they acted as gatekeepers to the

potential revenue from BigBank. This provided a powerful but complex role similar to the IS Roles witnessed by Fincham (1995).[1]

Within the NMM project, Technology Strategy applied tactics to maximise benefit for BigBank from its supplier relationships strategy used for managing the suppliers of network equipment. BigBank used two suppliers, 3Com and Cisco, for network equipment and pitted them against each other for bids to supply equipment. Desire to advance their position versus their competitor motivated Cisco to offer equipment and facilities to the NMM project. From this, we see some social shaping of the technology within NMM as the choice to use Cisco equipment over 3Com was economic, based on the fact that they provided the equipment for free. It also met the standards set by the department limiting selection to Cisco and 3Com. If equipment had been offered from another supplier, such as Ericsson, it would have been unacceptable. Use of standards is therefore an important tactic in managing supply relationships.

With the power offered by this role, it is unsurprising that the department faced challenges from both internal users and external suppliers. Suppliers attempted to use alternative routes and political tactics to position themselves directly with decision makers within BigBank.

The TCN project showed an example of a supplier circumventing the Technology Section. Corporate Communications had met a company called JNM at some conferences giving them a direct relationship with the project decision-makers. This allowed JNM to sell their perceived abilities and establish themselves without the technical scrutiny that the Technology Department would have placed them under. The Corporate Communications section of the Retail Bank introduced JNM to the Technology element of the TCN initiative, with a view that the company could provide functionality for the interactive training.

At around the same time, another bank supplier BT approached the Corporate Communications Executive from Corporate Communications directly, instead of working through the Technology section, as they held the budget for the project. BT 'offered' to perform the work themselves as they argued they had better resources to deliver the project. This caused problems for the Technology Department as external parties had some advantages over the internal section when bidding for work. The

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[1] Fincham observed technology departments acting 'as the gatekeepers of external sources of knowledge, they largely determined the timing and scope of recourse to suppliers constraining interaction between in-house and external supply'.

BigBank business units have greater visibility of the Technology Department's resources and capabilities than an external party. This gives the external party greater latitude regarding the capabilities they can claim and the perception they create. In response, the Technology Department has to use some political tactics in order to enforce its position.

The JNM group were enlisted into the project by the Technology team to solidify their claim of expertise against BT. This proved successful but this situation shows the need for the Technology Department to use power maintenance strategies to protect their position. It also shows the conflict between technical specialists and hierarchical management. In order to allow leverage against the Technology Department, it could be argued that Corporate Communications demonstrated its options of selection when resourcing this project by speaking to both companies. The result was that Technology had to involve JNM despite their reservations about the technical capability of their solution.

The heart of the technology mission remained the operation of BigBank's technical infrastructure. Maintenance of these elements and its support of the activities in BigBank are core functions of the Technology Department as it takes the role of a Network Gatekeeper. This is the basis for this Department's operations, as all its decisions and, as we have seen, influence, revolves around this responsibility. As detailed, this task was a key lever for the Technology Department's increased involvement in multimedia. Without the test results of NMM, the subsequent projects would not have occurred.

The changes to the BigBank environment by Multimedia technology were driven by Technology Statespeople managing communities of interest. Communities operated through a complex dynamic affected by social, cultural, political and technical factors. The relationship of these aspects within the community would serve to forge the technical trajectory of the innovation.

8.4 PROCESS OF CHANGE

In the previous sections, we have looked at the causes and effects of multimedia innovation within BigBank. Within this section, we shall consider the model of innovation it follows and the factors affecting it.

In the case studies, we identified the twin forces of actor's advancement and technological opportunity that fuelled innovation projects. The innovations studied required a number of events to occur to advance. The project must be formally approved by the organisation in order to gain budget and official access to resources.

Senior sponsors played a key role in achieving this approval. Access to resources required this approval but also needed Technology Statespeople to enrol and align resource owners within a community of interest around the project to ensure access.

Projects tended to evolve through initial opportunity identification by the Technology Statesperson or sponsor: resources are then sought through enrolment and negotiation with actors. Formal approval occurs at some point during this process with the alignment of actors and resources being necessary throughout the development.

The process witnessed within the case studies supports the interactive model of innovation proposed by social shaping theorists, rejecting the deterministic model. The enrolment and interaction of the community members served as an important area in affirming this shaping process through social aspects impacting technical decisions.

We have seen a number of choices made during the process, for example to use NetShow for the testing of NMM due to sponsor preference. This supports the core precept of SST that technology development contains choices with uncertain outcomes, affected by complex social processes. Again in TCN, the JNM technology component, whilst technically inferior, is included due to sponsor preference and as the Technology Department seeks to protect its position.

8.4.1 Communities of Interest: An arena for choice. What do communities consist of? Variety of actors, suppliers, sponsors and users.

The technical trajectory of each innovation is a product of the community of interests creation, alignment and evolution. This is a process that involved the creation and selection of a number of choices and trade-offs based on actors' agendas and environmental considerations. These communities were informal structures acting to influence the formal structure. The existence, operation and decision making criteria have been the subject of numerous studies (Burns and Stalker, 1961; Pettigrew, 1975; Whipp and Clark, 1986) but here we gain a refined view across linked cases encompassing the pre-project stages.

The creation and constituents of each community of interest were driven by a Technology Statesperson, acting to fulfil the sponsor's initial agenda. Initial agendas included the technical evaluation of multimedia tools (NMM) to desire for intranet activity (Praxis).

Communities of interest were formed around these initial agendas which were shaped due to a complexity of factors including political motivations and

technical restrictions. Actors are enrolled due to their ownership of an artefact or skill valuable to the project which they provided, in expectation of benefits for their own agendas, through involvement. Communities succeed through enrolment of a 'sufficient' level of resources in order to gain formal approval. In addition to necessary resources, approval also required an approved business case.

Sponsor enrolment serves as the catalyst for each community. This occurs through a variety of means. For NMM, the Change Management Executive sponsor approached the Research Group whereas for Praxis, the Research Group Project Manager approached the Technology Director as her friendship with the Technology Director's Executive Assistant had advised her of the interest in intranets. With a sponsor obtained, the Technology Statesperson would proceed to create a community of interest around the opportunity.

Enrolling the Community of Interest

The Technology Statesperson would enlist this support using various tactics to gain this actor's involvement and support and more importantly gain access to resources required for the project. As discussed previously, the new technology represents a potential new power resource. In order for each of the projects to happen, the team needed to align existing power resources, e.g. equipment, access to network, expertise, and so on. The need and process to align the community supports Vergragt's (1988) view that 'doable problems' require the alignment of the technical and social worlds through the coordinated efforts of various actors. He further contends that in order to achieve this alignment, the structure and direction of technology must be negotiated as these aspects are aligned.

Within the case studies, the Technology Statespeople had to negotiate with the owners of these resources to gain access. Negotiation required alignment of the actor's agenda with that of the innovation in a mutually beneficial manner. What was beneficial differed from actor to actor through variances in their situation and agenda. They each possessed a different interpretation of the innovation and what it represented.

Much of the initial negotiation occurs during the pre-project setting. Pre-project trading gives an insight into how Technology Statespeople enrol actors into their network using quasi-commitments and setting informal expectations around the value actors will receive from their involvement when the project is formalised. Resources are aligned prior to formalisation in each project through informal agreements, which do, however, require formal approval to be actionned.

Actors enrolled in communities based on subjective judgments of the value the project would offer to them. This was often necessitated by the limited economic means available to these experimental investigations. During the project phase, no budget was assigned at all so any expectations were based on the subjective judgment of the project gaining approval. The use of quasi-commitments and potential benefits applied to external and internal parties alike.

NMM's sponsor possessed no budget but enlisted the Research Group due to his position as valued customer of standing within the formal organisation. The Research Group perceived benefits through gaining a hierarchical ally within the organisation and the opportunity to enhance their reputation for identifying and assessing new technology areas for the bank. The Research Group in turn enlisted Technical Strategy and IT Services by agreeing that the experimentation with NetShow could be linked with these sections' interest in the effects of multimedia loads on the performance of the BigBank Network. This negotiation created the business case for the project. This then went for formal approval as discussed later.

The perceived value of multimedia expertise served as a consistent lure for enrolment. The Praxis team traded on the 'buzz' around web/intranet technologies so that people would commit time feeling they were learning something that would allow them to advance their situation. The network of Content Co-ordinators was based on this attraction. Content Co-ordinators provided content and promoted the intranet within their departments. This function was unpaid requiring the employee to devote their personal time.

Content Co-ordinators were eligible for web training courses, a restricted and highly valued privilege. The cost of the course was covered by personnel training budgets assigned by the company. This provided the Praxis team with access to individual section's information content following the respective Content Co-ordinator's web training, a critical resource for the system to succeed. Access to and monitoring of this information was the value that the Content Co-ordinators traded on in order to evolve into valuable internal actors.

As projects progressed and multimedia gained greater profile within BigBank, actors became more interested in being involved in projects. TCN gained the interest of the training section through offering them a new interesting medium for training. This and the high profile, helped to enlist the support of the, recently arrived, Head of Training. TCN managed to get his buy-in by offering the opportunity to make a quick impression through association in a high profile project. The enrolment of Human Resources and the Training boosted the project's credibility.

In creating the community, Technology Statespeople need to consider not only the resources necessary but the creation of perceived capability. The involvement of Edinburgh University contributed to both elements. Edinburgh University's involvement was gained quasi, informal commitments in return for resources but more importantly, independent and academic credibility. The majority of the testing across the cases was performed using University facilities and resources. The NMM study used EUCS labs and resources for development and usability testing which was conducted on university subjects. Praxis user surveys were conducted by the participant observer who also worked as part of the TCN development team. The participant observer shared social learning from each project across the cases and Technology Statespeople used the academic association to support the credibility of the projects and results. The University participant observer also gained access to valuable case material.

In some instances, Technology Statespeople enrolled resources for perception alone, as they assisted marginalisation of competitors. The involvement of JNM within the TCN case was used to marginalise a competitive threat from BT and appease the wishes of the project sponsor.

JNM were a technology supplier who had managed to bypass the Technology Department and meet the Corporate Communications Executive sponsoring Praxis. JNM produced a technology offering that polled electronic responses and created GUI presentations of results with connected analytic ability. Their application had been mainly used at conferences, at which they met the Corporate Communications Executive. The sponsor was impressed by the application but investigation by the TCN team exposed a number of technical and organisational weaknesses in their proposition making it unsuitable for the bank. JNM were very enticed by the reputational benefits of working with BigBank as well as the possible future revenue possibilities. The perception of Corporate Communications was that JNM had proven expertise relevant to the TCN project.

The TCN team only included JNM when Corporate Communications began discussions with BT. BT proposed developing and providing the whole system for BigBank, excluding the TCN team. In order to fend off this approach, the TCN team enrolled JNM to reinforce their perceived capability to deliver the solution. In reality, the TCN team had to re-engineer the JNM solution to deliver the project. As a result, JNM gained a vastly improved enterprise level project. The inclusion of Studio Videos (TV broadcast team) within TCN was another example of poor technical components being included based on perceived expertise. Technology Statespeople when constructing the community of interest, need not only to understand the

technical reality of the actors and artefacts but also how they are perceived, perception frequently having more importance.

In order for each project to achieve formal approval, it required an accepted business case. This justification was retrofitted requiring the Technology Statesperson and sponsor to align the informal community with an acceptable motivation.

8.4.2 Business purpose: Funding and Resources

With the variety of personal agendas operating within the organisation and fuelled by the desire for advancement, placing factions in opposition, it is extremely important that the formal organisation ensures that the needs of BigBank are met. The requirement for an acceptable business case for each initiative was a mechanism used by BigBank to protect the interests of the formal structure. Business reasons were retrofitted on each project in contrast with the belief that business need for projects is identified first in order to justify the project. The business purpose was reached via negotiation and agreement between the parties involved and the formal sponsors.

In each case, the parties involved have different objectives that they are looking to achieve from the project, with the core objective being that of individual advancement. Following agreement around these aspects, the business reason is then presented. In NMM, the motivation was the Change Planning Executive's interest in NetShow with the testing of the network a result of negotiation with Technical Strategy and IT Services. For Praxis it was due to the Technology Director's peer pressure and for TCN the desire was for a vehicle to expand the Corporate Communications Executive and the Resource Group Project Manager's roles. The business reasons provided for each were, as follows:

For NMM, the benefits of understanding the implications of carrying these loads were added to justify examining NetShow and fulfilling the interests of the other groups. The business purpose was to evaluate the effect on the system of multimedia loads that would be relevant to BigBank activities. BigBank was aware that at some point they would have to deal with loads of that type and wanted to know what steps they would need to take for their network to handle them.

The Praxis business case was that it would provide an improved method of storing, organising and retrieving information. It would replace the outmoded J-drive system and provide the 'one true word' of information.

For the TCN case, the benefits were built on those of Praxis as it was built onto the corporate rollout of the Intranet. It also had a cost-benefit for BigBank

which was required to provide a large amount of training, e.g. regarding the new EU monetary legislation. By setting up this training network, BigBank would save money on booking training facilities, paying for employees to travel to and stay at the training facilities plus not lose man-hours with the person being out of the office.

The Training Network was added to the Corporate Intranet to provide a bottom line reason which the Board would understand instead of the vague and diffuse benefits of the Intranet. In addition to the construction of the business case it needed to be presented effectively. Presentation and lobbying of the BigBank board to approve the TCN project demonstrated considerable sophistication. The original project aim was to expand the Praxis Intranet model across the company. They diagnosed that the selling point of the system would be the 'bottom line' benefits and as a result they sought to find a way to accommodate this perception. The training possibilities that they had seen in the NMM demonstrations fitted with the training requirements of BigBank and provided the cost-benefit.

As a result of changes in EU regulation, BigBank would have to train a number of its employees in these regulations. In addition to the costs of the trainers BigBank would incur costs for venue, accommodation and travel for attendees plus loss of revenue from their time out of the branches. By setting up the training in a multimedia format over the network, they would save on these costs. This then created the platform for the business case.

The enlistment went further as Corporate Communications produced a video which they showed to Board members to engage their support prior to the official Board meeting to approve the project. They sold to the Board members the fact that they would have cost-benefits and a system more advanced than any of their competitors, thus appealing to the business vanity of the senior executives.

When these projects where viewed later, it would appear that these were the business reasons that had been identified. Due to the view gained by the methodology employed for this thesis, we were able to view the socio-political drivers which created these initiatives and the projects. Typical post-project examination would have observed projects fitting a normative mode, ignorant of the activities of the pre-project phase. The insight of participant involvement across all stages of linked projects demonstrating the dynamics of social shaping in the informal organisation would have been obscured within the fog of post-hoc rationalisation.

While projects received formal approval, this only enabled access to relatively meagre budgets. As technology projects were perceived as cost savers instead of revenue generators, grand investments were not considered. Each initiative

needed to prove its worth on a low budget in order to receive any more funding required. TCN is an amalgamation of Praxis and NMM on a larger scale. The fact that these technologies had proved themselves on lower budgets in smaller environments provides them with the validity to try for funding for the bigger TCN project.

The impact of economic factors can be seen across projects. The use of Microsoft NetShow for NMM was not solely due to the Change Management Executive's personal view as Microsoft, Cisco and Intel provided testing applications and equipment free of cost. The consortium's motivation was not charity driven. Through support and collaboration with BigBank they would gain insight and social learning on the environment and use of multimedia offerings aiding future innovation. Collaboration between supplier and user is consistent with the interactive model within emergent markets where offerings are being developed and require 'user' involvement. While research has considered this at a market level for discrete Multimedia applications, insight into this process within the corporate environment is scarce. Within case studies, suppliers repeatedly offer applications at low price to gain adoption.

Economic considerations combined with social factors to impact technology selection for the Praxis and TCN cases. The decision to use Microsoft FrontPage as the development tool for Praxis was based on the fact that it was free and the lead developer for the project liked it. Also Microsoft applications were entrenched within BigBank. This was despite the fact that many other tools existed that may have provided superior functionality albeit at a higher cost. Non-technical factors established this as the best application to use. Here we see socio-economic factors influencing technology decisions (Hughes, 1983; Law, 1992).

The TCN projects technological trajectory was impacted by BigBank's desire to increase return on investment from previous technology selections. The planned use of TVs was to pander to the Board who had already invested substantial amounts on that system and wanted to feel it was correct by maximising the return on their investment. This was despite the fact that the NMM tests had shown that the BigBank network could accommodate loads of that type being sent over it. The use of Microsoft NetShow for those tests and the subsequent experimentation with its sister product, NetMeeting, in the labs led to that being selected for use in the TCN project. These links to the previous project validated the Research Group's work and enlisted their assistance with the TCN project. Despite the existence of a superior method, combining operation and use in one device, the satellite option preferred by the Board was selected. This choice ensured the support of the Board for the project.

The operation of the community of interest does not terminate upon project approval. Throughout the development of the projects, we witness their impact, combined with that of the wider environment, upon the technological trajectory of multimedia innovation. Through management of the community, Technology Statespeople may exert influence outwith their formal role. The Praxis community of interest allowed the Research Group Project Manager, the pre-project Project Champion, to maintain influence over the project via her friendship with the Technology Director's Executive Assistant. The Communications Department Head reported into the Technology Director's Executive Assistant who informally liaised with the Research Group Project Manager to direct the project.

Technology Statespeople must utilise the community to technically deliver the system and manage the perceived progress and success of the innovation. As a result of the various agendas of actors, the presentation of the project to all relevant groups should be appropriate as this will affect their benefit and success perceptions.

Technology Statespeople attempt to set expectations so that the perceived reality of the technology bears relation to the technical reality to make it deliverable. The perceived expertise of the Technology Statespeople when making these claims is an important factor. Within our studies, the Technology Statespeople possessed sufficient reputation to support their claims. In fact the success of each project further assisted the legitimacy of claims.

The manner of communication of project results was as important as the results. During the NMM, expectations were carefully managed by the project team. Locating the development lab at the University allowed the Research Group to fully control who saw the work, when and how. Project work presentations to business units included the relationship manager for that section, responsible for managing technology awareness and adoption within their assigned department, who attended along with business owners. Immediate discussion was allowed on opportunities and business needs in a controlled manner. The relationship manager received full knowledge of what the business owner had viewed and the ability to identify and qualify the possibilities.

The visual demonstration possibilities provided by Multimedia innovation positively impacted the delivery of the project's findings. These demonstrations gave visual evidence that the Technology section had the capability to deliver projects of this type in a way that could be understood by the layman. This established knowledge claims and created the avenues for further multimedia work by the Technology Department. This visibility was something that BT and other competitors for the project could not demonstrate. From an internal technology

perspective this also demonstrated the Research Group's value in pursuing these projects and their capability in delivering them. The visual aspect of multimedia made this relevant and differentiated from less visual technologies. This process allowed the project team to effectively stage manage and deliver the successful findings of the project in the best setting.

Project sponsors were also concerned with perceptions created by the published report. The Change Planning Executive was concerned about negative, yet accurate, aspects of the report. These aspects discussed the considerations required when building loads and mentioned some of the difficulties that could arise. While it was aimed at providing practical assistance, he felt it highlighted these problems too much. This demonstrates the concern with creating a beneficial perceived reality whilst filtering aspects of the technical reality.

Creation of a positive perception was also managed by the Praxis community of interest. When reviewing the system survey, they decided that the weighting should be on beneficial wording to create a positive feeling to the system. This was more important than maintaining the objectivity of the survey. Both situations demonstrate attempts to shape the social reality of technology. It is important to note that these attempts are designed to enhance technical realities as opposed to pure social creation of technical 'myths' divorced from reality.

The communication and perception management process was managed throughout the project. During the Praxis project the technology presentation was altered during the project. In order to gain initial enrolment, the Praxis team raised expectations of what was possible with the technology and their ability to deliver these possibilities. Once enrolment and project approval were gained, expectations were tempered to more realistic levels. Within the Praxis case, the business owners were sold the overall vision. Their relationship managers from technology would subsequently tone down what was possible. Expectations of richer functionality were constrained until development resource to deliver that functionality had been recruited. A number of sections requested dynamic features within their areas on the Intranet but sections with representatives in the 'Friends of Praxis' received preference.

The nature of multimedia technologies communication capabilities provided an important medium for managing perception. Perceptions were managed to marginalise competitors as well as to promote the community. The 'published or be damned' statement during the Praxis project expressed the fact that sections which published little on the Intranet were viewed as having little interest and hence received less support and assistance from the development team. In many cases, the

lack of publications was due to the system not being ready to handle the type of content they required. Unfortunately, the quantity of visual representation was used as the literal indicator of interest.

The Praxis team used this visual representation quantity measure to their advantage in order to establish the perception of Edinburgh as being the leaders in Web development. A number of the sections, which had limited presence on the Intranet, were based in London, mainly because they were traditionally the client-server experts, and had their own initiatives in the Intranet area outwith Praxis. The Praxis team presented the lack of content activity as indicative of interest level and used this to support their position. They bolstered this perception by establishing standards as a power maintenance strategy. Thus other intranet groups were forced to align with their initiative. These practices in the NMM and Praxis projects helped the Technology Department and relevant Technology Statespeople to legitimise knowledge claims (Pettigrew, 1975) and influence over power resources.

8.5 SUMMARY

Through consideration of the study as a whole, we witness a complex, interactive innovation process with social and technical considerations intertwined. The dynamic of Technology Statespeople enlisting new technology opportunities establishes this relationship which then permeates every impact and choice during the innovation process. Technology Statespeople use the potential value to the innovation as an attraction to enrol actors within 'communities of interest' who negotiate and direct the technology trajectory of the innovation, fashioned through the interaction of the various agendas. Within the following conclusion section, I will draw the key findings offered from observation of these aspects in operation.

9. CONCLUSION

9. CONCLUSION

9.1 INTRODUCTION

Social and technical factors require joint consideration throughout the multimedia innovation process. This was evident by the factors shaping the technological trajectory and the process of multimedia innovation throughout this study, especially within the supplier-user interchange of the configurational technologies encountered. As a result, the determinist linear model was rejected in favour of social shaping's interactive model.

Analysis of case study data has enabled the identification of some key findings to assist organisations acknowledge uncertainty and minimise costly mistakes when engaging in multimedia innovations. Innovation is driven by the operation of Technology Statespeople seeking advancement of their individual agendas through technology opportunities. This operation begins during the pre-project phase and continues throughout the process including delivery. Appreciation of the dynamics present within the previously obscured pre-project phase and Technology Statespeople are presented leading to appraisal of the themes of multimedia innovation they must navigate. Across each project we faced recurrent issues arising around the delivery method, content requirements and application of standards for multimedia. The collage of interests presents a picture of intertwined social and technical interests challenging the formalised management process of the Technology Department. The Technology Department's attempts to accommodate the requirements as orchestrators instead of producers offer beneficial findings regarding the management of a range of users, suppliers and business sponsors. The configurational nature of multimedia placed a need for collaboration restrained by the corporate need to balance user need with corporate objective.

The method of gaining this insight is also considered. In order to gather the rich case data contained, the research process adopted departed from the study techniques dominant within this field. The typical use of isolated case studies analysed through post-project interviews faces two main challenges: actors can post rationalize decisions and impacts of other projects are not satisfactorily considered.

For this study, the involvement of the researcher as a participant observer through three linked projects allowed unique insights. Access to the pre-project stage allowed understanding of the alignment and enrolment activities that occur prior to formal discussion within the organisation. Involvement in decisions as they are

made, from initial agenda formulation and establishment of the constituency of players involved as well as throughout the subsequent development of the project, provided first hand assessment of the decision mechanics at a micro level. By drawing on a variety of areas of study, an interdisciplinary lens of analysis was applied to retain and appreciate the richness of factors at play within these environments.

9.2 INNOVATION POSSIBILITIES NEGOTIATED DURING PRE-PROJECT PHASE

Pre-project environments proved a critical stage within the multimedia innovation process. The environment consisted of a variety of actors working to advance their own agendas within an informal structure (Burns and Stalker, 1961). This structure provides actors with an additional route to gain influence beyond the formal hierarchical structure, supportive of the organisational dynamics noted in previous studies (Burns and Stalker, 1961). To advance these personal agendas they create or participate in communities of interest where they buy into a shared agenda that also benefits their own individual objectives. In this process, choices are made as to intended business sponsors for the innovation to succeed: allies who possess key resources required for the innovation and potential opponents who need to be accommodated or overcome. These communities include actors internal to the organisation, such as the Technology Department and business units as well as external actors such as technology vendors.

Communities operated around a shared technology agenda, in this instance, the creation of multimedia technological resources of value to the organisation. The exact features of the agenda were impacted by the enrolment process of actors possessing required artefacts or expertise.

A number of innovation communities existed within the pre-project environment. Moving from discussion to execution, the community required alignment and involvement of sufficient resources and formal approval. Formal approval usually took place once the majority of the resources had been aligned.

Alignment of resources required negotiation with resource owners and influencers. The Technology Statespeople acted to gain informal agreement to participate from the owners and influencers of these resources prior to formal approval. Specific resource requirements are dependent upon the particular project and the organisational environment but the commonly required resources within BigBank projects included Technical Facilities and Equipment, the Bank Network,

Standards, Data, formal internal organisation hierarchy, various suppliers and staff with relevant expertise.

Actors were enrolled due to their relationship as either owner of or influencer over particular resources. Enrolment required negotiation between Technology Statespeople and actors to align actors' personal agendas with the community agenda to allow mutual benefit. During the pre-project phase, benefits offered by Technology Statespeople were seldom economic or tangible. Technology Statespeople offered potential or intangible benefits such as acquired influence, expertise or reputation.

Negotiations were necessary to deal with the delicate aspect of potential conflicts, due to new innovations causing disruption of existing balances of power. Potential issues and opponents were either enrolled or marginalised to allow the innovation to progress. As a result the process of alignment frequently required trade-offs. These trade-offs impacted the technical direction of the innovation in order to accommodate the requirements of certain actors and environmental factors. The socio-political enrolment process thereby shaped the technical trajectory.

The principal benefit to actors enrolling within communities was access to resources or knowledge that could assist advancement of their agendas. Exact benefits varied due to actors' individual agendas but typically involved enhanced political influence either through artefact ownership or possession of expertise.

Multimedia innovation projects were attractive to actors due to the high interest within the organisation and business community concerning their potential. This interest supported their potential as power resources within organisations (Burns and Stalker, 1961). This perception imparted value not only to the configured solution but the components as well. Owners and influencers traded on the value of these components, using them to negotiate benefits from involvement in the community. A key benefit was eventual influence over the configuration, allowing a greater level of political power. Technology artefacts' ability to act in this manner was a key reason for networks to be formed around them under a shared vision of the potential resource's overall value and its benefit to the actors involved.

Gaining Multimedia expertise and social learning through technology creation also attracted community members. Actors constructed knowledge claims through association with innovation activities and gained reputation for knowledge as a result. It was also important to enrol actors possessing established knowledge claims.

Involvement of expert resources benefited the credibility of communities' ability to deliver the project, a key aspect for approval. Support from 'experts' and

owners of 'expert' resources such as programmers was also an important aspect of community building. The embryonic nature of multimedia technology within corporate environments caused a scarcity of expertise. Thus, the resource was valuable and actors possessing or controlling this expertise held significant influence. These actors were able to exert influence above their hierarchical role, such as HTML developers selecting the visual presentation of the Intranet, a selection usually made in line with corporate marketing guidelines.

In attempting to assign resources, formal approval required the community agenda to be aligned against a perceived BigBank need. In the same manner as individual actors' agendas are served, the initiative had to answer the perceived need of the formal organisation. In order to advance the shared agenda of the 'community of interest' and the interests of the various members, they sought to answer issues faced by the organisation.

Formal approval is necessary for the project to receive the funds, resources and official permission to proceed. While informal agreements for resources may exist in the pre-project phase, they still require official validation. In this manner BigBank established a technique to ensure the activities of the informal structure are beneficial and not solely dedicated to in-fighting and political positioning. In every case, however, this objective is reverse engineered on to the initiative. This presented an interesting and contrary motivation behind the technological activity.

The motivation of advancement was a consistent driver behind projects. This finding provides an interesting nuance to the 'demand pull' perspective that argues technology emerges due to market need. In our case, the market need was not initially economically based but politically motivated. This motivation could be argued to have created the market for the componentised multimedia solutions. This view also opposes the 'supply push' perspective as multimedia technologies do not appear to create a market around their introduction. The market was created by technical specialists identifying an opportunity and configuring the relevant components to meet it. In each of our case studies, the opportunity for advancement constructs or identifies the need to provide a vehicle for this agenda.

Certain actors or Technology Statespeople acted to identify opportunities and align resources as described above. Political skills were critical as actors chose which projects to participate in based on their understanding of the importance of the project to the organisation and the benefits they can gain through involvement. In the absence of quantifiable means of evaluation, actors took decisions based on existing knowledge and perception of the project as well as Technology Statespeople's manipulation. Large groups of actors changed the direction and behaviour towards

the role of the bank network in multimedia applications. Test results indicated improved and wider potential for the network and therefore opportunity for associated parties. The alteration of political agendas as a result of perceptual alteration is consistent with 'bounded rationality' analyses (Whipp and Clark, 1986) whereby actors are seen to make 'satisfactory' solutions in the context of incomplete information through the use of heuristics and repertoires of problem definitions/solutions instead of executing agendas blindly without consideration or reaction to the environment (Pettigrew, 1975).

Perception was repeatedly impacted by the actions and statements of actors considered to possess expertise relevant to the area. As communities received favourable commentary, they gained credibility and certainty around their value and likelihood of happening. Evaluation of 'expert' opinions called for perceptual analysis due to the newness of the technological arena and the difficulties in assessing an intangible such as expertise.

It was therefore unsurprising that power imparted by possession or association with resources was variable dependent on existing perception constructed by a mix of social, technical, economic and political factors. As the importance of the CD-ROM as a method of multimedia delivery decreases across the case studies, the political influence of the owners of the medium diminishes.

Project leaders emerged during the pre-project phase and remained pivotal through the project, managing and influencing these changes to the groups' advantage. The alignment of communities of interest occurs largely through the efforts of these individuals.

9.3 PROJECT LEADERS REQUIRED TO BE 'TECHNOLOGY STATESPEOPLE'

The Technology Statesperson occupied a pivotal role throughout the course of the projects but is of especial key importance during the pre-project phases. During the pre-project period, the project leader operated to create the initial alignment of resources for the project. The project leader applied hybrid expertise to enrol the necessary actors and resources within the community navigating the negotiation process by which this occurs. This 'steering role' is seen to continue through the project as the various factors of the social, economic, technical and political environment maintain the innovations advancement. It is important to draw distinction between the characteristics of the Technology Statesperson and the roles of: 'project leader', 'technology sponsor' (Tidd et al., 1997), 'project champion'

(Bessant, 1985), etc. Technology Statesperson is not an alternative but instead identification of the type of actor that operates in these roles across projects offering 'generalist specialist' or 'hybrid' skills (Fincham, 1995). Technology Statespeople are typically middle management individuals in pursuit of hierarchical legitimisation of power. In this pursuit, they select and align with technology projects to advance their agenda, migrating as they realise or fail in their objective. Technology provides an effective vehicle for them to establish and apply their expertise and influence. Observation of linked case studies has provided insight of these individuals' evolution between innovations. Isolated case study research does not allow for observation of this process since it presents only a 'snapshot' of their activity and suggesting the drivers of projects were formally appointed (Bessant, 1985; Tidd and Pavitt, 1997). Observation of the pre-project environment demonstrated that project teams and communities of interest are created through socio-political activity of the Technology Statesperson prior to formal recognition.

At this point, the Technology Statesperson may not be the 'officially designated' owner. In fact in a number of instances, it was observed that the latter role was occupied by another officially identified individual. The project leaders were defined by the relationships they held and the influence they possessed over the innovation network. The unofficial role of informal community management evolved into the official project leader in some cases. In other cases, actors would play this role in an unofficial capacity steering a 'puppet' project leader. The core role was to manage the social forces involved in the innovation. This dynamic is contrary to the process of establishment of project champions which previous commentary (e.g. Tidd et al., 1997) had posited was solely an operation of the formal structure.

The Technology Statespeople were generally the initiators of the community building and they succeeded or failed in that role by their own efforts. Successful alignment of the resources was needed to gain the required 'critical mass'. In achieving this stage, they proved their suitability to occupy the project leader role. The case studies reveal a number of actors who were displaced or disadvantaged by proceedings, thereby suggesting that they were Technology Statespeople who failed or were overcome by the success of others. Although merely inference, given the dynamics of Technology Statespeople interactions, it is reasonable to assume that when some succeed others fail.

A number of factors impact the positioning and success of actors within the project leader role. In those cases, when an actor was successful at creating momentum for their role as project leader, one of the key factors was the existence of an executive sponsor for the project. In each of the cases, we saw an actor

fulfilling the role of sponsor in a manner akin to technology sponsor. The sponsor engaged the community either proactively or reactively in response to a project leader approaching them.

The sponsor assists, and supports, the project leader in alignment with the formal organisation and can also contribute with leverage and connections to gain access to required resources. The ability to gain access to these resources and build relationships with their owners and influencers was another important characteristic of an effective project leader's positioning.

The project leader's role at the nexus of this community was dependent upon his or her ability to align and maintain the requisite actors and resources. The aim is to create a community capable of meeting and matching an agreed 'doable problem' (Vergragt, 1988) through the coordinated elements; social, technical, political and economic possessed within the community.

In creating the community's 'doable problem', the Technology Statespeople must negotiate agreeable terms with the actors. Negotiation is required to accommodate any incompatibilities between the community's agenda and that of the actor. Conflicts commonly occur around technological direction. In these instances, compromises are reached whereby both objectives can co-exist. Compromises were manifested by alterations in the technological trajectory. Thus, multimedia was demonstrably the subject of social shaping and negotiability (Vergragt, 1988) from social, economic and power relationships within the innovative environment.

Enrolment of actors required Technology Statespeople to 'sell' the agenda to the actors. This process required the articulation of the potential of the innovation and potential benefits the actors could gain. Technology Statespeople are required to display technical expertise whilst also accommodating the social dynamics of the other actors. These dynamics impact the perception of the innovation which was slightly different between actors as each viewed it based on their own knowledge and relationship to their role. The Technology Statespeople in many cases targeted actors who had restricted technical knowledge allowing them to more easily 'sell' the potential of the innovation with less rigorous scrutiny of the limitations.

This practice is supportive of the often nebulous understanding many managers have around the actual detail of the technology identified in other studies (Fincham et al., 1995). Managers' concern is around the business impact so their expectations need to be set by those they perceive as knowledgeable as to what is and is not possible. The operation of bounded rationality is again evident.

The project leader role provided attractions and potential benefits to actors looking to advance their own agendas. Benefits correspond with the instruments of

political control observed in the informal structure, influence over a technological resource or perceived expertise. The value of these was considered in relation to the environment. Technology Statespeople sought to acquire the role as point of contact in order to legitimise power. An alternative route to gain influence was through acquired expertise. Association with certain projects allowed actors to gain social learning and perceived expertise through reputational networks (Fincham et al., 1995). Due to the embryonic nature of the area, formalised multimedia expertise did not exist within BigBank. Technology Statespeople attempted to formalise their knowledge claims to position themselves as influential owners and traders of multimedia knowledge. These efforts were made through lobbying of hierarchical supporters and associated experts in a manner supportive of Pettigrew's evolutionary view of occupational specialization (Pettigrew, 1975). Technology Statespeople played a significant role in this process.

Expertise required to implement multimedia innovations was certainly scarce. Across the cases, we witnessed a complex and demanding model of innovation.

9.4 DELIVERY, CONTENT AND STANDARDS: THEMES OF MULTIMEDIA TECHNOLOGY INNOVATION

The case studies present a complex interactive model of innovation for multimedia technologies requiring joint consideration of both social and technical factors throughout the project. Multimedia configuration required consideration of a range of interest groups, from different user groups, project sponsors and infrastructure operators. Each group carried different agendas and needs. This was compounded by the emergent nature of multimedia and growing realisation of the demands and restrictions it posed during development. Technical specialists guiding the project had to aggregate the needs of their internal clients and match against the shifting technical possibilities offered. The process of aggregation served as a forum for interest groups to exercise political desires, the essence of which became ingrained within the resultant innovation.

The interactive nature of the system also required users to contribute content as well as request functionality. Content would drive system usage amplifying the importance of users' involvement, although this was usually through proxy representatives. Adding to the complexity of internal alignment, configuration drew upon componentized offerings from a range of external suppliers. Development teams were required to understand individual components, their configurational

possibilities and how they could be translated into a solution to meet local requirements, a translation process that required compliance with BigBank technical standards. The maelstrom of considerations, factors and actors presented was radically at odds with the linear model of technology determinism concerned with 'black box' solutions of stable design. Instead, the interactive model for multimedia innovation proposed by SST advocates provided an applicable model employing the evolution of technology impacted by social, cultural and political aspects.

Multimedia innovations are configured from a number of components including HTML code, Microsoft FrontPage, VHS, Network, and streaming technologies. These configurations require integration, a process which is impeded by the lack of uniform standards. Componentised development supports the view of multimedia as a configurational technology (Fleck, 1988b). Common components are used across projects, e.g. HTML but no stabilised design is evident.

The ongoing struggle to account for environmental, political and social aspects within formal methodologies was evident in our study. Despite the wide variety of methodologies that exist for technological development, through our studies, we saw no universally utilised model. Consistent issues are evident but Technology Statespeople applied hybrid expertise and social negotiation to navigate these issues. Whilst this does not provide us with a formulaic recipe for success, it does provide a useful guide for management of these factors, although they are of a 'lessons learned' variety as opposed to a methodology. Methodologies had limited impact on the projects within our study.

Project teams failed to utilise an iterative, incremental methodology and while no official methodology was present, their approach aligned closely with the classic waterfall model. This was despite the well documented failings of this method and the challenges it faces when accommodating IT innovations. Certainly the need for a wider range of knowledge was required as we witnessed groups previously separate from each other having to share knowledge within the communities of interest. BigBank, like corporate society at large, experiences an erosion of boundaries between technical and business fields as TCP/IP standards facilitate the explosive growth of digitisation. The process of growth leads to expansion beyond procedural automation into complex interactive operations necessitating greater user understanding and environmental insight.

While the formal methodology followed a linear model, many of the practices of iterative and incremental techniques were carried out informally. Alterations occurred within the requirements and direction of the projects at very fundamental technical levels that impacted the project. The project teams and leaders

navigated these issues through social negotiation instead of formal methodology. The principal factor for success with each of the cases observed is the buy-in from the key stakeholders relevant to the project. Technology Statespeople would iterate the technological design of the innovation in response to the requirements of the stakeholders. The shift from network delivery to satellite delivery for TCN exhibits iterative development in response to changing requirements.

Multi-level consideration of implementation environment was required.

In applying multimedia to BigBank, consideration of the existing formal structure and the informal power relations within it was made by the development teams. Successful appreciation and navigation of these areas was critical to the sourcing and alignment of the requisite expertise and resources to undertake these projects. The NMM project remained dormant until the project team was able to enrol requisite expertise and facilities from the University which allowed the project to be approved and move to execution. Without awareness of where relevant resources are and how to access them, it would be impossible to align a community around a 'doable problem'.

Financial implications were, not surprisingly, of great importance to BigBank and required consideration and accommodation for the project to formally advance. Pressure existed for projects to use officially recognised standards, such as Web standards for Intranet and de facto standards, such as the TV satellite link. Economic pressures guided the selection of suboptimal technology solutions to accommodate organisational return on investment objectives. The selection of the satellite network over bank network in TCN serves an example as the BigBank Board directed this decision to recoup sunken investment in the former system despite the technical superiority of the latter. Thus, the entrenchment of technology choices motivated by desire for return on investment is demonstrated (Cowan, 1992).

Multimedia characteristics place specific demands upon infrastructure required, content inputs and standards employed. Multimedia applications initially delivered on stand-alone platforms via CD-ROMs were slowly migrated on to networked systems during our case studies. The migration of multimedia solutions to networked delivery presented a new set of considerations. This provided advantages in terms of cost, availability and currency of information but created additional demands upon areas of the organisation previously uninvolved. The network is shared by a number of bank functions. The impact of the additional data load imposed by multimedia needed to be balanced against the combined needs of the organisation to ensure additional use was not detrimental to the organisation's

overall operations. Impacts contained both technical and resource considerations for the separate groups handling the network delivery and CD-ROM delivery. The corporation had to consider how best to handle this sensitive migration of operation and responsibility whilst retaining and redirecting leverage skills. The original department was broken up and resources reassigned.

Multimedia's inclusion on the network required conformance with the organisational standards for network use and this was consistent across projects. The responsibility for enforcement of these standards was held by the Technology Department. During development, groups responsible for specific areas of compliance were assigned to test and ensure relevant standards were met.

Interactivity was a consistent feature throughout the projects. 'Multimedia-ness' and the convergence of a number of channels were not consistent, instead evolving across the projects as the static content of Praxis combined with video broadcast for TCN. This incremental move is in line with the caution of organisations surrounding systems development and its potential impact upon other operations. As each system release proved its value, BigBank allowed additional development.

The content requirements of multimedia innovations were a constant issue across innovations. The importance of content has been neglected in previous studies with focus directed on other aspects of the technical infrastructure required. While the delivery systems were certainly important, content was equally important. In order for the users to select certain types of information, it must be available on the system. Populating the system with information raised two equal concerns, conversion of data and governance of information.

The requirement, consideration and sourcing of content was important but the complexity of this process was not fully appreciated. Consideration focuses on where to get the content, how to input it into the system and who needs to be responsible and accountable for the activity. The 'where' and 'who' created the need to interact with groups that previously had limited interaction with the Technology Department. This included functions such as Corporate Communications and Human Resources whose main purpose was the production of content. Producing and providing content was an important aspect of these groups' operation and essential to their power relationships in the organisation. The enrolment of these actors required the effective presentation of benefits of another channel of delivery for their content. Accommodation needed to be made for their technological naivety and concerns about sharing the source of their group power. The highly visual aspect of

multimedia assisted Technology Statespeople in communicating the benefits to a technically naïve audience.

The technical difficulty of inputting information was underestimated. Whilst a number of different standards existed, none was dominant and translation between these formats was problematic at best. Translation was hampered due to the twin concerns of technical incompatibility and lack of facilities. Multimedia data demanded extraordinary technical facilities necessitating external sourcing. Even when facilities were available, the technical barriers to format translation proved insurmountable as it would have required content to be completely reconstructed placing additional resource requirements upon the project. As a result of the importance of content to multimedia innovations, project teams cannot underestimate the complexity of sourcing and technical translation.

Multimedia innovations were possible in BigBank due to a receptive environment. As a result of the need to configure multimedia technologies to the local setting, appreciation of multimedia characteristics must consider the specific organisational setting. In order for the innovation to be viable, the organisational structure, both formal and informal, must be receptive. In real terms, there must be individuals who have the interest and ability to initiate a project via alignment of interest as detailed within the pre-project stage. During this process, these actors will 'de facto' test the organisation's receptivity to multimedia innovation. Whilst this is dependent on the actor's skill in this area, if no actors' agendas can be aligned with a project, it is reasonable to assume that it is unsuitable for the organisation. These reasons could be due to technical unsuitability, lack of business benefit or lack of an innovative culture. The matching and balancing of the various agendas of influential actors within the organisation was the necessary first step within the innovation process. It therefore appears important that prior to commencing innovations of this type, the project proponents should test the receptivity of the environment to the benefits of the innovation.

Conformance with organisational standards was acknowledged as an important stage within this process especially for network access. In some cases due to the emergent nature of the technology, these standards have yet to be established but as the technology matures within the organisation and its impact extends, standards conformance becomes an increasingly important aspect. The NMM project had greater latitude due to its experimental, isolated state. The subsequent projects faced greater demands for conformance due to greater organisational impact. For BigBank, these standards served as a method of enforcing reuse of technological investments and a cohesive technology policy. This governance did not create a

Darwinian process, solely concerned with identification of the technologically fittest standard. Instead the process of selection was influenced by preferences of local 'experts', external actors, e.g. corporations (Microsoft, Sun Microsystems), industry consortiums, economic considerations and agenda alignment. In the absence of set standards, knowledge groups adopted recommendations of those perceived to have superior knowledge. The selection of certain development tools and design directions through existing technical understanding shaped by 'expert' opinion was common within projects, such as the selection of Microsoft FrontPage for web development. This aspect suggests the social shaping of standards with expert opinion, social setting and technical considerations requiring combined consideration. In light of this possibility, multimedia developers should carefully assess, as far as possible, the actual merits and motivations for standard selection.

BigBank standards did not experience the competitive pressure of competing market standards. Instant monopoly is achieved reducing choice and competition through the elimination of the competitive possibilities prior to deployment. This move was sensible due to the limited resources available within the organisation and the limited benefit from wasting resources within a 'market' type struggle. The formal organisation has little interest in groups within the organisation gaining 'competitive advantage'. The objective instead is to deploy resources on technology initiatives which will provide maximum benefit to the organisation. Selecting a standard allowed focus and direction.

The danger occurs if these decisions are irreversible and based on incorrect knowledge. Our case studies did not gain insight into the extent to which this danger existed and how it was dealt with.

The important ramification of standards upon technological direction requires careful consideration of the selection method. Attention needs to be paid to the agendas of 'experts' involved and the amount of knowledge available.

The confusing construction of expertise.

There has been considerable study concerning the construction (Wood and Kelly, 1982; Cockburn, 1985; Burns and Stalker, 1961), quantification and application of expertise within technological innovation. Despite this investigation, assessing this intangible aspect remains a problematic issue for technological innovation and specifically, from our investigation, multimedia innovation. This was true within these case studies.

In the absence of formal quantitative metrics, actors relied upon qualitative social measures such as reputation (Pettigrew, 1975), a practice consistent with other

innovation studies (Fincham, 1995; Whitley, 1988) with actors being assessed based on their associations with relevant actors and resources. During the study, actors created a 'track record' by gaining credibility through involvement in technology projects which allowed them to gain influence over the technology direction. In addition, their opinion imparted expertise upon resources and actors. Experts' opinions were used as a source of validation for the knowledge claims of other actors. For example, we witnessed the formal project owner for Praxis gain position due to the assertion from 'experts' that he is the appropriate person for the role. As a result actors seek to enlist and align other actors in the hope of gaining credibility via association. This proactive association behaviour was a common practice in the pre-project phase. In the absence of tools to evaluate expertise, we witnessed organisational actors accepting expertise based on these social aspects. Some aspects of expertise contained a quantifiable aspect. Programming capability was one such area with a test of expertise provided through ability to apply this skill to defined tasks. BigBank quickly discovered the ASP developer's capability through coding performance. The testing of technology also provided a proof of knowledge as in the case of the quantitative testing for the NMM project.

Although some aspects of skill have the capability to be quantifiably assessed, the pace and complexity of multimedia innovations seriously challenged structured methods of evaluation and we saw a continued reliance upon qualitative assessment by experts. The need for hybrid expertise combining both technical and social knowledge to manage the complicated application of multimedia technologies to the organisational setting was consistent across projects.

To assess this expertise, we see actors reliant upon reputation as the barometer for assessment. Actors who have demonstrated this expertise through the successful application of associated technologies were enrolled to either lead or assist in subsequent innovative processes. In this manner, social learning outcomes are shared through projects. The uncertainty and associated risk attached to these projects and the need for risk mitigation was a central driver for their involvement. The Technology Department needed to include the requisite resources within projects to minimize risk. As a result of the scarcity of the resource within the organisation, experts had to have the risk of involvement in problematic projects balanced by reward.

The operation of the Technology Statesperson requires skilful assessment of the state and possibility of technology projects. As their political possibilities and reputation are grounded in the perceived success of the project, they must act to align and migrate with projects with a likelihood of success. Judgment of success is

relative to their personal agendas. For the Research Group Project Manager, the Praxis project was a limited success. While it assisted repositioning through establishing knowledge claims and achieved success from the sponsor's perspective, it did not deliver a legitimised position to match personal ambition. On realising the project was 'failing' to meet her expectations, the Research Group Project Manager moved to the TCN project. This provided an opportunity to leverage expertise and pursue a wider opportunity. The year long lull of the NMM project prior to alignment of a sufficient community of interest, encourages reservation on making a premature assessment of project 'failure' subjectively. During the lull, the project could be considered a 'failure' but on completion was considered widely successful fulfilling and sufficiently benefiting community members. Drawing on wider studies within literature, attention has been directed to experimental multimedia projects (Williams, Slack and Stewart, 2000) that while resulting in economic failure achieved success in terms of social learning or network creation. Therefore 'success' needs to be considered against actors' agendas and timing of involvement is essential. Actors need to assess when a sufficient community exists around a project for it to progress and understand when and how they will receive benefit from involvement. In this manner, an opportunity cost is accepted, with involvement in a particular project preventing the potential realisation of benefit from other opportunities. As indications that the project will not deliver the actors' perceived benefits, competing options should be considered and pursued as in the case of the Research Group Project Manager and the Praxis and TCN projects.

Initially, it was simpler to contract external resources sourced to accommodate the organisational gap. External resources provided social learning from other developments that were passed to BigBank as it built up their internal capability to support the developing area. In doing so, the organisation moves to formalise and codify the area of expertise significant for the changing Technology Department.

The complexity of User involvement

There has been considerable discussion around the role of the user within the innovative process. This discussion is directly related to the importance of user involvement for effective configuration of the various components to meet organisational needs. The discussion has a variety of strands from the user directly leading innovation to the user defining how to effectively articulate and incorporate their needs within the development process. During the study we witnessed BigBank struggling to accommodate user demands effectively while maintaining a centralised,

cohesive direction. The various groups involved within the organisation also raised questions as to who the user actually was.

The Technology Department, as the systems integrators, found themselves as both supplier and user especially when considering the user requirements. In fulfilling this role they acted to consolidate local knowledge and requirements by aggregating insight from the various organisational areas. Although some formal techniques, such as HCI tools, are used, this understanding is principally gained through 'proxies'. 'Proxies' were members of the community of interest who acted informally as representatives for the wider user base. For example, the Content Coordinators within Praxis managed the content for their section but also served as a proxy for their section's user needs. Proxies were enrolled within the project network. In this capacity, they provided insight into a particular setting as well as acting as project ambassadors within their own sections to enable technology adoption. These informal and often politically motivated opinions were the primary 'user' input. While HCI techniques, such as user observation and surveys, were employed they served as validation or an afterthought to support pre-determined actions. While a perceived attention to the user existed, influencing impact predominantly came from sponsors and user input was used primarily to achieve their political ends rather than provide a functional, effective system. While this has provided user input into the innovative process, it does not conform to the end-user led process which has been proposed by some writers (Williams and Proctor, 1996; Williams, Slack and Stewart, 2000).

9.5 TECHNOLOGY SECTION AS ORCHESTRATORS

Studies of the innovation process for information technology have suggested a revised role for technology departments (Fincham et al., 1995). This revised role posits that in order to meet contemporary models of innovation, technology departments no longer operate as builder/supplier but instead serve as an integrator or orchestrator of various actors and interests across the innovation. The benefit of this departmental role for multimedia innovation is evident within this study. Indeed the departmental role is a meso level mirror of the Technology Statespeople micro role. During the study, it was difficult to obtain a macro perspective on the position of the Technology Department and the time period did not allow for radical organisational change and formalisation. From observing the activities of a number of departmental units, we were able to draw generalities about the shifting role of the department. Just as Technology Statespeople created and marshalled teams of actors

from various areas, the Technology Department was required to fulfil this requirement at an organisational level. The department attempted to moderate and manage the relationship between external vendors and BigBank's business units. As an entity, the department orchestrated and configured supplier components to match the needs of the organisation and maintain the infrastructure required for corporate operations.

In managing this network, units of the department were required to identify the possibilities of multimedia (Research Group), identify benefits for the organisation (Project Leaders) and configure the system (Project team liaising with departmental units) whilst retaining existing operations (IT Services).

Despite the operation and requirement for hybrid expertise, the formal organisation struggled to create structure to accommodate this need. Technology Statespeople applied experience and hybrid expertise in a micro setting through the use of ad hoc informal tactics. Formal capture and fostering of this knowledge did not occur. Problems arose around classification and alignment against existing skill types. Instead of capability building, BigBank assigned ownership of particular innovations and aligned resources around it. While the organisation established a research group dedicated to investigating new technological possibilities, its role was limited to initial investigation and was not seen to operate in any wider adoption of the technology. This wider role was not, in fact, fulfilled by a formal group.

The research group was evidence of the Technology Department acting in a 'gatekeeper' capacity to mediate between organisational need and external possibilities. The Technology Department had to manage the flow and form with which communication occurs between these parties. This position created new challenges for the group.

Due to the pace and range of technological advancement, the department needed to consistently justify its capability to fulfil the role of technological leader and adviser. New developments were accompanied by new skill requirements and obsolescence of older skills, necessitating migration and education of resources to areas of increasing priority. This combined the need for long-term knowledge acquisition and short-term need fulfilment. The latter need was accommodated through the enlistment of external experts who would play a key role in establishing initial credibility to knowledge claims. Sourcing external parties to provide skills in an emerging area of ignorance for BigBank presented obvious problems. How do you assess capability? The department employed qualitative measures of CV based track record and references which created their reputation, an important asset in itself. This reputation was used to marginalise the claims of external parties when

internal parties sought outside opinion. This situation was experienced during the TCN project as business units entertained propositions from BT to act as system integrator. Outside opinion was shaped by the possibility of commercial benefit. Resorting to outside input commonly appears in areas of new advancement where standards and systems have yet to be established. In each of the projects, we see outside opinion solicited requiring the Technology Department to have to re-establish and reaffirm its expertise.

The Technology Department applied a number of resources to effectively formalise and defend its operational position. The department's formal role provided legitimised power for the section as they act as the first resort source for business users seeking technology solutions. In the cases viewed, business users did not proactively seek these solutions but instead reacted to interest created by suppliers or members of the technology department. As noted, the greatest danger of these situations was the activities of outside suppliers. These suppliers attempt to gain direct access to these internal users to present technological and expertise claims. These claims create expectations which then required negotiation by the Technology Department in order to maintain their position.

Maintenance strategies are required in order to defend against encroachment attempts by other parties. These strategies leverage the power resources available to the department. These resources consist of technology, expertise and formal authority such as that enabled by ownership and enforcement of standards. In addition, Technology Statespeople used informal relations and negotiation with actors within the community to maintain alignment. In order to defend project involvement, we see that the TCN project team conceded to a technical opinion of a BigBank business unit, Corporate Communications who were also the project sponsors.

A core resource for the Technology Department is the BigBank Network. As multimedia technologies move to a networked application, they place themselves under the control of the Technology Department. This control is exerted via the requirements for network access operated by the department. These requirements or standards needed to be met in order for applications to be allowed on to the network. By setting and maintaining these standards, the Technology Department established the direction and parameters for future technology development. Within the projects observed, these standards helped to control the activities of the informal groups.

The Technology Department faced the complex challenge of allowing innovative activity whilst ensuring it is directed towards the organisational needs.

Meeting this challenge, the Technology Department needed to create mechanisms to understand organisational needs effectively.

There was an attempt to have these skills formalised into an intranet centre of excellence. This formalising attempt was driven by a project leader to create a legitimised power but proved to be unsuccessful.

9.6 RESEARCH METHODS

What was allowed?

Participant observation across linked projects allowed tracking of actors and innovations as they were encountered and adopted by BigBank. Pre-project activities previously unexplored by isolated case studies proved an important arena for innovation with the roles of Technology Statespeople within this scenario and throughout project activities identified for the first time.

How was this different?

Many previous investigations have used studies of isolated cases with data gathered through post-project interviews. This allowed the researchers a greater degree of flexibility in selection of the case material. Outcome and lessons from the project could be considered at a broad level with greater detail gained from interviews. Second-hand accounts however, often obscured the real motivations and factors around choices as actors post rationalised in light of their own situation and involvement. The snapshot of the isolated case prevented observation of the evolution of actors and technologies over time and the impact of choice in one innovation in related activities.

Participant observation across linked projects reduced the ability to 'cherry pick' cases, with researchers having to monitor and position within upcoming initiatives. As actors had to consider the possibility of success for each project, so did the researcher. In order to achieve this access, the researcher had to partake in the negotiation process offering relevant and legitimised expertise in order to gain the admittance and trust of the community of interest.

How was it enabled?

In order to achieve this level of access, it was necessary to gain credibility with actors within BigBank. Initially, University credibility and relevant academic qualification (M.Sc. in Computer Science) served to allow entry into the organisation through labour for the NMM project. Technical background also allowed understanding of the true technical reality of the innovations, instead of explanations

filtered through technical specialists which, as discussed, operate to their own agendas.

Indicators of credible expertise had to be validated by actors within BigBank, an opportunity provided by the NMM project. Project performance within the NMM project was vital in establishing legitimacy with BigBank actors and enabled access to other projects. Placement within the Research Group enabled access to multimedia projects during the pre-project phase. Alignment with the Research Group provided benefits: their role researching new technologies allowed their involvement in multimedia activities as they dealt with emergent technologies.

As BigBank actors negotiated their enrolment within communities of interest, the University participant involvement underwent the same process. To gain access to the case material, I had to commit to performance of project activities for BigBank.

What difficulties did it create?

This created dual responsibilities of fulfilling the organisation's requirements and research agenda. Demands upon time and objectivity were faced due to the need to live in and fulfil the demands of two worlds, a common issue within fieldwork (Evans-Pritchard, 1973). Maintenance of a journal to record activity allowed isolated reflection away from the subject environment, particularly once fieldwork has concluded. This assisted in the objective reflection on data gathered. Informal interviews gleaned the most valuable insights with actors providing unguarded insight.

Participant observation in the overall series of linked case studies opened up areas of innovation development previously unappreciated (pre-project phases) allowing insight into the socio-technical interplay operating around technical choice (suppliers, standards, etc.) and organisational politics. Importantly, the impact of individual choices on selections across projects was viewed.

This access required the participant observer to display relevant expertise and gain credibility within BigBank. Sponsorship of the Research Group was key due to their linkage into developments in the multimedia area.

9.7 SUMMARY

Social and technical factors require joint consideration throughout the multimedia innovation process. Study and analysis of multimedia innovation in operation led us to reject the determinist linear model in favour of social shaping's interactive model.

In order to reduce uncertainty and minimise costly mistakes, organisations engaging in multimedia innovations should seek to: manage the enrolment and alignment of actors and resources, ensure actors (Technology Statespeople) with hybrid expertise operate networks, accurately assess multimedia content and infrastructure requirements and implement formal mechanisms for technology departments to orchestrate these developments.

Enrolment and alignment of actors and resources take place from the earliest pre-project and innovative phases, an aspect previously obscured by post-hoc studies. Advancement of personal agendas, individual and collective, is the principal motivation for actors. Actors act within a 'community of interest' which must offer a 'doable' solution to an organisational issue to receive formal approval.

Technology Statespeople emerge through a process of positioning and construction shaped by their specific organisational circumstances. Within innovation, they act as 'Technology Statespeople' enrolling, aligning and maintaining innovation networks through the application of hybrid expertise. Technology Statespeople position themselves in the pre-project environment in line with their own agendas. Formal recognition of the 'actual' project leader at this stage is inconsistent.

Formal methodologies provided limited benefit to the management of social and technical aspects of multimedia innovation. Consideration of infrastructure, integration standards and content requirements demanded by Multimedia technology needs capabilities beyond these techniques. Some aspects allow quantified assessment, for example, network delivery of multimedia required measured consideration of the additional impact on existing bank operations. Formal testing and adherence to corporate standards had to be met by each multimedia innovation. Information delivery from multimedia systems required sourcing, conversion and input of appropriate content. The complexity of the process of content management was underestimated. Quantification and assessment of expertise requirements remain problematic and heavily reliant upon the intangible measures of perception and reputation. Subjectivity was also witnessed in the capture of user requirements. Despite the range of HCI techniques employed, results served only to validate existing thought with team members and user 'proxies' input given greater importance. While this method ignored best practice implementation principles, it assisted in an essentially 'political' buy-in for the project.

Interactive innovation required by multimedia technology was served by the Technology Department's move from a creator/supplier role to one of orchestrator/integrator. Within this role, management of relations between internal

business units and external suppliers required effective use of power maintenance strategies. These include formal structures (e.g. standards) and establishing knowledge claims. Knowledge claims impart expertise and validate the role of the department as technology 'experts'. The pace of technical change necessitates continual re-establishment of recognised knowledge. Appropriate staffing and political positioning was an important component of this validation.

The research process adopted in this thesis departed from the study techniques dominant within this field. The typical use of isolated case studies analysed through post-project interviews faces two main challenges: actors can post-rationalize decisions and impacts of other projects are not satisfactorily considered.

For this study, the involvement of the researcher as a participant observer through three linked projects allowed unique insights. Access to the pre-project stage allowed understanding of the alignment and enrolment activities that occur prior to formal discussion within the organisation. Involvement in decisions as they are made at this stage in the initial agenda formulation and establishment of the constituency of players involved and throughout the subsequent development of the project, provided first-hand assessment of the decision mechanics at a micro level. By drawing on a variety of areas of study, an interdisciplinary lens of analysis was applied to retain and appreciate the richness of factors at play within these environments.

9.8 FURTHER STUDY

The findings of this thesis present a number of areas for further investigation within the interactive model of multimedia innovation presented. Technology Statespeople and communities of interest act to shape and direct innovation. In order to better appreciate their role and how they can be used to mitigate risk, investigation should be directed to identify common characteristics and their implications. Further linked case studies should be engaged to validate the existence of Technology Statespeople operating and evolving across projects. By specifically investigating the role of Technology Statespeople it will be possible to confirm the failure as well as success of those individuals and the contributing factors. In addition, better definition should be gained around their hybrid expertise and how their operations are assisted by it. Linkage between Technology Statespeople and communities should be considered. What are the important constituents of the communities? Does a common model exist? Studies should consider operations across the project lifecycle with particular attention being paid to the pre-project stage due to its

evident importance. In linking this to the community constituencies, what aspects are necessary for the projects to move between stages? Within this, are there features evident at the approval of a project that provide a greater likelihood of success, aiding organisations in the selection of what projects to support and areas to supplement projects demonstrating risk.

Content management and consideration presents itself as a common area of risk through neglect. Multimedia innovation would benefit from enhanced understanding of issues and best practice to aid the effective execution of this process. The method of translating informal information sharing into formal governance while important for content, would also provide important learning for the Technology Department's management of multimedia innovation. The Technology Department's shifting role continues to present challenges around the creating of formal structures to manage the complex social process of managing multiple user needs whilst maintaining a cohesive organisational technology policy. Further investigation into how this may be achieved is essential in order that organisations deal effectively with this difficult and costly area.

CLOSING THOUGHTS

Technology innovation is complex, impacted by social, economic, political and cultural factors. Appreciation of this view and experience of it in practice provided me with invaluable experience. Through my fieldwork and associated analysis, I gained insights that have helped me in my working life.

Since completing my fieldwork, my consultancy work has allowed me to experience a range of organisations from Ericsson to Shell to Motorola to Sainsbury's implementing a multitude of technologies from E-Commerce to Content Management to Customer Relationship Management (CRM). A wide range of situations but with common problems all very similar to those experienced within this thesis.

The problems continue to defy formalised models instead relying upon actor's ability to apply social learning and hybrid expertise to the particular project. Issues arise where strict segmentation is applied between groups and expertise. These efforts of division of labour to simplify tasks tend to miss the important complexities that can make the difference between success and failure.

Hybrid expertise in projects is restricted to combined business and technical ability. I feel the social studies knowledge I gained makes a profound difference, provoking the need to look beyond surface appearances to consider the factors creating and influencing the technological trajectory. Through this appreciation of

the knowledge I gained, I feel that social scientists and associated theory have a far greater role to play within corporate innovation. While focus has been given to the provision of a fully formed, standardised model of innovation, the complexity and individuality of innovation suggest this is unlikely. Instead, a toolkit approach highlighting areas of concern and potential risk in addition to offering possible tactics for navigation appears more beneficial. An increasingly interactive relationship would increase the access and quality of research material while benefiting corporations. Issues are sure to arise around the need for academic distance, but surely these must come second to the benefit of sharing social learning.

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11. Abbreviations

ANT	Actor Network Theory
ASP	Active Server Pages
BCS	British Computing Society
CSCW	Computer Supported Co-operative Work
DSDM	Dynamic Systems Development Method
EUCS	Edinburgh University Computing Services
GUI	Graphic User Interface
HCI	Human Computer Interaction
HTML	Hypertext Markup Language
JNM	Software company with graphical presentation system
LAN	Local Area Network
MOT	Management of Technology
MSP	Microsoft Solutions Provider
NMM	Networked Multimedia – Case Study – Chapter 5
Praxis	Corporate Intranet – Case Study – Chapter 6
RAD	Rapid Application Development
SCOT	Social Construction of Technology
SLIM	Social Learning in Multimedia
SSK	Sociology of Scientific Knowledge
SST	Social Shaping of Technology
TCN	Training and Communications Network – Case Study – Chapter 7
URL	Uniform Resource Locators
USDP	Unified Software Development Process
XP	Extreme Programming

12. APPENDICES

APPENDIX 12.1

BIGBANK

This appendix gives some background on the organisation which was the subject of all three studies. An overview of the company organisation is given with emphasis on the structure in and around Technology Department.

1. INTRODUCTION

BigBank is a company that has progressed over 3 centuries from a time when transactions and records were recorded by the use of quill pens and ink to today's electronic recording via the Internet from palm tops, mobile phones etc. While business may still be conducted face to face, it may equally be conducted a hemisphere apart with the monetary transactions timely processed. BigBank has always had to maintain a reputation of the utmost stability and trustworthiness while conversely being highly innovative and responsive, indeed proactive, to changing times.

2. HISTORY

BigBank was founded in the 18th Century but the Group's roots can be traced further back through the amalgamation of private and joint stock banks which are its past and present constituents. This absorption of other banks within the BigBank Group umbrella has been a constant occurrence over the centuries contributing to its overall growth as a major player in the UK banking sector.

BigBank's history is as much a story of responding to or influencing social change and practices as it is developing banking methods and services. A simple example of this is to consider how people have been paid for their labour over the centuries. An early method was by cash with the employer paying on site with monies often drawn from the banks. It later became payment by cheque with people requiring access to their earnings either by drawing cheques on their accounts or withdrawing cash in person necessitating banking hours responding to their needs. Now we have automatic bank depositing of salaries and withdrawal of funds augmented by Internet transactions.

This tracing of social change and complementary monetary transactions could be applied to other subjects such as property ownership, trade including agricultural and industrial revolutions, foreign travel. Was BigBank responding to or driving the change? Both are probably the answer to this conundrum.

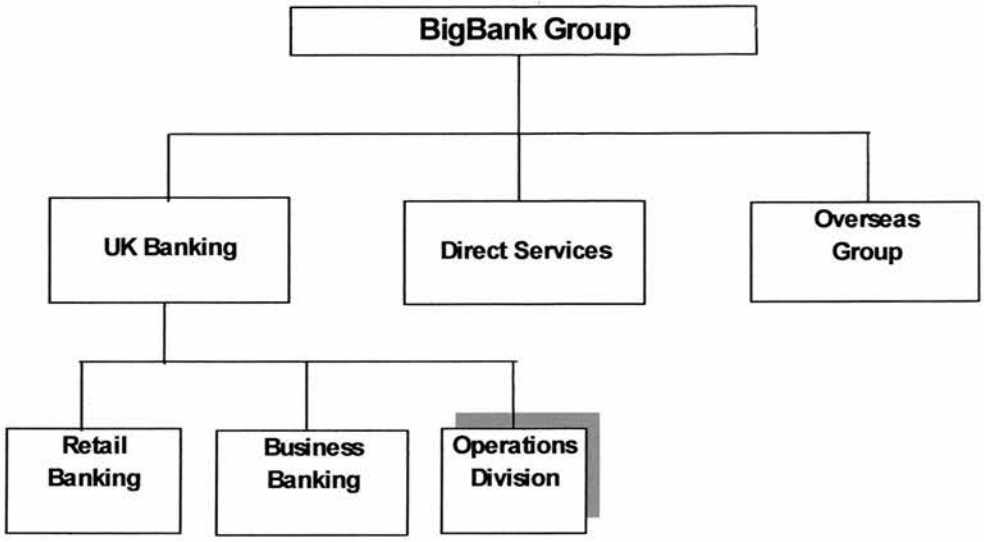
It has to be recognised that people generally are uncomfortable or wary of change especially the negative impact of failure. An organisation like a bank has to be seen to be highly dependable generating an air of assurance while moving forward to accommodate an ever changing local and world economic environment. Therefore change has to be well planned and innovation implemented well. Innovation in the early days of banking could be segmented into the three main categories of currency, services and customers but latterly these have become intertwined. There have been stages such as

- Currency money design to reduce counterfeiting
- Transactions by cheques, promissory notes etc
- Credit card transactions processed by hard copy vouchers
- Credit cards electronically cleared, and
- Internet transactions.

Technology System innovations can now embrace all categories in a single change. In an introductory article to BigBank in 1995 the accelerating rapidity of change was emphasised by the following comments made by the Chairman: "More recently, however, BigBank has undergone a period of dramatic transformation – changing perhaps more profoundly in the last three or four years than in the previous centuries". How BigBank organises itself to appear to seamlessly absorb these increasing communication and service support demands will be reviewed in the next two sections.

3. ORGANISATION DURING CASE STUDIES

During the period that the case studies for this thesis were being conducted, the organisation structure was as shown in this section. The organisation charts were displayed on BigBank's Intranet for reference by staff. The areas of responsibilities of the different functions and divisions were given as well as job positions with incumbent's names and photographs of persons in the more senior positions.



3.1 Corporate Structure

The chart on this page shows the three main arms of BigBank are UK Banking, Direct Services and Overseas Group. Operations Division is shadowed to highlight that the formal or structured reporting control for the Information Technology function descends from this box. The Operations Division supplied a range of professional services to BigBank, including human resources, property, money transmission as well as information technology. It also ran the extensive plastic card services.

The broad roles of these divisions are, as follows

(1) Retail Banking

Retail Banking provides a wide range of banking, insurance and other financial services to individuals and small business. These are provided through a Branches Network and also include direct telephone services and offshore private banking and trusts.

(2) Business Banking

Corporate Banking and Financial Markets provides an integrated range of products and services to mid-sized, large corporate and institutional customers in the UK and overseas. These include

- Corporate Banking
- Treasury and Capital Markets
- Securities Services
- Leasing
- International Banking Services
- Shipping Business Centre
- BigBank Development Capital

(3) Operations Division

This provides a range of professionally run services to the overall banking business. These include property, personnel and training, information technology,

money transmission services, business consultancy and administration. The Division also operates plastic card services and estates management businesses.

(4) Direct Services

Sells and underwrites retail and wholesale general and car insurance on the telephone and the Internet to customers.

(5) Overseas Group

Includes US subsidiary engaged in retail and corporate banking activities carried out through its branch network in some states as well as alliance relationships in Europe.

3.2 Operations Division

The Operations Division reported into the BigBank Board through an executive board member. The areas of responsibilities of the above 6 functions were, as follows:

(1) Operations

- Service Centres (CIB & Retail)
- Cash Centres
- Clearing
- ATMs
- Mortgage Processing

(2) Technology

- Technology Service Delivery
- Infrastructure
- Development Projects
- Technical & Application Strategy
- Security & Disaster Recovery

(3) Property and Facilities

- Property Management
- Facilities
- Security
- Environment

(4) Change Management

- CIB Programme Management
- Infrastructure Support
- Operating Platform
- Telephone Platform

(5) Finance and Business Services

- Finance
- Business Consultancy Services
- Purchasing & Contracts

(6) BigBank Cards

- Card Transactions Services
- New Card Promotion Support

3.3 Technology Function

The sections within the Technology Function (chart overleaf) can be divided into two types:

3.3.1 Technology Support Departments

These departments provide the support to the Supply Services by providing the administration, financial and planning framework. These are Communications, Financial Planning and Control, Human Resources and Strategic Value Management.

A brief outline of the Technology Support Function is

- Communications

This department deals with the public relations of the Group interfacing with the media, public organisations and general public.

- Finance, Planning and Control

All financial reporting both internal and external is the responsibility of this department along with monitoring and conducting risk analysis. Internal Audit ensures procedure compliance within the organisation.

- Human Resources

This department deals with personnel recruitment and matters dealing with the staff's general well being.

- Strategy Value Management

Strategic planning department supports the process of developing long and short term plans to assist in the structuring of future growth.

3.3.2 Technology Supply Service Departments

The Technology Supply Service Departments are much more banking specific operations and their scope was more what people probably expect under a functional description of technology. They are also much more pertinent background material to this thesis and will be, therefore, listed in greater detail.

(1) Retail Banking Systems Development
- New Operating Platform / Credit / Sales
- Direct Banking / Architecture
- Retail Banking
  - Programme Management
  - Support
  - Development / BigBank Initiatives
- Alliance Projects
- Card Services

(2) Operations Development
- UK & International Banking Services
  - International Systems
  - Payments and Integration
  - Electronic Banking Systems
- Architecture
- Card & Cashline Systems Development
- HR, Property, FBCS and Year 2000

(3) IT Services
- Distributed Infrastructure Services
- Systems Integrity
- Telecommunications
- Central Infrastructure Management
- Central Services Delivery
- Distributed Services Delivery
- Business & Change Planning

(4) Technical Strategy
- Strategy & Architecture
- Strategy Implementation
- Architecture Support
  - Data Services
  - Distributed Consultancy Services
  - Tools / Infrastructure Support
- Quality Management

(5) Corporate Systems
- Corporate Architecture
- Group Finance Systems
- Group Risk Systems
- Research Group

I was attached to this section which had responsibility for identifying and evaluating emerging technologies beneficial to the bank.

- Year 2000
- Training and Communications Network

  This section featured prominently in the case study described in Chapter 7.

(6) CIB Development

- CIB PC, Midrange & Mainframe Support & Maintenance
- Operational Framework, Strategy & Architecture
- Risk & Portfolio Management / Finance & Administration
- Trustee / Savers / Registrars
- EMU / Year 2000
- Corporate & Commercial Banking / Corporate Processing Centres
- Structured Finance / Shipping

Looking at the organisation of a Technology Section can often provide an encapsulated overview of the width of the commercial range of services offered by the organisation. This is certainly true when one sees how the BigBank Technology Division is aligned to support the commercial activities.

4. SUMMARY

It is clear that the increasingly rapid development in information technology will have to be matched with managerial foresightedness, judicious project selection and drive along with society responsiveness if the benefits for all are to be maximized. The many objectives in the three case studies all lend credence to this quest by BigBank to stay in a leading position with multimedia innovations being key assets in achievement of corporate goals.

APPENDIX 12.2

NMM USABILITY QUESTIONNAIRE

The following questionnaire was used during a controlled usability test. Details of the exact testing strategy are contained within:

PROCTER, R., A. MCKINLEY, S. GALLACHER, (2001), 'The Influence of Network Quality of Service Factors on the Usability and Effectiveness of Multimedia Internet Broadcasting', in: A. Sloane; D. Lawrence (Editors), Multimedia Internet Broadcasting, 35-52, (Springer).

Subjects were shown a consistent set of multimedia assets then presented with the questionnaire. The Usability questionnaire was used to assess the effectiveness of the interface between subject and system, considering how the subjects' technical background impacted their expectations and user experience. The comprehension questionnaire focused upon the efficiency of the various multimedia loads, and media, in delivering information, considering the impact of quality degradation.

Appendix A: Usability Questionnaire

Identification number:

Age: Sex: __Female__Male

I. User Background

1.1 How long have you used computer based multimedia systems?

Never	6 months to less than 1 year
Less than 1 day	1 year to less than 2 years
1 day to less than 1 week	2 years to less than 3 years
1 day to less than 1 month	3 years or more
1 month to less than 6 months	

1.2 On average, how much time do you spend per week using multimedia packages?

Less than 1 hour	4 to less than 10 hours
1 to less than 4 hours	Over 10 hours

1.3 How many different types of computer systems, including mainframes and PCs have you worked with?

A: None	C: 3-5
B: 1- 2	D: More than 5

1.4 Of the following devices, software, and systems, check those that you have used and are familiar with.

Keyboard	File manager
Numeric key pad	Electronic spreadsheet
Mouse	Electronic mail
Video conference suite	Graphics software
Touch screen	Computer games
Commercial desktop conference	Colour monitor
software	Personal computer
Internet telephone service	Hard drive
Text editor	Floppy drive
Word processor	

1.5 How long have you used the Internet?

A: Less than 1 day	C: 1 month to less than 6 months
B: 1 day to less than 1 month	D: 6 months or more

1.6 How much time, on average, do you spend on the internet?

A: Less than 1 hour	C: 4 to less than 10 hours
B: 1 to less than 4 hours	D: Over 10 hours

1.7 How often do you use a computer in your average week?

A: Less than 1 hour	C: 4 to less than 10 hours
B: 1 to less than 4 hours	D: Over 10 hours

1.8 What applications do you use? (Please grade in order of frequency use 1- 6, or 0 if you never use these applications.)

Word Processing	Graphic Design Packages
Spreadsheets	Internet Browsers
Games	Other (please specify)
Programming Tools	

2. Overall User Impressions

Please circle the numbers which most appropriately reflect your impressions about using the system. (Not Applicable = NA.) There is room on the last page for your written comments.

2.1 Very Poor Very Good

1 2 3 4 5 NA

2.2 Frustrating Satisfying

1 2 3 4 5 NA

2.3 Dull Stimulating

1 2 3 4 5 NA

2.4 Difficult Easy

1 2 3 4 5 NA

2.5 Much worse than live presentations Much better than live presentations

1 2 3 4 5 NA

2.6 Very Unusable Very Usable

1 2 3 4 5 NA

3. **Technical and Content Quality**

3.1 Overall the technical quality was:

Poor Excellent

1 2 3 4 5 NA

3.2 How easy was it to hear/see and understand the speaker?

Very Easy Very Hard

1 2 3 4 5 NA

3.3 How would you rate the content in this session?

Poor Excellent

1 2 3 4 5 NA

3.4 What was your level of interest in the content?

Very Low Very High

1 2 3 4 5 NA

3.5 Please rank the following in terms of importance.

Audio Quality	Signal delay
Visual Quality	Gaps in transmission
Audio- Video Synchronization	Other

3.6 Was the presentation impaired by any of the following? (tick where appropriate)

Quality of Slides	Gaps in transmission
Quality of Audio	Picture refreshment rate
Quality of Video	Other (please specify)
Audio- Video Synchronization	

Users' Comments

Please write any comments you have in the space below.

Appendix B: Post-trial Comprehension Questionnaires

Evaluation One

1. In the new salary scheme, managerial salaries will be related to *two* separate measures. What are they?
2. Name one feature of the old salary scheme that will be eliminated when the new pay system is introduced.
3. How much holiday will staff be entitled to under the new scheme?
4. What is the name of the interviewee (the person being interviewed)?
5. In what city did he meet with his officials to discus details of the scheme?
6. Name the three key components of the new scheme.
7. What does the interviewee invite you to do if you have problems with your manager over the new scheme?
8. How are "competencies" defined?
9. In which city is the new scheme already operating?
10. What, very briefly, will be the impact of the new salary scheme on the bank?

Evaluation Two

1. What is the name of the bank?
2. What period is covered by the results?
3. What are the names of the *principal* divisions of the Bank whose results are reported?
4. What did 'TS' say about staff morale?
5. When did the division headed by 'RI' come into existence?
6. Of what Division is 'MN' the head?
7. How many new customers has his division added to BigBank?
8. What are NewDivision's profits over this period and how much have they risen?
9. In what two areas is NewDivision "continuing to grow"?
10. What is the overall profit of BigBank for this period, and what percentage growth has been achieved?
11. How many of the speakers did you see?
12. How many of the speakers wore glasses?
13. Were there speakers who did *not* appear on camera at some time during the presentation?
14. Where did the speaker who introduced the presentation say it was coming from?

Evaluation Three

1. What is the general name for the kind of behaviour that is the main subject matter of the video?
2. What is the main aim of the video?
3. What proportion of BigBank staff are said to have witnessed this kind of behaviour and what proportion have experienced it for themselves?
4. What is the attitude of BigBank towards this kind of behaviour?
5. Five different forms of this behaviour were identified. Name three of them.
6. In the first work scene featured a manager talking to one of his staff:

    1. Were either wearing glasses?
    2. What was the manager holding in his hand when he walked over to the desk?
    3. What time was the manager's meeting?
    4. What was the name of the staff member to whom the manager was talking?
    5. Record your assessment of the manager's behaviour by choosing a point on the scale below between the following pairs of opposites. In each case, also record your confidence in your assessment.

				Confidence	
Appropriate	1 2 3 4 5	Inappropriate	Very	1 2 3 4 5	Not very
Aggressive	1 2 3 4 5	Non-aggressive	Very	1 2 3 4 5	Not very
Supportive	1 2 3 4 5	Confrontational	Very	1 2 3 4 5	Not very

    6. Record your assessment of the staff member's behaviour by choosing a point on the scale below between the following pairs of opposites. In each case, also record your confidence in your assessment.

				Confidence	
Anxious	1 2 3 4 5	Composed	Very	1 2 3 4 5	Not very
Impatient	1 2 3 4 5	Patient	Very	1 2 3 4 5	Not very
Constructive	1 2 3 4 5	Unconstructive	Very	1 2 3 4 5	Not very

    7. How many other people did you see in the room?
    8. Record your assessment of the other staff members' reaction to the conversation between the Manager and his staff member by selecting a point on the scale below between the following pairs of opposites. In each case, also record your confidence in your assessment.

				Confidence	
Concerned	1 2 3 4 5	Unconcerned	Very	1 2 3 4 5	Not very
Aware	1 2 3 4 5	Unaware	Very	1 2 3 4 5	Not very
Anxious	1 2 3 4 5	Composed	Very	1 2 3 4 5	Not very

7. The second work scene featured several colleagues talking:

1. How would you describe the role/status of the first person to speak relative to the other people present?

2. What part does the first speaker play in the remainder of the scene? Justify your answer

3. What two options are mentioned as things to do on the night out?

4. Record your assessment of the attitude of the other staff towards Barbara by choosing a point on the scale below between the following pairs of opposites. In each case, also record your confidence in your assessment.

			Confidence		
Friendly	1 2 3 4 5	Unfriendly	Very	1 2 3 4 5	Not very
Sympathetic	1 2 3 4 5	Indifferent	Very	1 2 3 4 5	Not very
Attentive	1 2 3 4 5	Unattentive	Very	1 2 3 4 5	Not very

5. Record your assessment of Barbara's reactions by choosing a point on the scale below between the following pairs of opposites. In each case, also record your confidence in your assessment.

			Confidence		
Aware	1 2 3 4 5	Unaware	Very	1 2 3 4 5	Not very
Indifferent	1 2 3 4 5	Interested	Very	1 2 3 4 5	Not very
Happy	1 2 3 4 5	Unhappy	Very	1 2 3 4 5	Not very

APPENDIX 12.3

PRAXIS SURVEY INTERVIEW

INTERVIEW QUESTIONS

In this appendix I outline the survey approach, including focus areas, questions, and techniques, which formed the backbone for the interviews referred to in Chapter 4. The questions were structured in three main sections: Subject Background, Multimedia Views and Experiences, and Project Information.

Subject Background

To put the subject at ease and get them talking, I would start the session by asking simple, straightforward questions which covered basic, general facts about the subjects. These questions were posed in a casual, unobtrusive manner. The strategy was to present the questions as if confirming information, but actually aiming to elicit response and elaboration on the information.

Question Areas:

1- Who are you?

2- What is your role within BigBank?

3- Career history (asked in a casual manner so as not to appear too intrusive e.g. "How long have you been in that section?"). They would hopefully answer the time and where they came from providing an avenue to probe further. If this did not occur, then I would follow with "And you've been with that section since you joined BigBank?" in a manner suggesting that they should interject if I am incorrect, thus providing me with an avenue to continue questioning. The key objective of the discussion would be to ascertain whether they had always been within the Technology Division or had some experience working outside of it. This distinction would provide some information on staff circulation and knowledge range.

Project Information

If a subject had been through a multimedia project these questions were used as a lead in to questions on Multimedia in general.

Question Areas

1- How did you become involved with this project?

2- What purpose do you feel this technology concerned will fulfill?

3- What is your role and the role of the others involved within the project?

4- What technical training/expertise do you possess with regard to computing technology in general and multimedia technologies?

Multimedia Views and Experiences

Next, I would discuss with the subject their views, experiences, feelings and expectations towards multimedia technologies. If the subject being interviewed was not connected to one of the case study projects (NMM, Praxis, TCN), I would go directly into this section without questions regarding any of the projects.

Question Areas

1- What multimedia technologies have you used within BigBank?

2- What functions have they catered for?

3- How were they introduced to your work/department?

4- Were other departments involved, who and in what way?

5- Are there any other multimedia technologies you are interested in at the moment? How are these being pursued? (How are the items sourced via an internal group or via liaisons with the suppliers directly?)

6- What other ways do you think multimedia is used within your group or the organisation as a whole?

7- What difficulties have you encountered with these technologies?

8- What aid have you received in solving these problems? (internal aid or supplier support)

9- Do you have any set guidelines or rules that you require these technologies to conform to? Who sets these and decides when they have been met? Are outside groups aware of these guidelines?

10- How have the technologies you have used aided your work?

APPENDIX 12.4

PRAXIS USER SURVEY

Praxis User Survey

Communications Main

How often do you use the information in Praxis?

- ◯ No more than once a week.
- ◯ Several times a week.
- ◯ At least daily
- ◯ Several times a day.

Do you find the information in Praxis clearly presented?

- ◯ Yes, very clearly.
- ◯ Clearly enough.
- ◯ Not very clearly.
- ◯ Confusingly.

How do you find the aesthetic design of Praxis (given that we are limited to 16 colours)?

- ◯ Excellent.
- ◯ OK.
- ◯ Not keen.
- ◯ I hate it!

Is the navigation in Praxis easy to use and understandable?

- ◯ Yes, very.
- ◯ It's good enough.
- ◯ No, not very.
- ◯ It's impenetrable.

With respect to the new section names (Know the Ropes etc), do you feel that...

- ◯ they are self explanatory and easy to use?
- ◯ they take a bit of getting used to but it's no problem?
- ◯ they are cryptic and best dispensed with?

How would you characterise the service in response to your difficulties/inquiries concerning Praxis?

- ◯ Responsive and helpful.
- ◯ Adequate.
- ◯ Surly.
- ◯ Not had any contact.

Do you feel that Praxis has made your job easier?

- ◯ Not noticeably.
- ◯ In small ways.
- ◯ In a significant way.
- ◯ Dramatically.

If so how?

Do you think that Praxis..

- ◯ fulfills (or is on course for fulfilling) the potential of a corporate intranet for business benefit?

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- ○ has some way to go but will probably get there?
- ○ is ill-conceived and needs a rethink?
- ○ is a complete waste of Bank resources?

Any comments on this...

Have you conributed content to Praxis?

- ○ Yes.
- ○ No.

Do you think that Praxis is adequately resourced for your particular business / technical needs?

- ○ Yes.
- ○ No.

What is your department?

What operating system are you using?

- ○ Windows 3.x
- ○ Windows NT
- ○ Other

Suggestions for the future and how Praxis can be improved in the immediate term...

This is my opinion of Praxis | Reset

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APPENDIX 12.5
PRAXIS ONLINE QUESTIONNAIRE

Praxis Survey

The Praxis system is the Technology Intranet which has been functional for X months. This survey is designed to gather your opinions on the system as it stands and regarding future developments. The results from this survey will feed into the future development of the system, and will influence the development of a corporate Intranet.

(All comments are completely confidential and cannot be traced back to individual users.)

YOUR BACKGROUND

This section is concerned with the facilities you possess for accessing Praxis.

Your Department [ ]

Your Location [ ]

Operating System Used:
(Click on relevant answer, single response only.)

- ○ Windows NT
- ○ Windows 3.1
- ○ Other

Does your PC allow you to use Praxis effectively ?
(Click on relevant answer, single response only.)

- ◉ Yes
- ○ No

If your system has not allowed effective use, what problems have occurred?
(Click on relevant answers, multiple responses accepted.)

- ☐ The Praxis pages are slow to respond
- ☐ I can't run Praxis along with other applications (such as Word, Excel, etc)
- ☐ My PC crashes when I try to use Praxis
- ☐ The pages do not update themselves on a daily basis.

Other (Please specify in text box below)

[ ]

Had you encountered Web technology (Internet, Web Browsers, etc) prior to Praxis ?
(Click on relevant answer, single response only.)

- ○ Yes
- ○ No

If so, in what context ?
(Click on relevant answers, multiple responses accepted.)

- ☐ Internet access at home
- ☐ Project work with Bank
- ☐ Project work with prior employer

YOUR USE OF PRAXIS

This section deals with how often you use Praxis and what sections are of particular relevance to you.

How frequently do you use Praxis ?
(Click on relevant answer, single response only.)

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- ○ Daily
- ○ Every couple of days
- ○ Weekly
- ○ Monthly
- ○ Very rarely

What sections do you use on Praxis?
(Rank them in order of value to your work.)

Ranking	Website	
1	Click to Select	
2	Click to Select	
3	Click to Select	
4	Click to Select	
5	Click to Select	
6	Click to Select	
7	Click to Select	
8	Click to Select	
9	Click to Select	
10	Click to Select	

How useful is the content of Praxis for your everyday work?
(Click on relevant answer, single response only.)

- ○ Very useful
- ○ Reasonably useful
- ○ Of limited use
- ○ Of no use at all

Do you have any other comments regarding the content on Praxis ?
(Please enter these comments in the text box provided below.)

YOUR OPINIONS ON PRAXIS SYSTEM USABILITY

The questions in this section are concerned with the user appeal of the Praxis system with regard to the graphic design, content provided and ease of navigation.

Thinking about the Praxis system, how would you rate the following factors?
(Click on relevant answer, single response for each column.)

	Colour	Content	Layout	Navigation
Very good	○	○	○	○
Fairly good	○	○	○	○
Poor	○	○	○	○
Very poor	○	○	○	○

Do you feel the graphic design of Praxis is...
(Please choose appropriate terms from list below, multiple selections are acceptable.)

- ☐ Cluttered
- ☐ Easy to use
- ☐ Uninspiring
- ☐ Clean
- ☐ Glaring

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- [ ] Complicated
- [ ] Austere
- [ ] Uninviting

Do you have any other comments regarding the graphic design of Praxis?
(Please enter these comments in the text box provided below.)

Do you feel the labelling of the sections (e.g. Know the Ropes, Running Systems, etc) on the Praxis front page is....
(Click on relevant answer, single response only.)

- ◯ Very straightforward
- ◯ Reasonably straightforward
- ◯ Slightly ambiguous
- ◯ Extremely ambiguous

COMMUNICATION ABOUT PRAXIS

This section is interested in the sources and channels of communication through which information about Praxis has been communicated and how effective they have been.

How well do you feel you have been informed about Praxis with regard to features available, new content, etc?
(Click on relevant answer, single response only.)

- ◯ Very well informed
- ◯ Quite well informed
- ◯ Badly informed
- ◯ Very badly informed

What is your main source of information about Praxis?
(Click on relevant answer, single response only.)

- ◯ Praxis itself
- ◯ Global E-Mails
- ◯ Department meetings
- ◯ Colleagues
- ◯ Livewire

Other (Please specify in text box below)

THE FUTURE DEVELOPMENT OF PRAXIS

The questions within this section are concerned with your views on the direction in which Praxis should develop in order to meet business needs and your work requirements effectively.

What enhancements would you like to see on Praxis ?
(Please choose appropriate terms from list below, multiple selections are acceptable.)

- [ ] An on- line phone book
- [ ] An improved information searching facility
- [ ] Employee locations with floor plans
- [ ] Organisational charts
- [ ] Discussion groups
- [ ] Bulletin boards

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- [ ] E-mail facility
- [ ] Quicker turnaround of material to be published

Other (Please specify in text box below)

What concerns do you have regarding the present state and future development of the Praxis system?
(Please choose appropriate terms from list below, multiple selections are acceptable.)

- [ ] Levels of support provided for maintaining and updating content
- [ ] Updating of material
- [ ] Relevancy to business needs
- [ ] Access to system
- [ ] Security
- [ ] The need to share information with business centres
- [ ] Viewed as a pilot and not sure if it is here to stay

Other (Please specify in text box below)

What would encourage you to use Praxis more ?
(Please specify within text box provided below.)

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